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La Société canadienne de météorologie et d'océanographie

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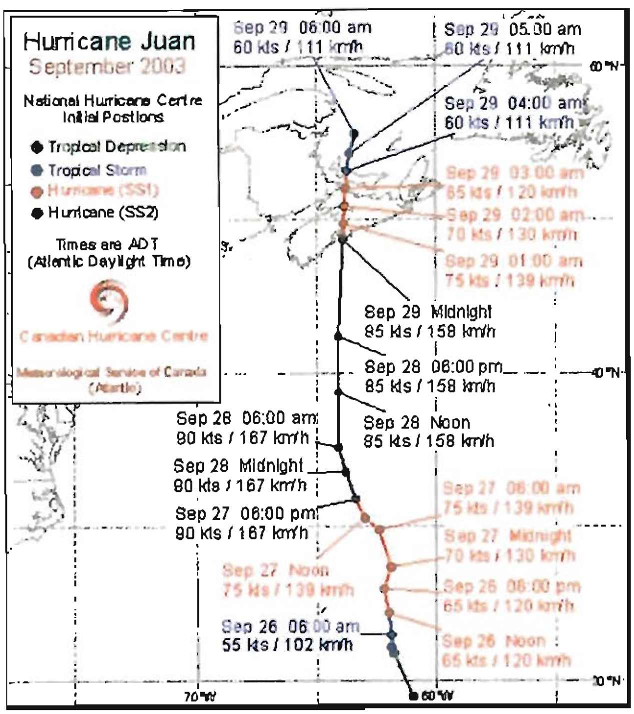
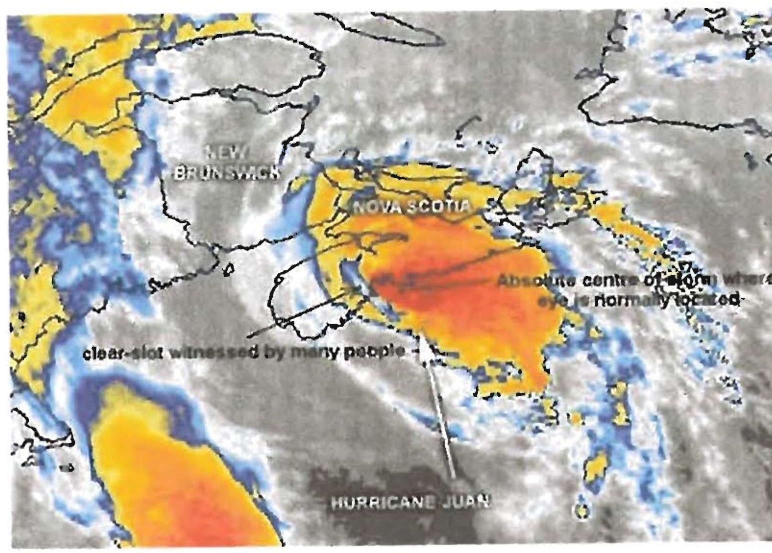
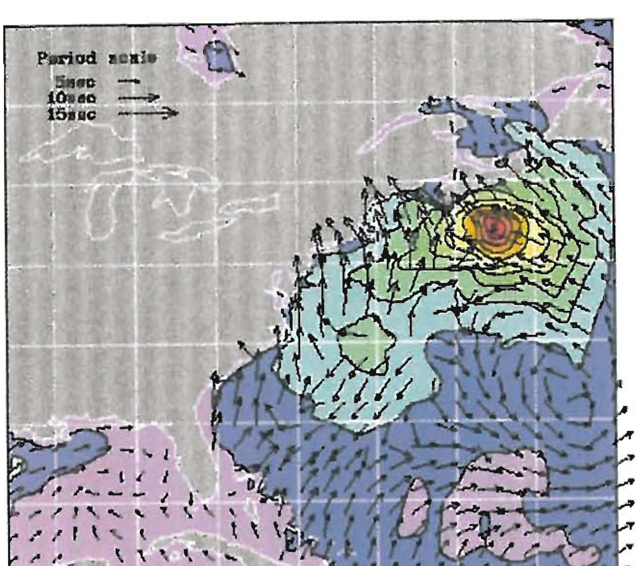
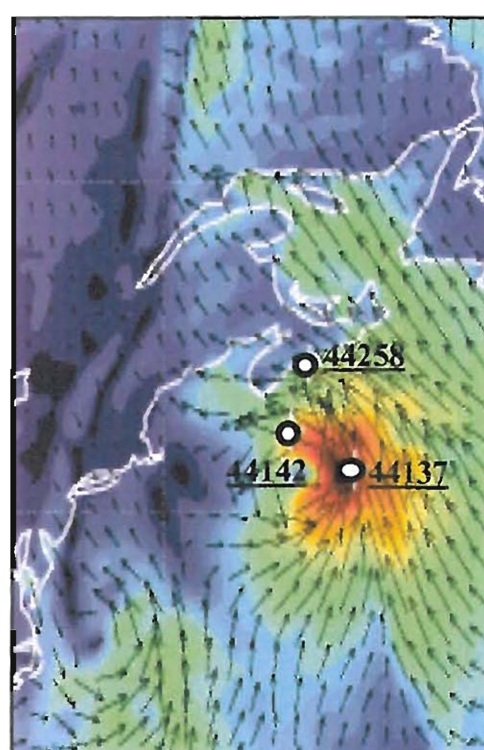






JUAN



CMOS Bulletin SCMO
"at the service of its members
au service de ses membres"

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Cover page: The cover page shows a composite picture of various aspects of Hurricane Juan that hit Nova Scotia last September 2003. Top-left: storm track; Top-right: eye of Hurricane; Bottom-left: BIO wave model results; Bottom-right: Observed wind field. To learn more, read the articles written by Peter Bowyer on pages **37, 42 and 49**, by Chris Fogarty on pages **40** and **41** and by Will Perrie *et all* on page **45**. Pictures are courtesy of the various authors.

Page couverture: La page couverture illustre les différents aspects de l'ouragan Juan qui a frappé la Nouvelle-Écosse en septembre 2003. Haut-gauche: trajectoire de l'ouragan; haut-droite: l'oeil de l'ouragan Juan; bas-gauche: résultats du modèle de vagues de BIO; bas-droite: vents observés. Pour en savoir plus, lire les articles écrits par Peter Bowyer en pages **37, 42 et 49**, par Chris Fogarty en pages **40** et **41** et par Will Perrie *et all* en page **45**. Les illustrations sont une gracieuseté des différents auteurs.

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Canadian Meteorological and Oceanographic Society (CMOS)

Société canadienne de météorologie et d'océanographie (SCMO)

Executive / Exécutif

....from the President's Desk

CMOS friends and colleagues:

I am not sure if the presence of the CMOS executive in Halifax has had any influence on the extreme weather that has visited us over the past six months. Hurricane Juan that came ashore in Halifax Harbour as a Category-2 storm closed down the city for a week in September. Ninety-four centimetres of snow coupled with one hundred plus kilometres per hour winds on 18 February resulted in a similar hiatus of regular activities throughout the city. For both of these events, we, as meteorologists and oceanographers, may take some pride in our skill in forecasting these events. However, we also realize that we have as much difficulty as the rest of our fellow citizens in anticipating the power that these events have to disrupt our lives, destroy our property and endanger our lives and limbs.

When I am travelling in Canada, I usually turn the hotel TV on to the Weather Channel. Their programming between local, national and international forecasts deals with the impact of weather on our communities. David Phillips often remarks how much Canadians like talking about the weather. It is through the telling of our weather stories to each other that we will come to develop a better personal understanding of the potential impacts of extreme weather on our lives. Weather Broadcasters have been Canadian media stars because of the quality of the information and stories that they have presented to us day after day.

CMOS has taken several steps to bring us closer to the Canadian Geophysical Union. CMOS Council agree to extend the lower cost Associate membership to members of the CGU. The CMOS Annual Congress in Edmonton will also feature a joint session with CGU. These changes will make both our organizations a more comfortable home for the hydrological community.

Although I still have three months and an Annual meeting to go as President, this is my final column. A year goes by so quickly. I now understand why the Past President is such an active member of the national executive. They are using their year to complete all of the things that they tried to initiate as President. I hope to see many of you in Edmonton and I look forward to reading the thoughts and words of Hal Ritchie in this space in August.

Allyn Clarke
President / Président

Volume 32 No.2
April 2004 - avril 2004

Inside / En Bref

Articles

Our regular sections / Nos chroniques régulières

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CMOS exists for the advancement of meteorology and oceanography in Canada.

Le but de la SCMO est de stimuler l'intérêt pour la météorologie et l'océanographie au Canada.

Letters to the Editor

26 February 2004

Subject: Climate Change

I fully agree with Allan MacRae's assertion that organizations like CMOS need to openly debate climate change (and other) science (Letters to the editor, CMOS Bulletin Vol 32 (1)). However, we also need to agree on some guidelines on how to structure such debate to make sure it is constructive and useful in advancing understanding. One such guideline should deal with distinguishing between sound, credible science and sloppy (incredible?) science. The two cases he presents are good examples of why we need this.

Shaviv and Veizer, in their paper in GSA today, present an intriguing argument as to why changes in cosmic radiation may have been the dominant cause of climate change on multi-million-year time-scales. However, their assumption that all residual long term changes in climate not attributable to cosmic radiation are due to changes in CO_2 concentrations, and are, therefore, indicative of climate sensitivity to projected CO_2 changes over the next century, is simply bad science. Firstly, there are many other important factors that affect climate change on million-year time-scales, including continental drift, changes in the Earth's orbit around the sun, imploding asteroids etc. Secondly, as their paper shows, various estimates for CO_2 concentrations 500 million years ago have a range of a factor of ten, making any attempt to calculate climate sensitivity to CO_2 change on that time-scale virtually meaningless. Thirdly, comparing causes of climate change on the time-scale of 500 million years with that of the next century is, figuratively speaking, like comparing factors that have affected average weather over the past 13 700 years (which happens to include most of the last deglaciation period *and* the entire Holocene) with that of the next 24 HOURS!. Furthermore, a recent critique of the Shaviv and Veizer paper published in EOS by a team of 11 international experts (Rahmstorf et al. in EOS 85: 37, 40, Jan 27, 2004) indicates that the authors, among other questionable steps in their analysis, applied several adjustments to the data to artificially enhance the correlation, and that this correlation does not hold up under scrutiny.

The second paper mentioned by MacRae is even more questionable in terms of the quality of the science. Neither McIntyre (a retired energy company executive) nor McKitrick (an economist) has any scientific background that would qualify them to judge the work of seasoned paleoclimatolgists. Nonetheless, they decide to do an 'audit' of the work undertaken by Michael Mann. Mann just happens to be one of the most respected investigators in the world of proxy data for climates of the past few millennia. The McIntyre & McKitrick audit was undertaken without any discussion with Mann regarding methodologies, involved adjustments to the data base used by Mann et al., and was then published in a relatively obscure, soft science journal called Energy & Environment without proper peer review by experts within the paleoclimate community. They claim to have found 'errors' in the analyses by Mann et al. that, when corrected, just happen to downgrade the significance of recent climate change. Mann and colleagues are apparently in the process of formally publishing their rebuttal, but have in the mean-time put their preliminary reactions on their website at http://www.cru.uea.ac.uk/~timo/paleo/EandEPaperProblem_03nov03.pdf. Meanwhile, a team of paleoclimate experts in the UK have also raised a cautionary? flag about the McIntyre paper, noting that "objective readers, with a desire to get to the "truth" of this issue, would do well not to jump to premature conclusions and at least allow these respected, experienced and invariably careful researchers the courtesy of a considered response, after they have had time to study the so-called audit in detail." (see http://www.cru.uea.ac.uk/~timo/paleo/). I suggest we all read those comments carefully!

That brings me back to my original comments on guidelines about distinguishing between good and sloppy science in the published literature. There are a number of criteria to consider. For example, what is the expertise of the authors with respect to the topic they are writing about? Has the paper been properly peer reviewed (by experts within the discipline under discussion)? Is the journal in which it is published a respectable venue for sound science on the topic in question? Has the new piece of 'evidence' been put into proper context with the large body of scientific knowledge already available on the issue?

Once we've answered these and other questions, we will be in a better position to judge *what* we should be debating. Indeed, let's talk about it!

Henry Hengeveld
Toronto, Ontario

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1 March 2004

Subject: Climate Change

It was with dismay that I read Mr. MacRae's letter to the editor in the February edition of the CMOS Bulletin. His arguments are misguided and I feel compelled to address his statements.

Mr. MacRae states that there is evidence to suggest that there "is essentially no correlation between atmospheric CO_2 concentrations and temperatures". On the contrary, it is a well-known fact that if it were not for the greenhouse effect (and the particular concentration of greenhouse gases), then the earth would be uninhabitable. This is based on the sound scientific principle that the concentration of greenhouse gases (GHGs) is *largely* responsible for controlling the mean global atmospheric temperature. In other words, there is indeed a direct link between temperature and the concentration of $C0_2$. To suggest otherwise would fly in the face of basic atmospheric physics. A review of the science used to determine the amount of radiative forcing caused by CO_2 is available on the IPCC web site at http://www.ipcc.ch/.

It is important to note that recent claims in the scientific literature (Shaviv and Veizer 2003) that cosmic rays control global atmospheric temperatures have since been dismissed by 11 eminent earth and space scientists (Rahmstorf et al. 2004). Rather, there is overwhelming research (e.g., Crowley 2000) that identifies anthropogenic GHG forcing as being dominant during the late 20^{th} century. Of course, other factors, such as the amount of incoming solar radiation, also play a role in modulating the mean global temperature. It is well understood that changes in the earth's orbit around the sun (Milankovitch theory) and solar activity can change the amount of incoming solar radiation, and in turn, affect global temperatures — this is nothing new. However, these changes in the earth's orbit occur on time-scales of many thousands of years, and would not, therefore, produce the rapid warming that we have observed in recent decades. This is supported by the fact that solar radiation flux record does not show an increase in the last 50 or so years that would explain the dramatic increase in global temperatures observed during this time.

Mr. MacRae's letter creates the impression that Mann's "hockey stick" (Mann et al. 1998, 1999; hereafter MBH) is incorrect and that this is the last "shred of evidence supporting Kyoto". As proof of this he sites a study conducted by McIntyre and McKitrick (2003; hereafter MM). Mr. MacRae neglects to point out that there is abundant evidence suggesting that the work of MM is seriously flawed and may contain critical errors. MBH recently stated that the reason for this discrepancy is that "...MM have made critical errors in their analysis that have the effect of grossly distorting the reconstruction of MBH. Key indicators of the original MBH network appear to have been omitted for the early period 1400-1600, with major consequences for the character of the MM reconstruction on the NH temperatures...". Both groups of researchers are in the process of trying to identify reasons for the observed discrepancies, so MM's findings are not conclusive. There is much more evidence indicating that the recent dramatic increase in CO_2 levels is largely responsible for the observed global warming than Mr. MacRae suggests. In fact, the work of MBH agrees with independent reconstructions of the historical temperature record made by Jones et al. (1998), Pollack et al. (1998) and Briffa (2000). So it is incorrect for Mr. MacRae to cite MM's paper as proof that anthropogenic forcing of global warming is not occurring.

Mr. MacRae does not provide any evidence whatsoever to support his statement that ".....climate computer modelling proves absolutely nothing, especially when the science on which it is based is incorrect". This kind of rhetoric is unwarranted and grossly misleading. For example, how would he explain the remarkable advances shown by modern numerical weather prediction models (which employ the same physics as do the climate models) in recent decades? It should also be noted that climate models have only been able accurately to reproduce the observed climate record since 1880 (and dramatic warming observed in recent decades) by including natural forcing *and* by increasing the concentrations of GHGs according to the levels observed during that time (Stott et al. 2000; see graph at www.grida.no/climate/ipcc_tar/wg1/fig12-7.htm).

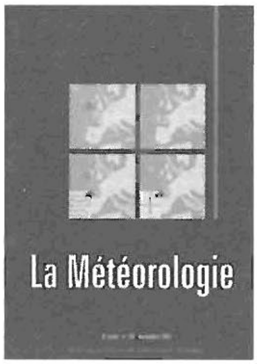
Since the onset of the industrial revolution, humans have been responsible for burning enormous amounts of fossil fuels. The result is that, according to several independent ice core studies, the current concentration of CO_2 is at its highest level in 500,000 years, and likely the highest levels in the past 20 million years. Perhaps more importantly, the rapid rate of increase in the concentration of CO_2 observed since the 19^{th} century is unprecedented. Furthermore, we know for a fact that anthropogenic CO_2 is the reason for this increase. Reputable scientists agree that such a significant increase in CO_2 levels is having a dramatic effect on the fragile balance of the closed earth-atmosphere system. Consequently, it would be naïve and irresponsible to assert that the projected doubling of CO_2 levels would have no effect whatsoever on that system through an increase in the mean global temperature.

What most people fail to recognise in the hype surrounding the Kyoto debate is that all those smoke stacks and vehicle exhausts that are producing GHGs are also venting copious amounts of pollutants into the atmosphere. These pollutants are having a marked detrimental effect on the health of both humans and the environment. One side benefit of Kyoto is that by reducing GHGs we will ultimately also reduce the amount of pollutants that we are producing. Another important fact that is lost in the Kyoto debate is that the current rate at which we are exploiting our natural resources is not sustainable. Developed countries may benefit in the short term (in materialistic terms at least), but both our and future generations will pay a very dear price for our greed and shortsightedness.

Kyoto is not perfect, but it presents a very important mechanism to counter global warming while also encouraging nations to adopt ethical, sustainable and environmentally-responsible operating practices. Moreover, Kyoto will improve the quality of life of the entire global community. In recent years, several European countries have shown that it is possible to lead an environmentally-responsible lifestyle and still prosper — all it takes is political will, ingenuity and commitment.

Julian Charles Brimelow
MSc Meteorology
Edmonton, Alberta

La météorologie en langue française dans la revue *La Météorologie*



Au sommaire, chaque trimestre :

- L'actualité en météorologie et en climatologie
- L'atmosphère vue de l'espace (images satellitaires commentées)
- Des articles scientifiques et accessibles sur les phénomènes météo, la prévision du temps, le climat, l'environnement...
- Des débats entre météorologistes
- Des dossiers sur la coopération et les colloques internationaux, les méthodes d'enseignement...
- Les dernières parutions en météorologie et en climatologie

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Classifying Hurricane Juan

by Peter Bowyer[1]

Foreword: At 12:10 a.m. ADT, Monday September 29, 2003, Hurricane Juan made landfall in Nova Scotia as one of the most powerful and damaging hurricanes to ever affect Canada.

Préambule: C'est à 0 h 10 HAA, le lundi 29 septembre 2003, que la Nouvelle Écosse a été touchée par l'ouragan Juan, l'un des ouragans les plus puissants et les plus destructeurs jamais observés au Canada.

"Why was Juan downgraded to a Category 1 hurricane when we have had Category 3 damage in Halifax?"

"Why was Juan downgraded to a tropical storm before it reached Prince Edward Island; it's obvious that we were hit with a hurricane?"

"If Hortense (1996) was a Category 1 hurricane when it hit us, then isn't it obvious that Juan should be a Category 2-3 hurricane given the more extensive damage?"

These are just a few of the questions that have been asked in the countless emails that I have received since Hurricane Juan hit the Maritimes at the end of September. A power-denied and hurricane-wary public is looking for someone or something to blame, and the storm that hit us "had better be more than just a Category 1 hurricane!"

So what is the classification of Juan at landfall? In many ways, the answer is straightforward. The Saffir-Simpson scale is a 1-5 rating based on a hurricane's present intensity. The scale is used to give an estimate of the potential property damage and flooding expected along the coast from a hurricane landfall. Wind speed is the determining factor in the scale, as storm surge values are highly dependent on the slope of the continental shelf in the landfall region. Note that all winds are a 1-minute average.

Category 1	119 - 153 km/hr
Category 2	154 - 177 km/hr
Category 3	178 - 209 km/hr
Category 4	210 - 249 km/hr
Category 5	Winds more than 249 km/hr

Table 1: Saffir-Simpson scale

The extensive wind damage (especially to trees) seems to indicate that something stronger than a Category 1 hurricane hit the Maritimes. However, it is difficult to use trees to make an assessment because their vulnerability to toppling depends on their type and the depth of their roots. As well, the severe wind shear (strong changes in wind through small changes in elevation) associated with tropical cyclones in higher latitudes could result in winds that are 20-30 km/hr higher at the tops of trees than at their base. Wind shear of this magnitude can be a large factor in significant tree blow-downs. In keeping with these findings, the US National Hurricane Center cautions that wind speeds at the top of tall office buildings may be as much as 1 Saffir-Simpson category higher than at the surface. In addition, small-scale vortices and wind maxima within the storm can create areas of locally higher winds, and greater damage.

Wind Data

Surface wind reports, whether they be from land stations, ships, rigs or buoys, are invaluable in measuring the strength of a severe storm like a hurricane.

In the absence of wind data from near the surface, satellite imagery is diagnosed and the hurricane compared to analogous satellite signatures from known storms of the past. This diagnostic technique, known as the Dvorak technique, becomes more unreliable as hurricanes leave the tropics and move into our latitudes.

[1] Program Manager, Canadian Hurricane Centre, Halifax, N.S.

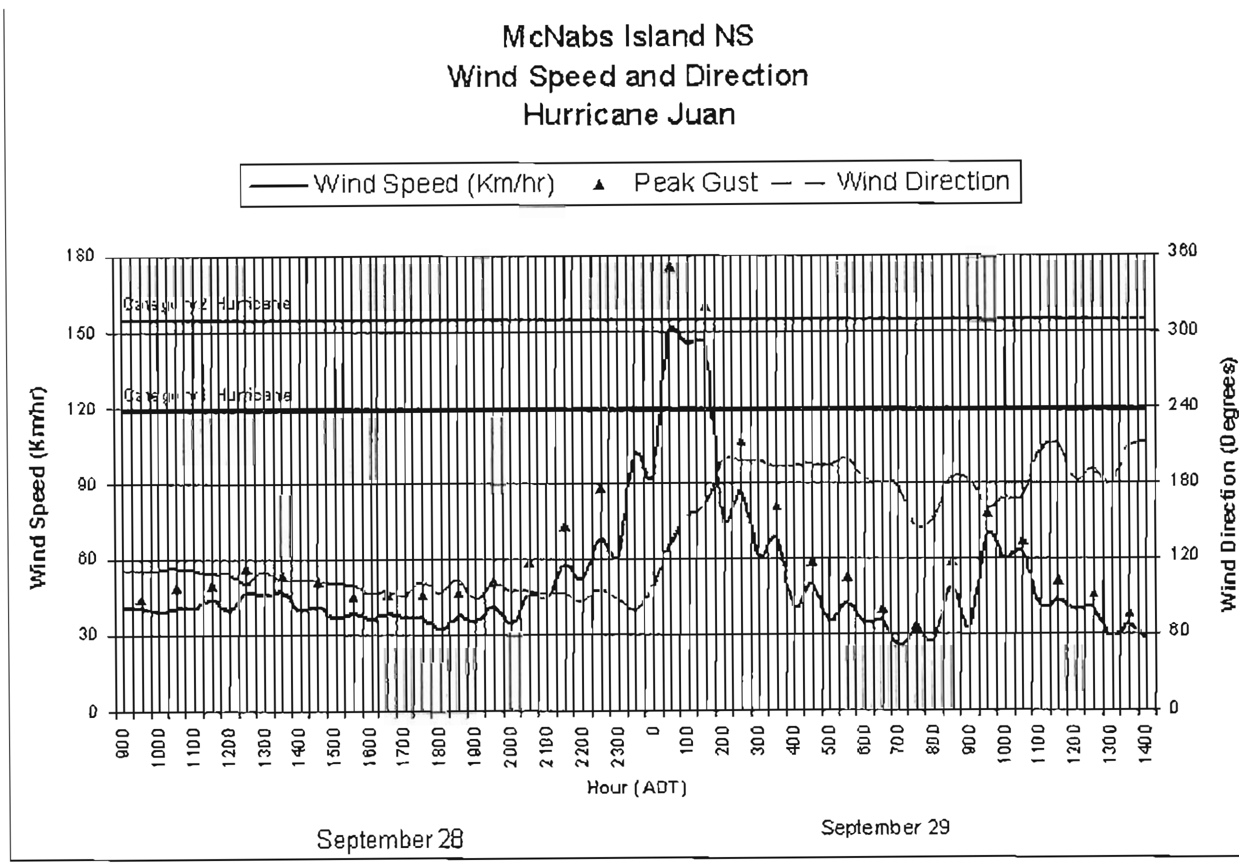

Figure 1: McNabs Island, NS, Wind Speed (knots) and Direction (degrees) during Hurricane Juan with peak gust illustrated

Doppler radar data provides another perspective as it remotely estimates the winds throughout the core of the storm. Radar echoes reflect back from the rain within the storm and a comparison of subsequent echoes allows for a calculation of rainfall motion, and hence, the wind. While Doppler radar gives only an estimate of wind speeds, it provides a glimpse at winds throughout the entire storm all at once.

In addition to surface, satellite, and radar data, reconnaissance aircraft may also be sent into a storm to help determine its intensity. Flight-level winds are converted to representative surface winds through known reduction factors. During three of the last four hurricane seasons, Environment Canada's Meteorological Service of Canada (MSC), in collaboration with the National Research Council (NRC), has used the Convair 580 aircraft to fly into tropical cyclones to deploy data-gathering instruments called dropsondes. These instruments, analogous to radiosondes (weather balloons), are released from the aircraft while it flies through the storm. As the dropsonde descends, it measures temperature, pressure, humidity, and wind, and transmits these data back to the ground station.

Regardless of the data source, winds must be converted to a 1-minute average at the 10-metre level (the standard level established by international standards). These converted winds are referred to by meteorologists as "surface winds."

The Strongest Winds in Juan

The Convair aircraft flew into Juan just prior to landfall and deployed a number of dropsondes. The most notable winds were from the dropsonde released about 28 km south-southeast of Clam Harbour, NS, at 11:54 pm ADT (taking 8 minutes to reach the surface). It is likely that this was just east of the strongest winds in Juan. The dropsonde reported winds of 154 km/hr at 240 m above the surface, 174 km/hr at 630 m, and 182 km/hr at just over 1 km. Conversion of the strongest of these winds to surface winds gives 143 km/hr.

The Doppler radar at Gore, NS, estimated the strongest winds between 206-213 km/hr about 1 km above the surface. Using a similar rate of change of winds in the lower level of the atmosphere recorded by the dropsondes gives surface winds of 133 km/hr.

The McNabs Island autostation (anemometer located atop the 19-metre high lighthouse on Maugher's Beach) reported a 2-minute sustained wind of 151 km/hr with gusts to 176 km/hr. This converts to a surface wind of 152 km/hr.

The Eirik Raude (a semi-submersible drill ship) located about 37 km south of Lawrencetown, NS, reported a wind of 99 knots (the anemometer was pinned at the top of its range for 30-60 seconds indicating that the winds were actually higher). This converts to a surface wind of 147 km/hr.

The Earl Grey recorded a peak wind gust (at 20 metre elevation) of 125 knots (234 km/hr) while at anchor in the Bedford Basin (the head of Halifax Harbour). This converts to surface winds of 159 km/hr.

There were also a number of anemometers which were destroyed during the hurricane and were, therefore, unable to capture the highest winds. The Marine Traffic Control Centre for Halifax Harbour reported that both of their instruments broke (Shannon Hill and Chebucto Head). The MacDonald Bridge between Halifax and Dartmouth recorded a sustained wind of 91 km/hr with gusts to 126 km/hr before it stopped reporting at 11:40 p.m. ADT (perhaps a power failure). The Sambro Light Boat Station anemometer was torn out by the storm even though it had survived a previous storm in which it had logged a peak wind of 198 km/hr.

Other notable wind reports include:

- Halifax International Airport - new record extreme gust of 143 km/hr;

- Charlottetown Airport - sustained 95 km/hr, gusting to 139 km/hr;

- Confederation Bridge - sustained 111 km/hr, gusting to 135 km/hr.

Hurricane force wind gusts (119 km/hr) extended up to 140 km east of the storm (such as Beaver Island, NS, with 132 km/hr gusts; and Caribou Point, NS, with gusts to 119 km/hr).

Conclusions

Juan was a Category 2 hurricane at landfall!

The available wind data objectively suggests that the storm was right on the line between category 1 and 2. The fact that it carried sustained hurricane force winds all through Nova Scotia, and was possibly still at marginal hurricane strength as it was about to enter Prince Edward Island, indicates that it was a very strong storm at landfall. The storm surge data also suggest that Juan was more likely a Category 2 than a Category 1.

As is the practice within meteorology, re-analysis of the data from Juan will be ongoing as after-the-fact information becomes available. The methodologies for converting upper level winds to surface values in a hurricane is well documented for more southerly latitudes but clearly requires refinement for storms approaching Atlantic Canada. As well, the practice of categorizing hurricanes by 10-metre winds (which is done for the purpose of assigning an expectation of damage) may be problematic for hurricanes in our latitudes: damaging winds at 20-30 metres may be considerably higher than those at the 10-metre level of classification. This is true everywhere, but even more pronounced in more northern latitudes where the underlying coastal water temperatures are much lower.

Hurricane categorization can be very complex; Hurricane Andrew (1992) was upgraded to a Category 5 hurricane this past year . . . ten years after making landfall in Florida. It is hoped that we will be aided by wind/structural engineers regarding the damage from Juan to buildings and man-made structures and that this will help to polarize our findings to a single confident conclusion.

As to our certainties:

- Juan claimed more lives (at least 8) in Atlantic Canada than any other tropical cyclone since the "Escuminac Disaster" killed over 30 fishermen in the southwestern Gulf of St. Lawrence in June 1959;

- Juan is the first hurricane since 1893 to bring its worst winds over the city of Halifax;

Even had Juan been weaker and of comparable strength to Hortense (1996), it would have been perceived as a worse storm because the worst conditions in the storm affected a greater portion of the population.

Acknowledgements
I would like to thank the following people for helping pull together this report:

- Bill Richards, Robert Brannen, and Michel Desjardins of the Atlantic Climate Centre for providing the hourly observational data, and in particular, for extracting the winds from the McNabs Island station despite its communication failure during the storm.

- Doug Mercer of the Maritimes Weather Centre for making contacts with various vessel operators and obtaining the data to help in our analysis.

- Bridget Thomas of the Climate Research Branch of MSC for converting the wind observations to standard 1-minute 10-m values and providing data interpretation.

- Chris Fogarty of the Canadian Hurricane Centre for extracting the dropsonde data and providing data interpretation.

- The crew of the Convair 580 for flying into another hurricane to obtain this data.

Source: Environment Canada, Atlantic, website at:
http://www.atl.ec.gc.ca/weather/hurricane/juan/
Reproduced here with permission of the author.
October 10, 2003.

A different perspective of Hurricane Juan: flying into the storm!!!

by Chris Fogarty[2]

Hurricane Juan was the fourth tropical storm that Canadian weather researchers have flown into during the past four years. The Meteorological Research Branch of Environment Canada has funding from Search and Rescue to learn more about dangerous hurricanes moving into Canadian territory. Hurricane Juan was an excellent research opportunity for our team, and I was one of the crew members (support meteorologist) on board the National Research Council's Convair aircraft the night we flew into the storm.

This note is a descriptive time line of the flight and meteorological conditions we experienced the night of September 28th, 2003. Figure 1 illustrates the flight pattern and the locations where we dropped our weather instrument packages (dropsondes).

- 9:45pm - aircraft is outside at the IMP hangar at Halifax International which looked like a ghost-town on the drive over; it is closed to all commercial flights tonight; pilots are powering up and technicians are frantically trying to fix a problem with the power supply.

- 9:55pm - the power supply problem is fixed; heavy gusts of wind already moving into airport and occasionally rock the plane which is still stationary.

- 10:02pm - all clear for departure; rain intensity is picking up as we climb out and head to the south.

- 10:08pm - you can feel wind buffeting the aircraft with a side-to-side motion; winds are out of the southeast at 70 kts at 3000 feet.

- 10:10pm - continuing light-to-moderate turbulence due to strong southeast winds of 75-80 knots about 12 000 feet.

- 10:15pm - releasing first dropsonde instrument about 20 km offshore of Prospect, Nova Scotia; big sigh of relief when wind data comes in (previously there were problems with instruments' wind data).

- 10:30pm - first transect through the eye heading south along the storm track; light-moderate turbulence stopped once in the eye.

- 10:35pm - waiting for rain to show up on radar but it never does - the south side of the storm is dry; we are depending on instruments for information - can't see a thing out the windows (night).

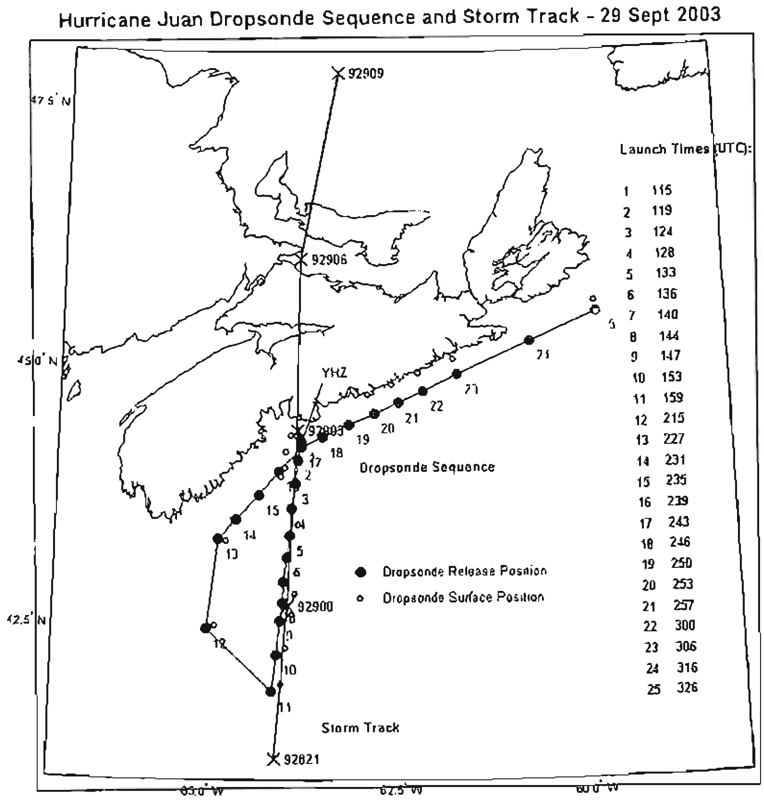

Figure 1: Hurricane Juan Dropsonde Sequence and Storm Track - 28 Sept 2003

- 10:41pm - noting very warm airmass with freezing level at 16 500 feet and flight-level temperature of only -5°C.

- 10:45pm - beginning discussions with flight crew and ground support meteorologist (Jim Abraham) about adjusting our flight plan to turn around and fly through the eye again before it hits land.

- 11:00pm - making a hard right turn to the northwest; stop dropping instruments for a while.

- 11:15pm - I request that we now start heading north...I'm getting nervous about possibly missing flying through the centre again, based on discussion with Jim regarding the acceleration speed of the storm.

- 11:27pm - begin resuming high-frequency dropsonde deployments; now heading northeast parallel to the Nova Scotia coast and about 70 km southeast of Shelburne.

[2] Hurricane Researcher, Canadian Hurricane Centre, Halifax, N.S.

■ 11:40pm - things get interesting again...rain signals return on radar; turbulence increasing again; icing occurring on wings.

■ 11:43pm - nose-cone radar shows that we are in the eye again; there is a steady turbulent shake of the plane, but nothing severe; co-pilot notes ice crystals/mixed-phase ice on the aircraft suggesting high ice concentrations in the clouds; I note very warm flight-level temperature of -2°C at 20 000 feet.

■ 11:46pm - now just east of the eye and about 40 km south of Halifax; moderate turbulence, southerly winds about 80 kts at flight level.

■ 11:53pm - continue to see incredibly strong southerly winds below the aircraft down to the ocean from dropsonde data; a few strong updrafts push plane around.

■ 12:05am - decide to decrease frequency of dropsonde deployments; moving further away from the storm centre.

■ 12:10am - talking with Jim at the weather office where the weather is going downhill rapidly; speaks of blackouts in the city.

■ 12:26am - last dropsonde being released, that makes 25 total; happy mood among the crew - wind data from sondes was a lot better than hurricane Isabel; Walter says he is very happy with cloud microphysical data.

■ 12:30am - pilot is contemplating whether to attempt a landing in Sydney, making the left turn.

■ 12:40am - weather deteriorating in Sydney with gusty winds, decide to recover in Stephenville, Newfoundland.

■ 12:42am - talking with Jim who is in lobby of weather office building which was evacuated; conditions are near the worst in the city.

■ 1:00am - en route to Stephenville, encountering sudden turbulent jolts likely due to mountain turbulence; these jolts worse than in the hurricane!

■ 1:15am - landing in Stephenville, **Terra-Firma!**

Source: Environment Canada, Atlantic, website at:
http://www.atl.ec.gc.ca/weather/hurricane/juan/
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October 31, 2003.

Why did a Category-2 Hurricane hit Nova Scotia? An explanation of the unusual intensity of Hurricane Juan

by Chris Fogarty[3]

It is not rare for hurricanes to strike Nova Scotia (once every three years lately), but usually they are barely hurricane strength when they reach our shores. Hurricane Juan made landfall on September 29th, 2003 as a marginal Category 2 hurricane with maximum sustained wind speeds of 85 knots (158 km/hr). Based on hurricane records during the past 100 years, it appears that such a strong hurricane in Nova Scotia occurs only once in 50 years.

So what made Juan so powerful when it reached Nova Scotia? The answer to that question has a lot to do with the unusually warm ocean surface water temperatures during the tail end of September 2003. Hurricanes need 26°C water temperatures to intensify. Once they move over colder waters, they begin to weaken. The rate at which they weaken depends strongly on the water temperature. The general water temperatures between the Gulf Stream and the Nova Scotia coast on September 28th were about 18°C. The normal temperatures are around 15°C for this date, so the large area of yellow in the image south of Nova Scotia would normally be green. The basic answer to the question is that the warmer-than-normal water slowed down the rate at which the hurricane would normally weaken in this region.

There is more to the story than just water temperatures. Hurricane Juan actually did not weaken much at all when it headed across the cooler shelf waters south of Nova Scotia. The hurricane accelerated, and, as a result, the wind speeds increased relative to the ground and ocean. The storm on its own was still weakening, but the rapid forward motion almost counteracted the weakening as far as wind speeds were concerned. Furthermore, the hurricane spent less time over the cooler waters because it was moving so rapidly, and hence there was less time for the storm to weaken.

The warmer-than-normal water can have two effects. Firstly, it can keep the hurricane going a little longer than it would otherwise. Secondly, the atmosphere is more unstable if the water is warm, and this equates to stronger winds reaching the ground and ocean. If stronger winds

[3] Hurricane Researcher, Canadian Hurricane Centre, Halifax, NS.

reach the ocean, then these winds can help fuel the storm with more moist energy from the water.

There are indications that Hurricane Juan may have been 20-30 km/hr weaker when it hit Nova Scotia under normal ocean conditions. That would correspond to a 130-km/hr storm. When you factor in the increased stability of the atmosphere over 15-degree (as opposed to 18-degree) water, then this may account for 10-20 km/hr less wind at the surface. These considerations leave you with a marginal hurricane hitting the coast, with less damage.

More work will be done in order to quantify the influence of ocean surface water temperature on the intensity of hurricanes in Atlantic Canada. If the seemingly small departure of water temperature from 15°C to 18°C makes a significant impact on storm strength like we believe, then we should be very concerned about long-term trends in ocean temperatures. This could happen in an increasingly warmer climate or with changes in the dynamics of the warm Gulf Stream that may allow warmer waters to move toward Nova Scotia.

Source: Environment Canada, Atlantic, website at: http://www.atl.ec.gc.ca/weather/hurricane/juan/
Reproduced here with permission of the author.
October 24, 2003.
You may also wish to consult the following website: http://www.novaweather.net/Hurricane_Juan.html

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Should "Hurricane Juan" Be Retired?

by Peter Bowyer[4]

Naming of Hurricanes in the Atlantic

The custom of naming hurricanes and tropical storms in the Atlantic began in 1950. Experience showed that the use of names, both in written and spoken communication, was less subject to error than the more cumbersome latitude-longitude identification methods that had been in use. These conventions evolved until 1979, following which they have remained unchanged to today.

- **1950** - Storms named according to the phonetic alphabet: Able, Baker, Charlie, etc.
- **1953** - Phonetic alphabet names abandoned; a single list of female names adopted: Alice, Barbara, Carol, Dolly, Edna, Florence, Gail, Hazel, etc.
- **1955** - Rotating lists of female names introduced.
- **1979** - Male names introduced; six different lists of names to be used in rotation, alternating gender between subsequent names as well as the starting name in subsequent years. The names must reflect the languages prevalent in the Caribbean, and Central and North America, namely: English, Spanish and French.

The Retirement of Hurricane Names

Hurricanes that have a severe impact on lives or the economy are remembered for generations after the devastation that they have caused. Some go into weather history. In many cases it is felt that the future use of the name of such a devastating storm is inappropriate for reasons of compassion and sensitivity. Whenever a hurricane has had this level of impact, any country affected by the storm can make a request to the World Meteorological Organization (WMO) that the name of the hurricane be "retired."

Retiring a name actually means that it cannot be reused for at least 10 years, to facilitate historic references, legal actions, insurance claim activities, etc., and to avoid public confusion with another storm of the same name. The WMO Hurricane Committee in the region of responsibility (in the case of the North Atlantic, it is Region Area IV) considers the request by the affected country, and if agreeable, strikes the storm name from the list and selects another name of like-gender and like-ethnicity.

To date, more than 50 storm names have been retired.

Asking for Juan to Be Retired

In consideration of the lost and damaged lives, the impact to economy, and the widespread destruction of trees through two provinces, the Meteorological Service of Canada, on behalf of Nova Scotians and Prince Edward Islanders, will request that Hurricane Juan be retired.

This request will be presented at the annual meeting of the WMO RAIV Hurricane Committee in the Spring of 2004, along with supporting justification. This will be the first time that Canada has requested the retirement of a storm name.

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[4] Program Manager, Canadian Hurricane Centre, Halifax, NS.

A Matter of Perspective

As Environment Canada's Senior Climatologist David Phillips often reminds us, people are fascinated by the weather. It is little wonder that we are comfortable personifying storms that wreak havoc, or that we find amusement in the naming of hurricanes. And where a storm doesn't come with a name, we seem compelled to find a moniker to facilitate our need to talk about it. Infamous storms such as "The Independence Hurricane," "The Saxby Gale," "The Columbus Day Storm," "The Groundhog Day Storm," "The Escuminac Disaster," and, "The Ice Storm," each provide rallying points for conversation and reflection. As unique as the names, were the calamities brought by each of those tempests.

Next year will mark the 50th anniversary of Hurricane Hazel: another infamous storm with a name. For those of us who weren't in Toronto on that infamous October night in 1954, the inevitable books, TV specials, and radio shows in the coming year will fascinate and entertain us with stories and images. For those who were there, the painful reminders will only bring sobriety. After 1954, the name of Hazel was never used again.

Some think it is melodramatic to ask for the name of Juan to be retired. My guess is that the vast majority of the half million people who were significantly affected by this storm inherently understand that retiring the name won't mean that it will be forgotten. Hazel hasn't been forgotten. Likewise, Juan won't be forgotten; it will be remembered, with perspective.

(Note: The name of "Hazel" was retired after causing considerable loss of life and destruction through the Antilles and the Carolinas in 1954. Because Hazel was not officially a hurricane when it struck Ontario, ultimately killing 83 people, Canada was not one of the countries which requested the retirement . . . but Canadians were very much in agreement).

Acknowledgements

I would like to thank Mr. Bill Appleby for his input and review of this article. Mr. Appleby is the Regional Director for Atlantic Region of the Meteorological Service of Canada and is a long-standing Canadian member of the WMO Region Area IV Hurricane Committee.

A more complete history of the practice of naming tropical cyclones, along with the current lists of names, can be found here at a web site from the U.S. National Hurricane Center: http://www.nhc.noaa.gov/aboutnames.shtml. Some of the material used in this short article was taken from that site.

Source: Environment Canada, Atlantic, website at: http://www.atl.ec.gc.ca/weather/hurricane/juan/
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October 31, 2003.

2003 Atlantic Hurricane Summary

Note from the Editor: The following table of information is taken from the Monthly Summaries, released during the hurricane season, and the Tropical Cyclone Reports, the official reports by the U.S. National Hurricane Center on each tropical cyclone in the Atlantic (see:http://www.nhc.noaa.gov/2003atlan_summary.shtml). During the hurricane season the table is updated on a monthly basis or as the information becomes available. The fourth column (W/P) provides the max 1-minute wind (**W**) in mph and the minimum sea-level pressure (**P**) in mb.

#	Name	Dates	W/P	Deaths
1	Ana	21-24 April	50/996	2
2	Two	10-11 June	35/1008	0
3	Bill	29 Jun-1Jul	60/997	4
4	Claudette	8-17 July	90/979	1
5	Danny	16-20 July	75/1000	2
6	Six	19-21 July	35/1010	0
7	Seven	25-27 July	35/1016	0
8	Erika	14-17 Aug	75/986	2
9	Nine	21-22 Aug	35/1007	0
10	Fabian	27 Aug-8 Sep	145/939	8
11	Grace	30-31 Aug	40/1007	0
12	Henri	3-8 Sep	60/997	0
13	Isabel	6-19 Sep	165/920	16
14	Fourteen	8-10 Sep	35/1007	0
15	Juan	25-29 Sep	105/969	2
16	Kate	25 Sep-7 Oct	125/952	0
17	Larry	1-6 Oct	60/993	5
18	Mindy	10-14 Oct	45/1002	0
19	Nicholas	13-23 Oct	60/997	0
20	Odette	4-7 Dec	65/993	8
21	Peter	7-11 Dec	70/990	0

Call for Nominations
A.G. Huntsman Awards – Silver Jubilee

The A.G. Huntsman Award was created in 1980 to recognize excellence in marine sciences. To mark its 25th anniversary, a 2-day jubilee is planned for the fall of 2005, hosted by the Bedford Institute of Oceanography and Dalhousie University. Medals will be presented in each of the following disciplinary categories:

- Biological/Fisheries Oceanography;
- Marine Geosciences; and
- Physical/Chemical Oceanography.

In addition, a special award will be presented to recognize excellence in interdisciplinary marine science. This award is intended to recognize exceptional contributions across two or more marine science disciplines, at the interface between marine science and related science disciplines, or in the expansion of marine sciences into new fields.

You are encouraged to submit nominations for outstanding individuals in the above categories by **30 June 2004**. More information on the nomination procedure can be found on the Huntsman website at:

http://www.bio.gc.ca/huntsman/huntsman-e.html

For further information, please contact John Loder (Chair, Huntsman Selection Committee) at **loderj@mar.dfo-mpo.gc.ca** .

Appel de candidatures
Prix A.G. Huntsman – 25ième Anniversaire

Le prix A.G. Huntsman a été créé en 1980 pour reconnaître l'excellence dans les sciences marines. Une présentation spéciale de deux jours est prévue pour l'automne 2005 pour souligner son 25° anniversaire. Durant cette cérémonie tenue par l'Institut océanographique de Bedford et l'université Dalhousie, on présentera des médailles dans chacune des catégories disciplinaires suivantes:

- géosciences marines;
- océanographie physique et chimique; et
- océanographie biologique et des pêches.

De plus, une médaille spéciale sera présentée pour reconnaître l'excellence pluridisciplinaire en sciences de la mer. L'intention est de reconnaître les contributions exceptionnelles qui chevauchent deux disciplines ou plus, qui se situent à l'interface entre les sciences de la mer et d'autres disciplines scientifiques, ou qui ont mené à la croissance des sciences de la mer dans des nouveaux domaines de recherche.

Vous êtes encouragés à soumettre des candidatures pour des individus exceptionnels dans les catégories décrites plus haut au plus tard le **30 juin 2004**. Consultez le site web Huntsman à:

http://www.bio.gc.ca/huntsman/huntsman-f.html

pour plus d'information sur les procédures de mise en candidature. Pour d'autres informations, veuillez contacter John Loder (Président, comité de sélection Huntsman) à **loderj@mar.dfo-mpo.gc.ca.**

Lauréat du Prix A.G. Huntsman 2003

La Fondation A.G. Huntsman est heureuse d'annoncer que le lauréat du Prix A.G. Huntsman en 2003 est Lynne Talley, professeur à l'institut Scripps d'océanographie, à La Jolla, Californie. Le prix a été remis par Dr. Garry Rempel, de la Société royale du Canada, lors d'une cérémonie spéciale tenue à l'Institut océanographique de Bedford, le mercredi 5 novembre 2003. Dr. Talley a été honorée pour ses contributions exceptionelles à la compréhension de la circulation et de la ventilation de l'océan global. Pendant sa carrière, elle a rassemblé et synthétisé de grandes bases de données pour jeter un éclairage nouveau sur la circulation thermohaline des océans. De plus, elle a publié des analyses importantes de processus océaniques tel que les instabilités barotropiques, la théorie de la ventilation de la thermocline, et le mélange et la convection. Elle a mené des expéditions océanographiques dans tous les principaux bassins océaniques autres que l'Arctique, et elle a dirigé les comités scientifiques directeurs de programme majeurs sur le climat océanique, tel que le World Ocean Circulation Experiment. Elle a reçu le prix Rosenstiel en 2001 et une bourse pour les jeunes chercheurs de la U.S. National Science Foundation en 1987, et elle est membre de l'American Academy of Arts and Sciences.

A.G. Huntsman Award Winner 2003

The A.G. Huntsman Foundation is pleased to announce that the winner of the 2003 A.G. Huntsman Award is Dr. Lynne D. Talley, Professor at the Scripps Institution of Oceanography in La Jolla, California. The award was presented by Dr. Garry Rempel of the Royal Society of Canada at a special ceremony at the Bedford Institute of Oceanography on Wednesday, 5 November 2003. Dr. Talley was honoured for her outstanding contributions to the understanding of the circulation and ventilation of the global ocean. Throughout her career, she has illuminated the overturning circulation of the oceans through her assembly and synthesis of large datasets. In addition, she has published significant analytical studies of oceanic processes such as barotropic instabilities, ventilated thermocline theory, and mixing and convection. She has led oceanographic expeditions in all of the major ocean basins other than the Arctic and has chaired national and international scientific steering committees for major ocean climate programs such as the World Ocean Circulation Experiment. She received the 2001 Rosentiel Award and a 1987 U.S. National Science Foundation Young Investigator Award, and is a Fellow of the American Academy of Arts and Sciences.

Waves in Hurricane Juan

by Will Perrie[1,2], Bechara Toulany[1], Yongcun Hu[1,3], Roberto Padilla[1,2], Peter Smith[1], Qingping Zou[1,2], Weiqing Zhang[1,2], and Xuejuan Ren[1,4]

Hurricane Juan made landfall at 12:10 a.m. ADT, Monday, September 29, between Prospect and Peggy's Cove, Nova Scotia, and then moved northward across the central portion of the province, passing over Northumberland Strait and Prince Edward Island. This was a Category 2 hurricane, the largest storm to pass over these coastal areas in several decades. Associated high ocean waves were experienced in coastal waters, lashing shoreline villages and beaches from Peggy's Cove to Sheet Harbour. Growing to epic proportions on the Scotian Shelf, the height of these waves exceeded the 100-year return wave, based on the present climatology.

Scientists at Bedford Institute of Oceanography (BIO) are presently involved in programs to test and evaluate modern state-of-the-art, high-resolution wave-forecast model systems for the northwest Atlantic. This work is funded to address issues related to safety concerns of the oil and gas offshore industry, coastal transport, fisheries, Coast Guard Search and Rescue, recreational boating, and coastal development. The first real-time test of these high-resolution wave forecast models, for this region, was Hurricane Juan. Maximum winds exceeded 150 km/h, gusting to 176 km/h, with the maximum wind core passing over Halifax Regional Municipality.

Accurate wave forecasts are dependent on reliable forecast wind fields. At BIO, winds are routinely downloaded from Fleet Numerical Meteorological and Oceanographic Center (FNMOC) in Monterey, California, because we are the pre-operational wave-forecasting component of GoMOOS (Gulf of Maine Ocean Observing System, www.gomoos.org). These winds are from the USA Navy COAMPS (Coupled Ocean Atmosphere Model Prediction System), and for Hurricane Juan they were of particularly high quality. Figures 1a-c presents COAMPS winds at 00 UTC on 29 September (9:00p.m. ADT on September 28), in comparison with blended scatterometer winds, using Florida State University satellite-wind algorithms, and Canadian Hurricane Centre (CHC) storm track analysis. The COAMPS storm track appears to be slightly to the east of that presented by scatterometer data and the CHC analysis, a feature that is qualitatively and quantitatively consistent with the COAMPS wind fields.

The BIO wave model system for GoMOOS consists of nested grids. These include a fine mesh 0.1° resolution grid for the Gulf of Maine, nested within an intermediate 0.2° resolution grid for the northwest Atlantic, which is nested within a 1.0° coarse resolution North Atlantic grid. The operational Wavewatch III (WW3) model developed by the USA National Centers for Environmental Prediction (NCEP) was implemented for the coarse- and intermediate-resolution grids. Variations of this overall nesting formulation are presently being evaluated and reconstructed to better address the needs of Atlantic Canada offshore interests. We report results from the intermediate-resolution grid for this discussion of Hurricane Juan.

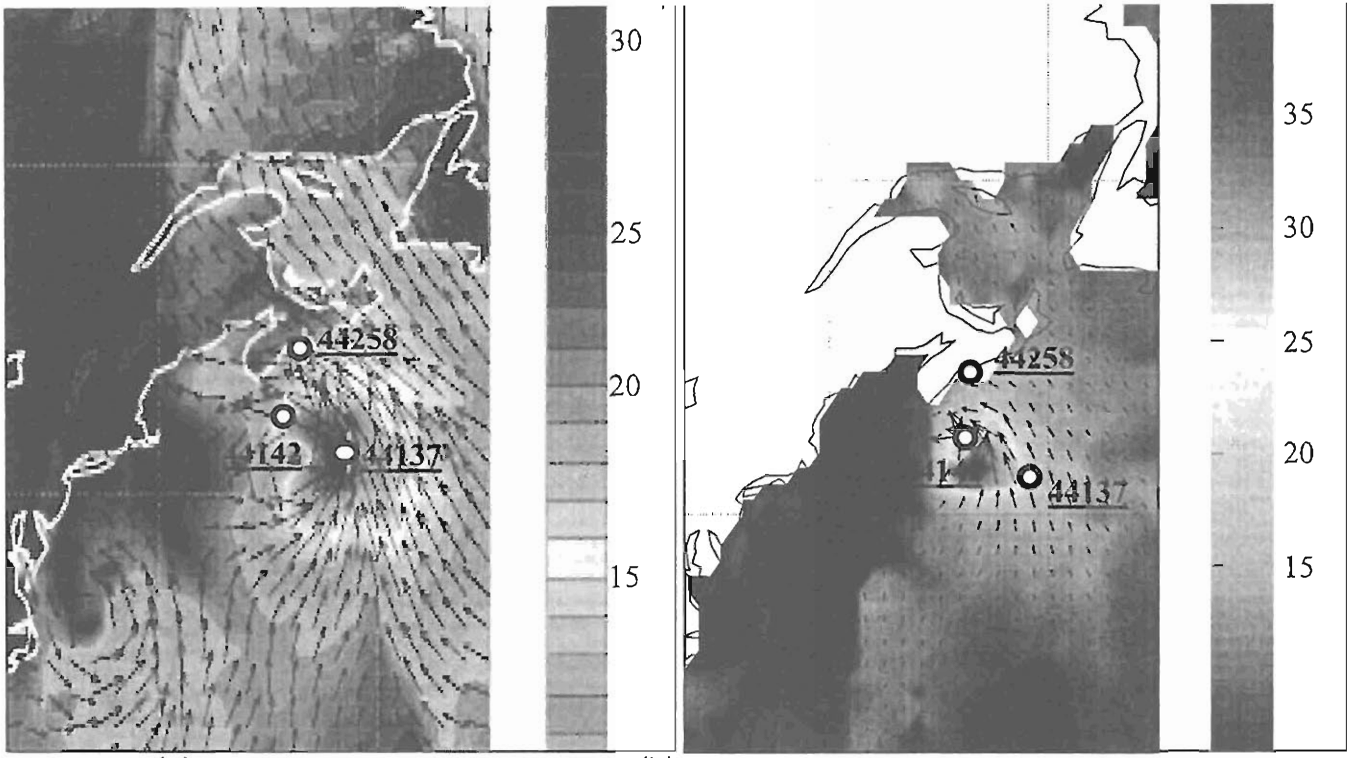
The GoMOOS composite wave model routinely produced 48-hour wave forecasts, every 12 hours, before and during the passage of Juan. In the aftermath of the power blackout that followed Juan, the forecast system was able to continue for a day, until 30 September, at which time the computer was shutdown because BIO's back-up power was beginning to fail. As shown in Figures 2a-b, the wave model forecasts suggest significant wave heights (Hs) of almost 12 m for Scotian Shelf, at 00 UTC 29 September. Along the Eastern Shore of Nova Scotia, Hs wave heights as high as 10 m were predicted for coastal areas. These forecasts compare well with available measured wave heights. Waves were observed to pass at least 2 m over the sea wall at Peggy's Cove, which is 2 m high and located on a ridge that is 5 m above sea level, crashing through the village and causing extensive damage.

[1] Fisheries & Oceans Canada, Maritimes Region, Bedford Institute of Oceanography Dartmouth, Nova Scotia

[2] Engineering Mathematics, Dalhousie University, Halifax, Nova Scotia

[3] Forrest Numerical Modelling, Halifax, Nova Scotia

[4] Department Atmospheric Sciences, Nanjing University, Nanjing, PR China



(a) (b)

Figure 1. Comparison of wind fields: (a) COAMPS winds at 00 UTC on 29 September, (b) blended scatterometer winds from 18-24 UTC on 28 September.

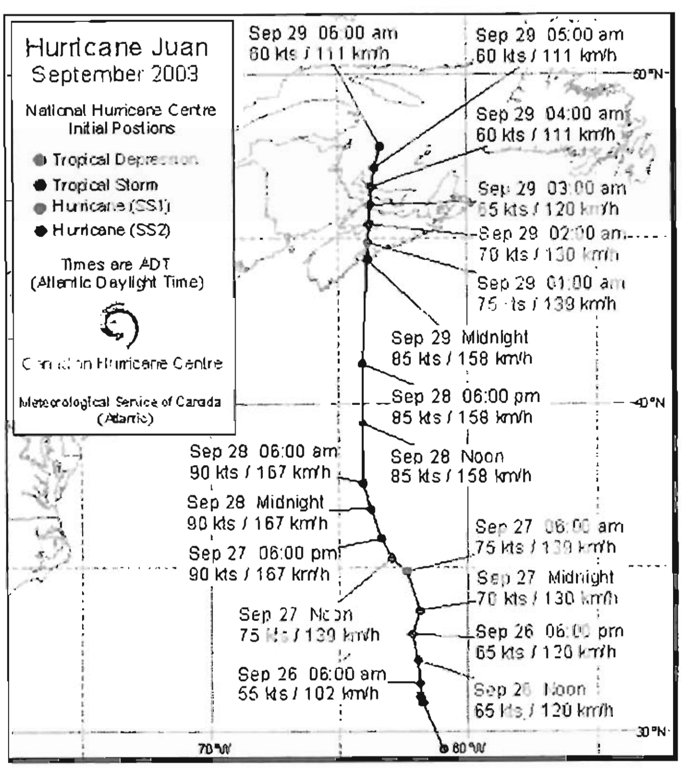


Figure 1c) CHC storm track analysis and peak storm winds from http://www.ns.ec.gc.ca/weather/hurricane/juan/track2_e.gif. MSC buoys are 44142, 44137, and 44258 as indicated. Wind speed units are m/s.

COAMPS winds were able to capture the timing of Juan's passage correctly, but did not completely simulate the peak storm intensity, or storm track. The actual storm track passed slightly to the west of the simulated COAMPS model forecast track over Scotian Shelf. Therefore, the COAMPS winds are too low at (Meteorological Service of Canada - MSC) buoy 44258 at the mouth of Halifax Harbour (Fig. 3a), and at offshore buoy 44142 (Fig. 3b), and too high at offshore buoy 44137 (Fig.3c), compared to measured winds.

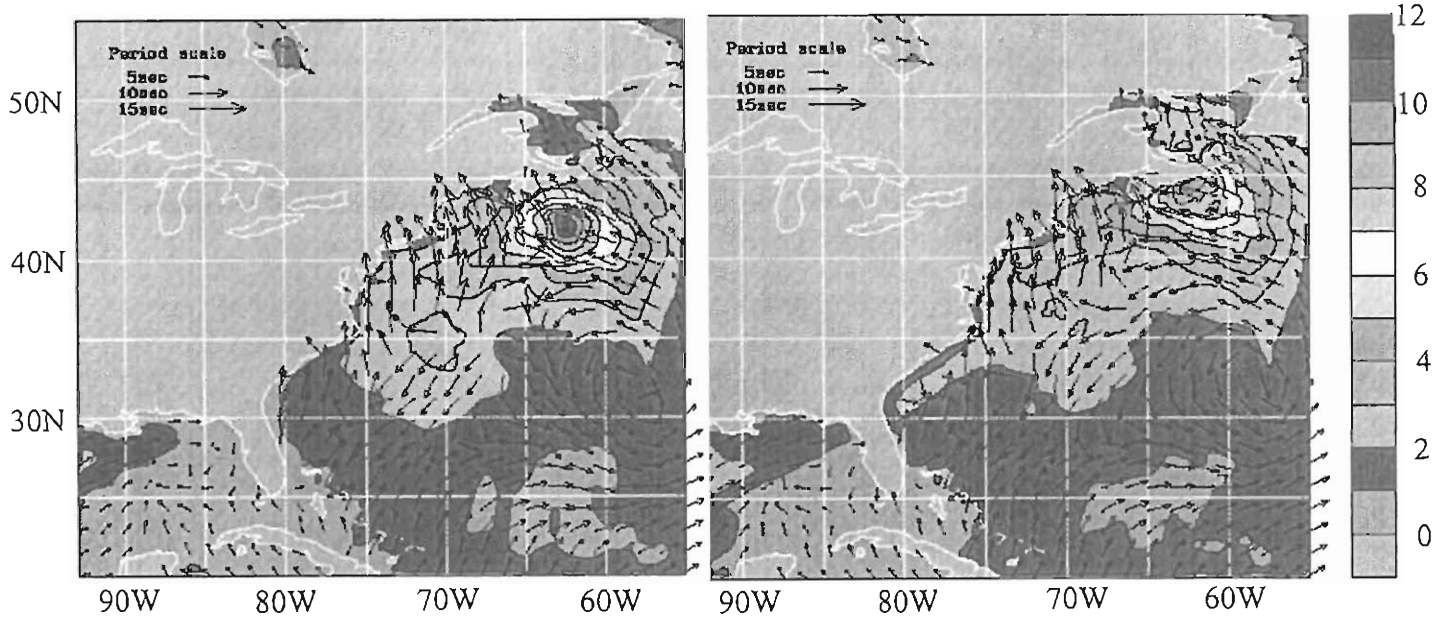
The largest Hs wave heights recorded at buoy 44258 off Halifax Harbour were almost 9 metres (Fig.4a), with maximum waves of about 20 metres. Corresponding wave model estimates from the BIO WW3 implementation appear to underestimate these Hs waves by about 1 m, although the timing of the peak is very nearly correct.

Maximum significant wave heights (Hs) of 12 m were measured at buoy 44142 on western Scotian Slope (Fig. 4b). Although the COAMPS winds and WW3 wave forecast correctly simulated the timing of the storm, the observed Hs peak at this site was underestimated by about 4-5 m, and the observed winds were high by as much as ~15 m/s relative to COAMPS (Fig. 3b). Note however, that 12 m Hs waves were achieved within the WW3 wave field at 00 UTC (Fig. 2a). By comparison, a maximum observed Hs of 7 m, measured at buoy 44137 on eastern Scotian Slope (Fig.4c), was overestimated in the WW3 wave forecast by about 1 m, reflecting a systematic overestimate of the observed wind speed by about 1-2 m/s (Fig.3c). Again the forecast timing of the storm's passage was excellent at buoy 44137, so that in spite of slight quantitative errors related to storm track, the GoMOOS forecast for Hurricane Juan was essentially correct.

BIO scientists are supporting Environment Canada (EC) weather specialists in the examination of all collected data, including surface wave observations as well as wind data from aircraft and satellite measurements. As information becomes available and we learn more about the storm's nature and impacts, results will be presented in workshops and conferences. A successful outcome of Hurricane Juan would be a collaboration between EC and DFO researchers to formulate and implement reliable models for accurate prediction of marine winds and waves in storms affecting coastal areas of Atlantic Canada.

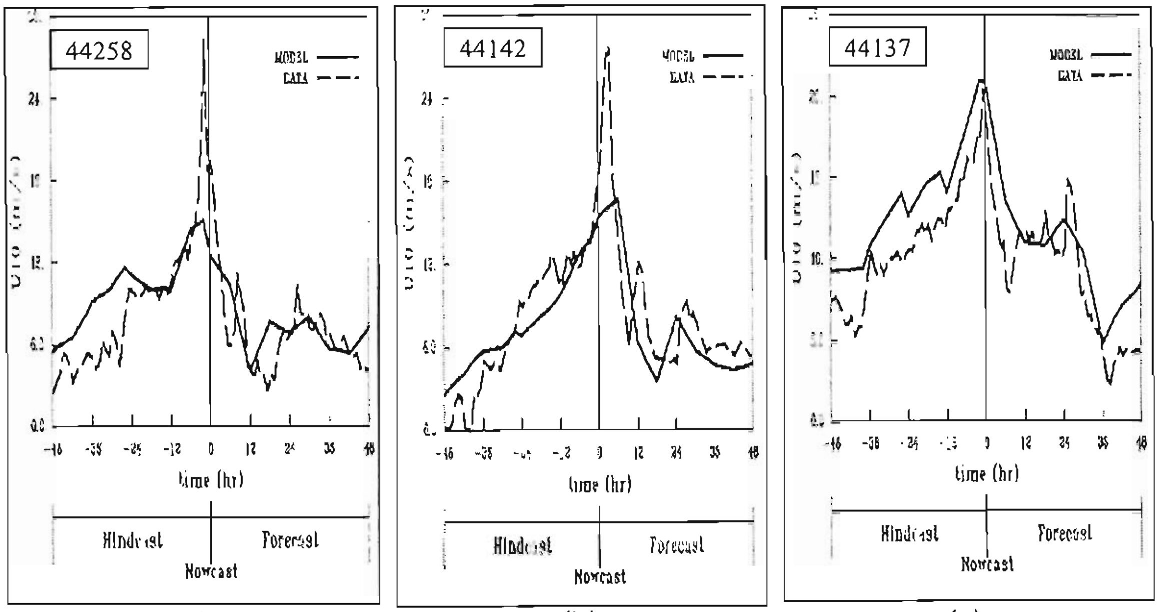
Acknowledgements

We are grateful to Fleet Numerical Meteorological and Oceanographic Center (FNMOC) in Monterey California for assistance in accessing and using COAMPS wind products, and to Mark Bourassa and Jim O'Brien at Florida State University for satellite-wind blending algorithms and codes. Funding was provided by the Panel on Energy Research and Development (PERD), the Gulf of Maine Ocean Observing System (GoMOOS), the Petroleum Research Atlantic Canada (PRAC), the Canada Foundation for Climate and Atmospheric Studies (CFCAS). Canada Coast Guard New Initiatives Fund (SAR NIF) is supporting an initiative led by Environment Canada that collected aircraft and *in situ* data during Juan.



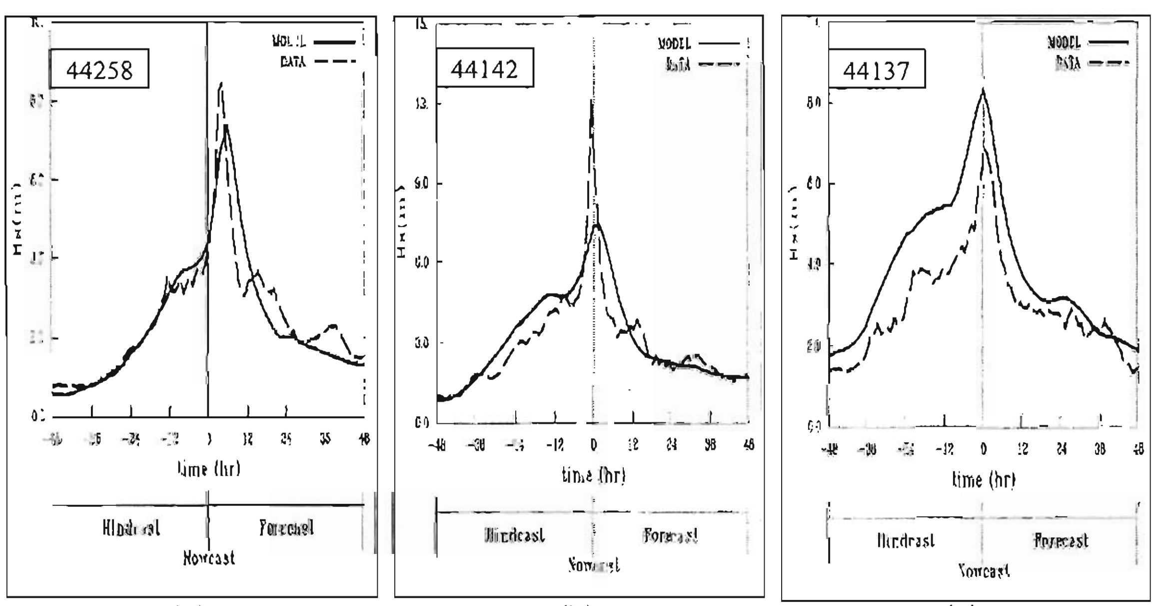
(a) (b)

Figure 2. BIO WW3 wave model outputs for (a) 12-h and (b) 18-h forecasts, based on GoMOOS pre-operational run at 12 UTC on 28 September. These forecasts, valid for 00 UTC and 06 UTC 29 September, respectively, indicate the peak wave heights for Juan occurred in the early hours of 29 September. Significant wave heights (contours), wave directions (arrows), and wave periods (length of arrows) are shown.



(a) (b) (c)

Figure 3. Comparison of COAMPS wind forecasts with observations from operational MSC buoys on Scotian Slope (44137 and 44142) and at the mouth of Halifax Harbour (44258) for 10-m wind speed (U10). Routine forecasts are plotted every 12h, from hindcasts (-48≤t<0 hr), nowcast (t=0), and forecasts (0<t≤48 hr) for each buoy.



(a) (b) (c)

Figure 4. Comparison of wave model forecasts with observations from buoys 44137, 44142 and 44258, for significant wave height (Hs), during Hurricane Juan. Routine forecasts are plotted every 12h, from hindcasts (-48≤t<0 hr), nowcast (t=0), and forecasts (0<t≤48 hr).

The Storm Surge and Waves at Halifax with Hurricane Juan

by Peter Bowyer[5]

Storm Surge in General
A storm surge, as the name implies, is a surge of water at a coastline as a direct result of a storm. A storm surge at any coastline is the onshore pileup of ocean water (or lake water) caused by a combination of high winds and low pressure with a cyclone (a low pressure system). Storm surges occur both with tropical cyclones (like hurricanes) or extratropical cyclones (like winter storms). The lower central pressure of the storm causes the ocean to rise up in response, much the way a carpet bulges underneath a vacuum moving across it. It is sometimes assumed that this effect is the dominant factor in storm surges associated with hurricanes. In fact, it is the wind ahead of the hurricane that plays the key role in setting up large surges at the coastline; sometimes, 75% or more of the surge is the result of the wind, not the low pressure.

A simple and general rule-of-thumb for estimating a storm's low pressure contribution to the surge is as follows: 1 cm of rise above predicted tidal values for each 1 hPa below the standard atmospheric pressure of 1013 hPa. For example, Hurricane Juan had a central pressure of 974 hPa when it made landfall just west of Halifax Harbour. The pressure effect alone would result in a surge of approximately 39 cm; however, the surge measured in Halifax Harbour was about 150 cm. Clearly, a more important mechanism was at work.

The wind is the key answer. As a hurricane approaches a coastline, the very strong pressure gradient (a large difference in atmospheric pressure over a small area of geography) pushes the ocean surface ahead of the storm and predominantly to the right side of the track. Other factors such as the speed of the storm's motion, the angle at which the storm makes landfall with the coast, and the coastal bathymetry (the shape of the seabed) all help determine the specific storm surge experienced at each point along the coast . . . but the wind is the most important factor.

The Surge with Juan - the Big Picture
Four independent events have to happen for a "worst case scenario" surge event to occur in the Maritimes: a spring tide; a lunar perigee; a daily high tide; a powerful storm. How did these line up with Hurricane Juan?

Firstly, the new moon on September 25th meant that the biweekly run of spring tides-one of the two monthly peaks in the tidal cycle-would give large tides on September 28th. Secondly, the occurrence of the September 28th lunar perigee-the point in the moon's monthly orbit when it is closest to the earth-meant that the spring tides were higher than normal. Thirdly, the Atlantic coast of Nova Scotia experiences two daily high tides, opening two windows of flooding-opportunity each day during a run of perigean spring tides. Finally, the arrival of Juan-a Category 2 hurricane-near the time of high tide lit the fuse leading to a damaging surge event.

Hurricane Juan came straight north for 24 hours, taking about the worst possible track for setting up high water levels along the Atlantic coast of Nova Scotia. A straight track sets up the worst waves while the northward track sets up a bad surge. The highest surges occurred east of the point of landfall which was near Prospect, NS.

The Surge at Halifax - a Detailed Picture
The accompanying graphs of data collected by the Halifax Harbour tide gauge (operated by the Canadian Hydrographic Service) shows: the predicted water level based on astronomical tides (green line); the actual water level recorded by the tide gauge (orange line); the difference between these two values as a result of the storm-the storm surge (red line); the old record water level (light blue line); the new record water level established by Hurricane Juan (dark blue line). The three graphs show the tide gauge data surrounding the arrival of Juan during successive zooms in time: 4 days, 2 days, and 8 hours, respectively.

The surge began its rapid rise at 9:45 pm ADT, September 28, reaching a peak of about 150 cm (5 feet) at 1:00 a.m. ADT, and establishing a new record storm surge at Halifax (since at least 1940). Together with the already high tidal levels, a record water level of 290 cm (above the tidal benchmark known as "chart datum") was established at Halifax. This value is greater than all Halifax water level data since 1961, although the new record has yet to be officially confirmed by the Canadian Hydrographic Service. Unfortunately, with this record came widespread flooding along the waterfronts of both Halifax and Dartmouth.

When winds shifted about 1:00 a.m. the water in Halifax Harbour drained immediately back into the Atlantic. It took the harbour waters 5 hours to rise 2 metres (6.7 feet) with the incoming tide and surge. The hurricane force east-southeast winds acted to damn the water up in the harbour, preventing it from draining back into the Atlantic as it normally does with the ebb tide. When the winds at the mouth of the harbour shifted from southeast to south, that was enough to "lift the floodgate" and allow the 2 metres of excess water to drain dramatically back into the ocean. The harbour returned to its original level in an hour-and-a-half.

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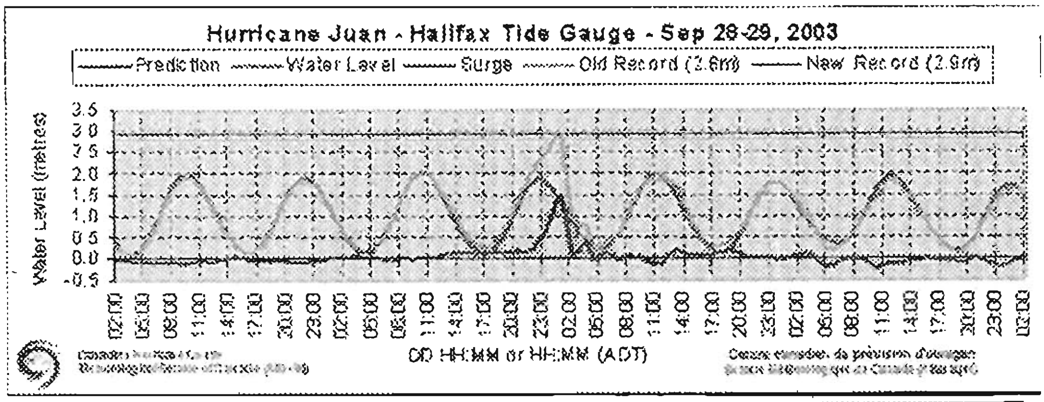
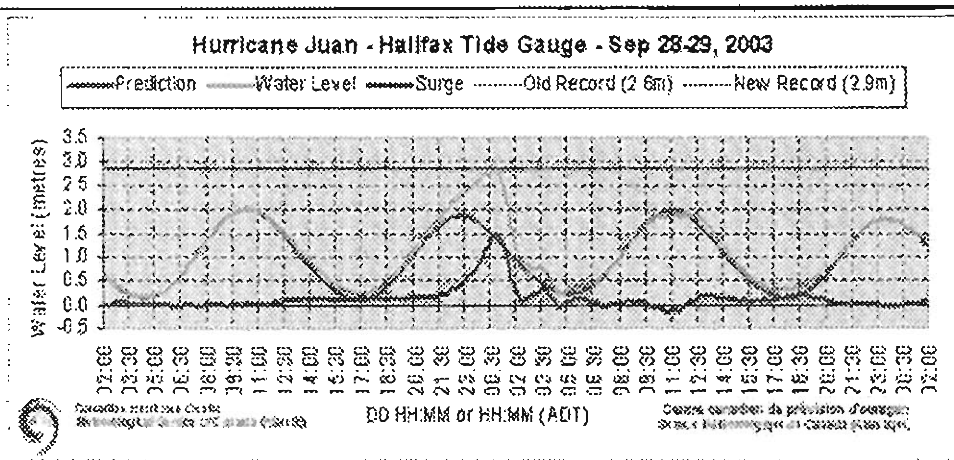
[5] Program Manager, Canadian Hurricane Centre, Halifax, N.S.



Zoom = 4 days



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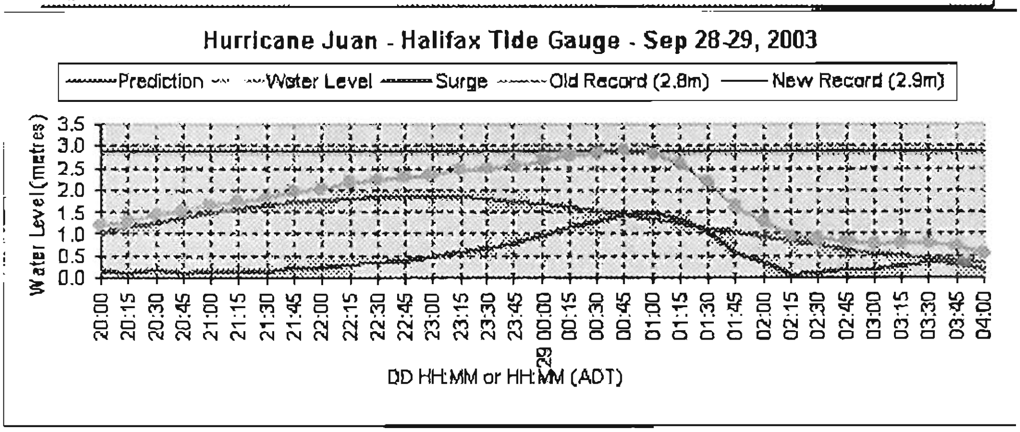
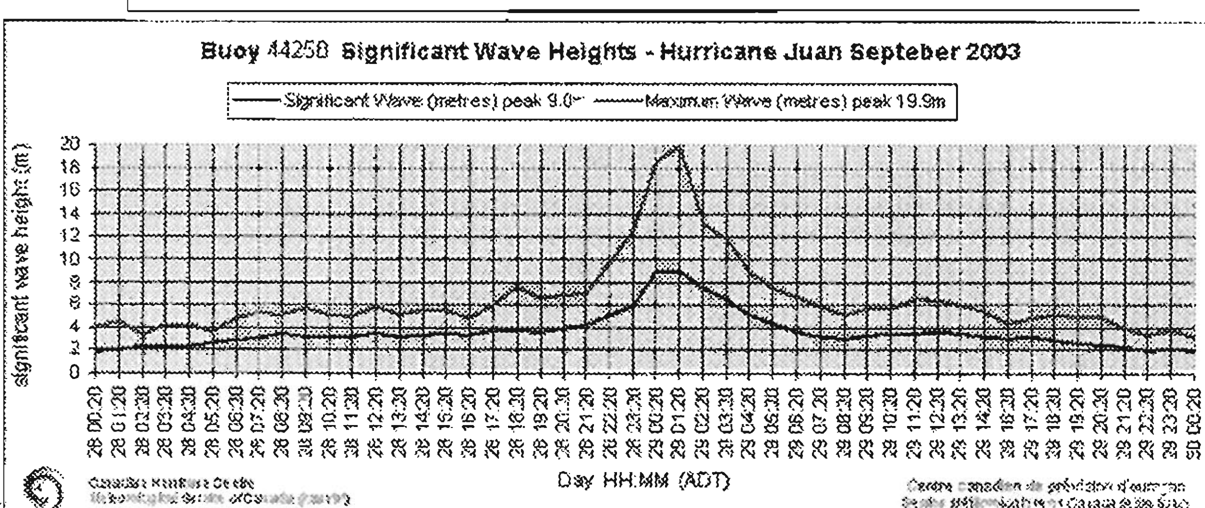


Zoom = 8 hours



Waves

The Waves at Halifax

A field of 9-13 -metre (30-43 feet) significant wave heights- an average of the highest one third of the waves- approached the coast of Nova Scotia with Hurricane Juan. The Environment Canada buoy 44258, just outside Halifax Harbour, recorded maximum significant wave heights of 9.0 metres at the same time that Juan was making landfall. The maximum waves around the same time were 19-20 metres (62-66 feet). The accompanying graph shows that the largest of these waves occurred between 12:20 and 1:20 a.m. ADT.

The high waves contributed to the pileup of water in the harbour and the more exposed locations near the mouth of the harbour felt the full brunt of the waves.

It Couldn't Have Been Much Worse

Besides Halifax experiencing the highest winds in Hurricane Juan, the highest storm surge and highest waves menacingly combined to arrive at the coastline at the same time, making the Halifax waterfront flooding problem even worse. Sometimes with landfalling hurricanes in Canada, the storm surge peaks near the time of landfall, whereas, the highest waves can lag the storm by an hour or two. As well, the straight-line path of Juan in the 24 hours before landfall allowed for substantial wave growth with the storm. In particular, Juan was moving at just the right speed for the highest surge, the highest waves, and the strongest winds to arrive all at about the same time.

In many ways, it couldn't have been much worse.

Actually, It Could Have Been Worse

When we look a little closer at the timing of the water levels in Halifax, it becomes apparent that the event had a silver lining; Juan missed the high tide! Had Juan arrived only 2 hours earlier, the peak surge in Halifax Harbour would have coincided exactly with the high tide, possibly resulting in an additional 45 cm (1.5 feet) of elevated water. Had it arrived 10.5 hours later, it would have coincided with the higher of the two daily high tides and instead, an additional 60 cm (2 feet) would have resulted. An additional 2 feet of water in the harbour could have had staggering consequences.

In addition to the timing being less than "perfect" for creating the worst conditions, the hurricane approached the coast at a slight angle. The coastline and its sea bed are oriented facing southeast, not south. A more damaging surge event would have occurred if Juan approached from the southeast rather than from the south.

When we look a little closer at the wave growth we see that Juan was moving just a little too quickly to allow for maximum wave growth. By the time it made landfall, Juan was already outstripping the waves that it was generating. Had the storm's acceleration been a bit slower the waves being generated would have moved in closer harmony to the storm's speed, thereby allowing for larger waves.

In many ways, Juan was no "perfect storm"; it could have been much worse.

Conclusion

In comparison to storms of memory, there is little doubt that Hurricane Juan was "the big one" for the Halifax Regional Municipality. However, many less-than-perfect factors tell us that "a bigger one" is still out there: a storm with higher winds, larger waves, greater storm surge, and a more sinister combination of all three.

Therefore, it's not a question of IF?, just WHEN? How long? What we know is that it has been 110 years since the last similar event. Statistics tell us that it will likely be another hundred years before Halifax sees another Juan. Statistics also tell us that a worse hurricane could hit Halifax next week.

It has been said that "Climatology is what you expect, but weather is what you get!" Climatology tells us that we should expect to wait a very long time before we see another Juan. Meteorology teaches us to keep watching anyway!

Acknowledgements

I would like to thank the following people for helping with this report:

1) Lorne Ketch of the Atmospheric Science Division for preparing the map and graphs for this report and for providing data interpretation and critical review.

2) George Parkes of the Canadian Hurricane Centre for providing data interpretation and critical review.

Source: Environment Canada, Atlantic, website at:
http://www.atl.ec.gc.ca/weather/hurricane/juan/
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October 17, 2003.

Please send your nominee for the Rapporteur/Associate Editor from your Centre as soon as possible. We need your help!!!

Paul-André Bolduc,
Editor, CMOS Bulletin SCMO

Canadian Meteorological and Oceanographic Society | **La Société canadienne de météorologie et d'océanographie**

CMOS SCMO

Gulf of Alaska storm
Tempête dans le golfe d'Alaska

Badger flood - February 2003
Inondation à Badger - février 2003

Prairie drought
Sécheresse dans les Prairies

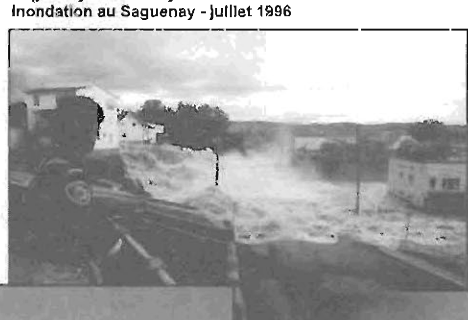
Human Dimensions of Weather and Climate

38th CMOS Congress,
31 May - 03 June, 2004
Fantasyland Hotel
Edmonton, AB
www.CMOS.ca

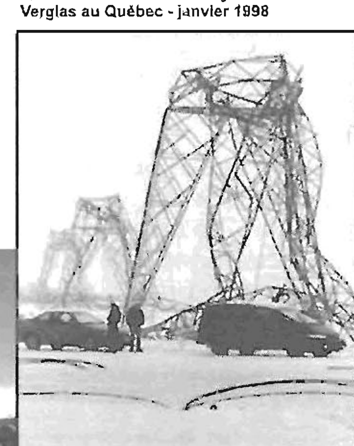
www.SCMO.ca
38ième Congrès de la SCMO à Edmonton, AB
31 mai - 3 juin, 2004
Hôtel Fantasyland

La dimension humaine de la météo et du climat

Saguenay flood - July 1996
Inondation au Saguenay - juillet 1996



Quebec Ice storm - January 1998
Verglas au Québec - janvier 1998



Red River flood - April 1997
Inondation de la rivière Rouge - avril 1997

Edmonton tornado - July 1997
Tornade à Edmonton - juillet 1987

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Atmospheric Pollution History, Science, and Regulation

par Mark Z. Jacobson, professeur
Université de Stanford

Cambridge University Press, Hardback Cover,
ISBN 0-521-81171-6, $110.00US

Livre critiqué par Claude Lelièvre[1], Ph.D.

Ce livre constitue une introduction détaillée de l'historique et de la problématique de la pollution de l'air. Ce livre s'adresse aux étudiants sous gradués et gradués qui prennent des cours en chimie et physique de l'atmosphère, en météorologie, en loi environnementale et en planification urbaine. Il peut également constituer une excellente introduction au sujet pour le public en général. Ce livre est abondamment illustré et il utilise souvent les couleurs vives telles que le jaune, le vert et le magenta, pour mettre en relief les passages importants et le contenu des tableaux. À la fin de chaque chapitre, il y a une série de problèmes à résoudre.

Le premier chapitre présente l'historique de la découverte des composés chimiques de l'atmosphère tout en fournissant des définitions simples mais précises de nombreux termes. J'y ai appris notamment que c'est le britannique Frederick George Donnan qui a inventé le mot aérosol à la fin de la Première Guerre Mondiale. L'origine des noms des éléments chimique enrichit le texte et contribue à alimenter l'intérêt du lecteur. Par exemple, le krypton provient du mot grec kryptos qui signifie caché et oxygène signifie générateur d'acide. Les découvertes faites par les alchimistes sont également présentées ainsi que celles des chimistes modernes. L'auteur présente ensuite l structure de certains des composés communs, allant de l'oxygène moléculaire à l'acétone. Quelques réactions chimiques et photochimiques sont ensuite décrites brièvement.

Le deuxième chapitre est consacré à l'évolution du soleil, de la terre et de l'atmosphère terrestre. J'y ai appris qu'un photon qui se trouve au centre du soleil met en moyenne dix millions d'années avant de s'échapper de la zone de convection d'hydrogène qui s'étend entre 86% du rayon du soleil et environ 500 km sous la surface du soleil. L'historique de l'atmosphère terrestre est intéressant. La production d'oxygène par les cyanobactéries a permis d'augmenter graduellement la proportion d'oxygène dans l'atmosphère, ce qui a contribué à produire la couche d'ozone protectrice il y a environ 400 millions d'années. L'effet protecteur de la couche d'ozone contre les rayons ultraviolets a alors permis le développement des plantes terrestres.

Le troisième chapitre aborde la structure et la composition de l'atmosphère actuelle qui est souvent le point de départ des livres sur la pollution atmosphérique. La particularité de ce livre est de tout replacer dans son contexte historique. L'auteur ne se contente pas de dire comment se mesure la pression atmosphérique, il nous raconte également que c'est Evangelista Torricelli qui a été le premier physicien à mesurer la pression atmosphérique. Quelle est la vitesse thermique d'une molécule d'air à 300 K? Vous trouverez la réponse dans ce livre. L'auteur présente l'historique de la découverte des gaz parfaits et décrit la composition de l'atmosphère qui est bien connue de tous les météorologistes. Les principaux polluants atmosphériques décrits incluent le monoxyde de carbone, l'ozone, le méthane, le dioxyde de soufre, le dioxyde d'azote et le plomb.

Le quatrième chapitre aborde la problématique de la pollution de l'air urbaine. La pollution atmosphérique date depuis très longtemps et a été rapportée par des auteurs latins et grecs il y a plus de deux mille ans. L'industrialisation au dix-huitième et dix-neuvième siècles a aggravé les problèmes. Le terme smog a été introduit par Harold Antoine Des Voeux pour décrire la combinaison de fumée et de brouillard visible dans plusieurs villes britanniques. Les principales réactions photochimiques qui se produisent lors du smog sont décrites et commentées en détails.

Le cinquième chapitre présente la problématique à l'échelle mondiale des particules d'aérosol dans le smog. Les sources naturelles de poussières sont d'abord décrites, puis c'est au tour des sources anthropiques. Les effets sur la santé des particules d'aérosols sont brièvement discutés.

Le sixième chapitre décrit de façon trop succincte les effets de la météorologie sur la pollution de l'air. Ceci s'explique probablement parce que l'auteur a publié un livre dédié à la modélisation atmosphérique ("Fundamentals of Atmospheric Modeling") et ne voulait pas couvrir deux fois en détails le même sujet.

Le chapitre sept couvre les effets de la pollution sur la visibilité, la radiation ultraviolette et l'optique atmosphérique de façon plus approfondie. Les effets des gaz atmosphériques et des polluants atmosphériques sur la radiation solaire sont bien décrits.

[1] Enviromet International Inc., Montréal, QC.

Le chapitre huit décrit la réglementation internationale du smog urbain à compter de 1940. La réglementation américaine est bien couverte. La réglementation canadienne est présentée rapidement sans mention spécifique des réglementations provinciales. Cette section devrait être améliorée substantiellement pour les lecteurs canadiens.

Le chapitre neuf sur la pollution de l'air intérieur est intéressante et constitue une brève introduction au sujet.

Le chapitre dix est consacré aux précipitations acides. Les causes du phénomène sont expliquées brièvement ainsi que certains des effets.

La réduction de l'ozone stratosphérique constitue le sujet du chapitre onze. Ce sujet est traité en détail avec une emphase sur les aspects chimiques et réglementaires du problème.

L'effet de serre et le réchauffement global sont discutés au chapitre douze. Un des aspects intéressants de ce chapitre se trouve dans la comparaison de l'atmosphère terrestre avec celle des autres planètes. L'historique sur les changements climatiques présente un intérêt certain pour les météorologistes. L'auteur s'interroge également sur les conséquences possibles d'un réchauffement climatique.

Le livre est très bien fait et constitue une bonne introduction aux sujets traités. Son utilisation comme manuel de référence au Canada devrait cependant être complétée par des textes plus précis sur la réglementation provinciale. Les aspects météorologiques devraient également être couverts avec plus de profondeur pour être utile aux étudiants en météorologie.

CLIMATE INTO THE 21ST CENTURY

Editor: William Burroughs
World Meteorological Organization

Published in August 2003 by Cambridge University Press
Hard Cover: ISBN 0 521 792029, 240 pages, US$35.00

Book reviewed by Patrick Spearey[2]

This book was produced to assist a broad audience generally understand and learn about how to deal with the wide-ranging impacts that the earth's climate is capable of delivering. It was compiled under the auspices of the World Meteorological Organization by a team of experts from around the world, representing many climate-related disciplines. The lead author and editor, Dr. William Burroughs, was closely assisted by a project task team of five of these experts, one of the five being David Phillips of the Meteorological Service of Canada.

Five major sections divide the contributions into (1) peoples' perceptions of climate over the past century, (2) a survey of the climate system through major weather and climatological events and human influences of the past, (3) the impacts of varying climate on the earth and its people, (4) the development of observational and monitoring systems and the attempts at climate predictability, and (5) the prospects for applying this knowledge and these experiences to benefit society in the 21st century. These five sections are comprised of a total of 101 two-page spreads, each covering a topic in as self-contained a way as possible. Connectivity is achieved by the sequence of the topics and by a few cross references. The narratives are easy to comprehend and are complemented in each spread by three or more small yet mostly adequate coloured photographs, tables, figures, diagrams or maps. Appendices include: a six page glossary of terms; lists of expansions for acronyms, abbreviations, chemical symbols and SI and other related units; and conversion factors. The index appears to be thorough and contains about 1400 entries.

Three examples of the type of content included in the two-page spreads follow, two chosen at random, the other containing Canadian content. From the first section, under the title "Our Increasing Vulnerability", the growth and spread of populations into areas vulnerable to weather extremes and climate fluctuations are examined together with ways to minimize these increasing dangers. Areas such as coastal and flood plains, arid regions, deforested tracts, and cities are covered. The need to make better use of weather and climate services is stressed. A world map shows population densities within 100km. of coastlines. Photographs depict a flash flood in a crowded and poor area, people searching for fish in an almost dried-up lake in Thailand during drought associated with the 1998 El Niño episode, and a crowded city street scene where the inhabitants are exposed to health risks, including photochemical smog.

"*Northern Middle Latitude Winter Storms*", in the second section, discusses how such storms cause damage and death mainly by excessive winds, precipitation and related sea-wave action. There is mention of the work in recent decades to determine if there is evidence of a link between variations in the number and strength of these storms and increases in the earth's average near-surface temperature and of the work to better understand long term wind and surface pressure trends. Emphasized are Asian cold waves, the European storminess in the late 1980s and the 1990s, and North American east coast storms. Highlighted here are the frequent damaging storms affecting the Canadian Maritime Provinces and the cold air drawn from Canada that causes temperatures to plummet in eastern USA. It is stated that what some may think is an upward trend in storminess may be due, in part, to improved observation and detection methods. A map shows maximum wind gusts over departments of France on 25-26

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[2] CMOS Member, Ottawa, ON

December 1999 and a chart depicts the intensity of the peak gusts on the morning of 26 December at a Swiss location. There are pictures of trees felled by the 15-16 October 1987 storm in southern England and of a heavy snow of March 1888 along the east coast of the USA that paralysed transport services over a hundred years ago and brought plunging temperatues down to minus 20 deg C in New York.

"*Energy and Society*" is the heading of a spread in the fourth section. Energy is stated to be at the heart of economic and social development but also the cause of a range of environmental problems. The use of the degree-day statistic in energy usage and prediction, methods of electricity generation and distribution, and the vulnerability of distribution systems to extreme weather events are all covered. The potential of renewable resources such as wind, water and solar energy is examined. There are pictures of ice storm damage to power and telephone lines, of an offshore energy facility needing protection through accurate weather and climate forecasts, and of a solar home system project. A map shows annual means of required heating degree days in Sweden for the 1961-1979 period. A chart indicates the percentages of the primary energy source for 1995 world electricity generation.

This eminently readable and enjoyable survey of weather and climate plus related oceanography is a sound and complete reference and refresher book for the first decade of the 21st century. It presents scientific considerations on an important subject to non-scientists. It can be read straight through, sampled by general subject area, or readily consulted by specific topic. Persons generally interested in worldwide weather and climate, government officials, politicians, business people and scientists in other disciplines whose efforts would be aided by a good base of general knowledge of these sciences, and teachers and high school students are likely to find the publication of considerable use. It should be on the shelves of libraries. Its strength is in the lucidly written narratives. Pleasing to see is the emphasis placed on drought and flood as the climate extremes that matter most for living beings.The impact of human activities on the climate is discussed in a number of spreads but the reader can also learn about oceanic, solar and volcanic influences. There could have been more information on health aspects. An appendix listing recommended scientific and technical publications on specific topics would have been of benefit to anyone wishing to explore climate matters further.

The book should leave most readers feeling more knowledgeable and aware that this is a rich research subject, still full of uncertainties and replete with challenges as to how the climate functions and how its changes will affect all beings in Canada and elsewhere in the world.

Polar Lows: Mesoscale Weather System in the Polar Region

Editors Erik A. Ramussen and John Turner

Cambridge University Press, Hardback US$120.00
ISBN 0-521-62430-4, April 2003, 612 pages

Book reviewed by André April[3]

Polar Lows provides a comprehensive review of the understanding of the small high latitude weather systems known as polar lows. These often vigorous depressions are a hazard to maritime operations and high latitude communities, yet have only been investigated in detail since 1960s. In areas such as the North Sea, there are many gas and oil platforms and it is necessary to have good forecasts of the arrival of severe polar lows to minimize the impacts on operations. Within the Antarctic, most of the polar lows are not as vigorous as their counterparts in the North. Nevertheless, they can still cause severe problems during the summer relief operations at the research station and affect work in the deep field.

In Chapter one, the introduction, the authors provide details of the scope of the book and discuss the historical background to the subject and the bewildering variety of names used over the years to describe the phenomena observed. The definition of a polar low used in the volume is: A polar low is a small, but fairly intense maritime cyclone that forms poleward of the main baroclinic zone (polar front or other major baroclinic zone). The horizontal scale of polar low is approximately between 200 and 1000 km and surface winds near or above gale force.

Chapter two deals with the climatological occurrence of polar low, based largely on satellite imagery. Climatology areas are divided in 5 regions for the Arctic: 1) the Nordic seas; 2) East Canadian seas; 3) Beaufort and Chukchi seas; 4) northeast Pacific seas; and 5) northwest Pacific seas. 3 regions are defined for the Antarctic: 1) the Ross sea; 2) the Weddell sea; and 3) the Bellingshausen and Amudsen seas. An important goal here was to try and relate the spatial and temporal variability of the lows with some of the major climatological cycles, such as the El Niño-Southern Oscillation and the North Atlantic Oscillation.

Chapter three covers the observational investigations that have been carried out and attemps to summarize this work into a picture of the underlying mechanisms that are responsible for the observed form of the vortices. For polar lows in the Nordic seas, a classification from Wilhelmsen based on a combination of synoptic features and physical

[3] Service Météorologique du Canada, Québec, QC.

considerations is presented. The Canadian waters polar lows do largely reference the handbooks of N. Parker (Edmonton). In the southern hemisphere, with fewer observational studies of mesocycle vortices than north, the studies are based on satellite imagery and sounder data.

Chapter four examines the various theoretical ideas that have been proposed to explain the observed weather systems. The arguments that polar lows were either baroclinic disturbances, or convective systems akin to tropical cyclones, were gradually replaced with the understanding that both mechanisms were important. This advance led to the idea of a 'polar lows spectrum' with a purely baroclinic system at one end, and purely convectively driven systems at the other. In between the two 'pure types', there is room for a variety of hybrid systems for which both mechanisms such as CISK (Conditional Instability of the Second Kind) or WISHES (Wind Induced Surfaces Heat Exchanges) can exist.

Chapter five deals with recent numerical experiments that have attempted to simulate various cases of polar lows in the Arctic and Antarctic. The small scale of the vortices, the relatively large influence of internal forcing, such as latent heat release, the rapid development, the large range of intensities and the lack of observations make such simulations a challenging task. The studies concentrate on the structure of the lows, rather than on details of the numerical modelling.

Chapter six examines the practical aspects of forecasting polar lows using model output and observational data. The forecasting of polar lows can be applicable for 12 hours or more in exceptional cases and depend mainly on the numerical weather prediction analysed forecast systems and satellite imagery.

Chapter seven draws an overview of the book and suggests possible topics for future research.

Overall, this book is very well documented with nice pictures of Arctic and Antarctic polar lows, written by a number of experts within the field and, in my opinion, this volume will be surely a reference on the subject. Chapter 4 on the various theoretical ideas to explain the polar lows is the most interesting of the book but observational and climatological studies are the major components. The book will be of value to meteorologists and climatologists with an interest in the polar regions, as well as professional weather forecasters concerned with these areas. The book contains more than 500 references on polar lows.

Oil and Hydrocarbon Spills III: Modelling, Analysis and Control

Editor C.A. Brebbia

Wessex Institute of Technology, Hardback Cover
ISBN 1-85312-922-4, $245.00US

Book reviewed by Allard B. Ages[4]

This book contains a collection of 42 papers presented at the Third International Conference on Oil and Hydrocarbon Spills on the Island of Rhodes in 2002. Its content is subdivided into nine sections covering a wide range of topics related to oil spill modelling, detection, laboratory analysis, clean up measures, biological impact, remote sensing and risk assessment.

The first section, *"Modelling of trajectory and fate of oil spills"*, confines itself to only five numerical models, three of which simulate oil spills in coastal waters and the two remaining papers relate to a terrestrial environment. The marine oil spill models update the existing and proven models with weathering processes, dispersion, and a spreading analysis developed by Fay in 1970 (the inclusion of Fay's equations in these computations is somewhat academic because the spreading forces become almost instantly negligible compared to winds and currents). The two papers on land spills simulate transport of contaminants and biodegradation in aquifers and ground water systems.

Section two, "*Oil spill detection and prevention*", consists of seven papers. Four presentations cover forensic oil spill identification with recommendations on refinements in the methodology of finger printing. Other studies discuss the detection of oil slicks with a microwave technique; a method of drawing volatile hydrocarbons out of soil; and finally an interesting procedure to detect leakage of oil in a pipeline by following an engineering approach analogous to an analysis of water hammer.

The first paper in Section three, "*Land spills*" should be of particular interest to Canadian readers since it gives us a detailed description of the spill management in Greater Toronto with its population of three million in an area of only 2000 square kilometres. The next paper deals with oil pipeline failures in China and a method to compute the maximum flow stoppage time before restarting.The third and last paper of this section investigates an in situ method of bioremediation of contaminated soils in Russia, where excavation and off-site treatement are now prohibited.

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[4] Scientist Emeritus, Institute of Ocean Sciences, Sidney, BC.

The four papers in Section four, "*Experimental and Laboratory Analysis*", examine a variety of cleaning methods in coastal zones. One test seeded oil degradation bacteria along oleophilic fertilizers to successfully facilitate bioremediation of a sandy beach; a second experiment heated up oiled debris with a thermal blanket rather than digging up the soil for disposal. A third study examined changes in the composition of crude oil due to evaporation of the volatile components and biodegradation; and the last paper describes different types of flasks to simulate mixing oil and dispersants by waves.

Most of the eight reports in Section five, "*Clean up measures*", stress the importance of bioremediation rather than the application of the traditional, often toxic chemicals. Four papers introduce us to oil-degrading bacteria while two others analyze the application of adsorbents such as lignite in oil-permeable but water-repellent mats, and an innovative remedy of launching large numbers of small synthetic adsorbers from an aircraft or ship; these elements sink, adsorb oil and then rise to the surface to be collected with nets. Although the field tests appear quite promising, financial and logistic aspects have yet to be examined. (One might recall that a much cheaper and perhaps equally effective method was followed with peat moss and a floating barrier of spruce branches to protect the beaches of Prince Edward Island after the "Irving Whale" spill in 1970!). Finally, other research projects included in this section are an air-suction system to suck oil from the water surface and a numerical model of steam injection into an aquifer.

Section six, "*Biological impact of oil pollution*", starts off with a pilot study of the effect of a tube-burrowing polychaete upon the biodegradation of petroleum hydrocarbons in marine sediments, especially of the persistent polycyclic aromatic hydrocarbons (PAH's). The second paper takes us to the University of Rio de Janeiro where the variability of phytoplankton biomass in Brazil's coastal zone is modelled. A third contribution to this section of five papers describes toxicity tests in the U.K. of products treating oil spills. A Canadian paper subsequently examines the tainting of arctic freshwater fish by oil; and finally we are introduced to a monitoring program of discharges from oil-production platforms near the Brazilian coast.

Section seven, "*Case Studies*", comprises four papers, starting with an environmental valuation of economic developments and a case study of potential environmental damage created by shipping activities along the SE coast of Brazil. The section then continues with a paper of interest to Canadian readers. According to a panel of Canadian government specialists, there is no evidence of impact from oil sand operations in Northern Alberta on hydrocarbon distributions and sediment toxicity in the Athabasca delta. Another Canadian case study, apparently so far the only one on this topic, investigated a spill of diesel fuel in the winter in northern Canada and found that the cold temperatures prevented weathering, leading to a retention of the toxic fractions normally removed by weathering. Finally, a Libyan group reported completion of the investigation on organics along the Libyan shore, reported in earlier sessions of this conference.

Two of the three papers in Section eight, "*Remote sensing*", introduce us to the role of satellite-borne SAR (Synthetic Aperture Radar) in detecting marine oil spills and identifying their sources. In their description of different aspects of this relatively new technique, both papers are clear and concise and should be strongly recommended to the uninitiated reader. A more conventional application of remote sensing is reported in a third contribution, which used aerial photographs to determine the effect of an oil burn upon the vegetation of a marsh.

The final section of the proceedings, Section nine, "*Risk Assessment*", consists of three papers. The first paper, originating in Italy, evaluates causes of accidents at sea as well as in harbours and presents a statistical analysis of toxic hazards; a second report proposes clean-up standards for soil pollution in Belgium while the concluding paper addresses hazards associated with the natural gas exploitation in South America.

<u>REMARKS:</u> While reading the conference papers presented in this book, old-timers among us must have noticed some encouraging changes in our approach to oil spill counter-measures. Dispersing an oil spill with toxic chemicals or burning the oil by dropping a bomb on the grounded tanker ("Torrey Canyon", 1967) are methods of the past and are being replaced by, for instance, cultures of oil-degrading bacteria. We also note a trend of recent oil spill conferences to include land spills, as demonstrated by these proceedings.

The book covers a large range of topics pertinent to oil spills and should be a valuable source of information for readers interested in recent advances in oil spill research. Most of the reports are very specialized but provide extensive lists of references.

Unfortunately, the syntax of some of the papers defies even the most basic rules of the English language. It puzzles me why the editor and his staff did not take steps to correct these blatant errors, even though earlier reviewers made similar comments.

Everybody talks about the weather, but nobody does anything about it!

- Mark Twain

Books being reviewed
Livres en circulation pour critique

Radiative Transfer in the Atmosphere and Ocean, Reviewer: Chris McLinden, Toronto, ON.

Land Use, Land-Use Change and Forestry, Reviewer: Richard Fleming, Sault-Ste Marie, ON.

Ecological Climatology, Concepts and Applications, Reviewer: Brad deYoung, St. John's, NL.

Inverse Problems in Atmospheric Constituent Transport, Reviewer: Dr. Irene Rubinstein, Toronto, ON.

Inverse Modeling of the Ocean and Atmosphere, Reviewer: Dr. Irene Rubinstein, Toronto, ON.

Environmental Change, Climate and Health: Issues and Research Methods, Reviewer: Sharon Jeffers, Montréal, QC.

Ecohydrology: Darwinian Expression of Vegetation Form and Function, Reviewer: Nigel Roulet, Montréal, QC.

Scattering, Absorption and Emission of Light by Small Particles, Reviewer: Syd Peel, Downsview, ON.

Innovative Energy Strategies for CO_2 Stabilization, Reviewer: Tracy Garner, Toronto, ON.

Lightning: Physics and Effects, Reviewer: Peter Lewis, Bedford, NS.

Dynamics of the Atmosphere, A course in theoretical meteorology, Reviewer: Adam Monahan, Victoria, BC.

Emissions Scenarios, Intergovernmental Panel on Climate Change, Reviewer: T. Colleen Farrell, West Porters Lake, NS.

Handbook of Atmospheric Science, Principles and Applications, Reviewer: Michel Jean, Dorval, QC.

Climate Changes during the Holocene and their Impact on Hydrological Systems, Reviewer: Mungandi Nasitwitwi, Port Coqutilam, B.C.

Books in search of a Reviewer
Livres en quête d'un critique

Climate Change 2001, Synthesis Report, Contribution of Working Groups I, II, and III to the Third Assessment Report of the Intergovernmental Panel on Climate Change, by Robert T. Watson, Editor, April 2002, Cambridge University Press, Paperback Cover, 0-521-01507-3, $40.00US

The State of The Nations's Ecosystems, Measuring the Lands, Waters and Living Resources of the United States, The H. Heinz III Center for Science, Economics and the Environment, Cambridge University Press, Paperback Cover, 0-521-52572-1, $25.00US.

The High-Latitude Ionosphere and its Effects on Radio Propagation, by Robert Hunsucker and John Hargreaves, Cambridge University Press, Hardback Cover, 0-521-33083-1, $140.00US.

Exploration of the Solar System by Infrared Remote Sensing, by R.A. Hanel, B.J. Conrath, D.E. Jennings, R.E. Samuelson, Cambridge University Press, Hardback Cover, 0-521-81897-4, $120.00US.

Coasts: Form, Process and Evolution, Colin D. Woodroffe, Cambridge University Press, Paperback Cover, 0-521-01183-3, $50.00US.

Global Change and Local Places: Estimating, Understanding and Reducing Greenhouse Gases, Association of American Geographers - GCLP Research Group, Cambridge University Press, July 2003, Hardback Cover, 0-521-80950-9, $75.00US.

Measuring the Natural Environment, by Ian Strangeways, 2nd Edition, Cambridge University Press, November 2003, ISBN 0-521-52592-2, $70.00US.

The Oceans and Climate, by Grant Bigg, Cambridge University Press, October 2003, ISBN 0-521-01634-7, Paperback Cover, 50.00$US.

If you are interested in reviewing one of these books for the *CMOS Bulletin SCMO*, please contact the Editor at the e-mail address provided below. Of course, when completed, the book is yours. The instructions to be followed when reviewing a book for the *CMOS Bulletin SCMO* will be provided with the book. Thank you for your collaboration.

Si vous êtes intéressés à faire la critique d'un de ces livres pour le *CMOS Bulletin SCMO*, prière de contacter le rédacteur-en-chef à l'adresse électronique mentionnée ci-bas. Bien entendu, le livre vous appartient lorsque vous avez terminé la critique. Les instructions qui doivent être suivies lors de la critique d'un livre dans le *CMOS Bulletin SCMO* vous parviendront avec le livre. Merci pour votre collaboration.

Paul-André Bolduc
Editor / Rédacteur-en-chef
CMOS Bulletin SCMO
bulletin@cmos.ca
or / ou
bulletin@scmo.ca

Where did the meteorologists stop for a drink on the way home from a long day in the office?

The nearest ISOBAR!

Atelier d'été en météorologie Projet Atmosphère

Demande de candidats professeurs de niveau pré-collégial

Comme par les années passées, la Société canadienne de météorologie et d'océanographie (SCMO) a été invitée à choisir un enseignant canadien qui participera au PROJET ATMOSPHÈRE en 2004. Il s'agit d'un atelier d'été à l'intention des enseignants de niveau pré-collégial spécialistes en sciences atmosphériques; cet atelier est parrainé par l'American Meteorological Society (AMS) et la National Oceanic and Atmospheric Administration (NOAA) américaine. Il aura lieu du 19 au 30 juillet 2004 au centre de formation du National Weather Service à Kansas City au Missouri.

Les dépenses de l'enseignant choisi seront assumées par l'AMS et la NOAA, avec une contribution financière de la SCMO et du Conseil canadien pour l'enseignement de la géographie (CCEG). Ceci n'inclus pas les déplacements à destination et au retour de Kansas City pour lesquels la SCMO et le CCEG offrent chacun 300 $ (canadiens), soit un total de 600 $ au candidat canadien choisi.

Les anciens participants du Canada ont trouvé leur expérience très enrichissante et stimulante. Les exposés de l'atelier sont présentés par des experts américains les plus réputés dans les sciences atmosphériques et océanographiques. Les enseignants sont revenus avec du matériel, des ressources et des modules didactiques qu'ils peuvent facilement adapter dans leurs cours.

Les enseignants intéressés sont priés de demander un formulaire de candidature à l'adresse suivante:

Directeur exécutif
SCMO - Atelier d'été
Casier Postal 3211, Station D
Ottawa (Ontario) K1P 6H7
Téléphone: (613) 990-0300;
Télécopie: (613) 990-1617
Courriel: scmo@scmo.ca

Ces demandes doivent être soumises au plus tard le **25 avril 2004.**

Summer Meteorology Workshop Project Atmosphere

Call for Applications by Pre-college Teachers

As in several previous years, the Canadian Meteorological and Oceanographic Society (CMOS) has been invited to select a Canadian teacher to participate in PROJECT ATMOSPHERE in 2004. This is a summer workshop for pre-college teachers of Atmospheric Science topics sponsored by the American Meteorological Society (AMS) and the National Oceanic and Atmospheric Administration (NOAA) of the United States. It takes place July 19-30, 2004 at the National Weather Service Training Center, Kansas City, Missouri.

The expenses for the participating teacher are paid by AMS/NOAA, with a financial contribution from CMOS and the Canadian Council for Geographic Education (CCGE). This does not include the travel to and from Kansas City for which CMOS and CCGE provide $300 (Canadian) each (total $600) to the selected Canadian participant.

Previous Canadian participants have found their attendance a very rewarding and significant experience. Presentations are made at the Workshop by some of the most respected American Scientists in the fields of atmospheric and oceanographic sciences. Participants have returned with material, resources and teaching modules readily adaptable to classroom presentations.

Interested teachers should request, as soon as possible, an application form from the following address:

Executive Director
CMOS - Summer Workshop
P.O. Box 3211, Station D
Ottawa, ON K1P 6H7
Telephone: (613) 990-0300;
Fax: (613) 990-1617
e-mail: cmos@cmos.ca

These requests should be submitted no later than **April 25, 2004.**

Prochain numéro du *CMOS Bulletin SCMO*

Le prochain numéro du *CMOS Bulletin SCMO* paraîtra en **juin 2004.** Prière de nous faire parvenir au plus tôt vos articles, notes, rapports d'atelier ou nouvelles à l'adresse indiquée à la page ii. Nous avons un besoin **URGENT** d'articles.

Next Issue *CMOS Bulletin SCMO*

Next issue of the *CMOS Bulletin SCMO* will be published in **June 2004.** Please send your articles, notes, workshop reports or news items at the earliest to the address given on page ii. We have an **URGENT** need for your articles.

38th Annual CMOS Congress

EDMONTON, ALBERTA

31 May to 03 June 2004

Invitation and Welcome

We are proud to invite you at the 38th Congress of the Canadian Meteorological and Oceanographic Society, to be held at the Fantasyland Hotel (http://www.fantasylandhotel.com/home/) at the world-famous West Edmonton Mall (http://www.westedmall.com/home/homepage.asp) in Edmonton, 31 May to 03 June, 2004. We urge you to participate in what we hope and plan to be the best Congress ever! Alberta has hosted the annual Congress only three times in the past – in 1968 (Calgary), 1972 (Edmonton), and 1983 (Banff), so that we feel we are overdue and therefore plan to make up for lost time.

The theme of the 2004 CMOS Congress is *Human Dimensions of Weather and Climate*, providing particular emphasis on anthropogenic impacts on the environment (and climate), and feedback effects of our atmosphere, waters, and climate on mankind. Within the context of this theme, we have also identified seven key focus areas for this year's Congress, which are *Climate Change*, *Aviation Meteorology*, *High Latitude Processes*, *Severe and Hazardous Weather*, *The Northern Oceans (Arctic, Atlantic and Pacific) and their Linkages*, *Drought and Water issues*, and *Remote Sensing and New Technologies*. We sincerely hope that these special focus areas will attract meteorologists and oceanographers alike in this year's program, despite the Congress being in land-locked Alberta; we are also placing special emphases on related disciplines such as hydrology, thereby highlighting the combined importance of all three aspects of the hydrological cycle. We strongly encourage presentations by our graduate students in these disciplines, who may wish to apply for a Graduate Student Bursary offered to assist with their travel expenses.

Several concurrent workshops are also planned in conjunction with the 38th Congress, including those of GEWEX/MAGS and the CWRP (Canadian Weather Research Program). There will also be traditional CMOS sessions in other aspects of meteorology and oceanography, and we are once again encouraging a special Teachers' Day at Congress. The Congress will also provide the opportunity for us to gather together in our various national committees to review our progress and plan our future and to feast together at the Awards Luncheon and the Banquet as we honour the achievements of our colleagues. These all demonstrate why CMOS Congress is Canada's primary annual meeting for both research and operational meteorologists, oceanographers, climatologists, hydrologists, and other related disciplines. We invite you to come and help us make this the most successful Congress ever!

For further information or questions regarding our science program, contact geoff.strong@shaw.ca; contact brian.paruk@ec.gc.ca for information on local arrangements.

Geoff Strong
Chair, Scientific Program Committee

Special Welcome for Oceanographers

Despite Edmonton's inland prairie location, the Congress Scientific Program Committee (SPC) would like to ensure there is a good turnout from the Canadian oceanographic community, with a number of special sessions planned that should be of broad interest. The Fluid Mechanics/Oceanography group here at the University of Alberta (Andy Bush, Paul Myers, Bruce Sutherland and Gordon Swaters) echo this sentement and call on the Canadian oceanographic and fluids research communities to attend CMOS 2004 and make this is a good "wet" conference.

The theme of this year's congress is *"Human Dimensions of Weather and Climate"*, with a goal to integrate research done on all aspects of the climate system (including the ocean) and relate that to the impact on people. A number of overarching sub-themes have also been identified, several with an oceanographic focus. The "Northern Oceans (Arctic, Atlantic and Pacific) and Their Linkages" theme will examine, through contributed papers, each of these three important oceans that bound Canada, and the linkages between them. Talks on sea ice, air-sea and air-sea-ice interactions are also encouraged. The second congress sub-theme that has a strong oceanographic connection is one on "New Technologies". Within this sub-theme, special sections will be held on Towards Ocean Nowcasting/Forcasting and Unstructured Grid Modelling.
The congress SPC is proud to announce that we have two excellent plenary speakers confirmed for the congress to support the two above themes. From the Institute of Ocean Sciences, Eddy Carmack will speak on the Arctic Ocean and its linkages to other basins. From Rutgers University in the US, Dale Haidvogel will speak on recent developments in ocean models and modelling.

Additional sessions on the climate carbon connection (measurement and modelling of the past and present), data assimilation, operational oceanography, air-sea interactions and waves, the cryosphere and climate and geophysical fluid dynamics are also going forward.

Therefore, the Canadian Oceanographic community is more than welcomed to attend CMOS 2004 Congress in Edmonton and make this one of the best CMOS congresses yet!

Paul Myers
Member, Scientific Program Committee
Department of Earth and Atmospheric Sciences, University of Alberta

Air travel - Air Canada

Air Canada was appointed as the official airline of the CMOS Congress in Edmonton. Simply contact Air Canada's North America toll free number at 1-800-361-7585 or local number 514-393-9494 or your travel agent and take advantage of Special Discounted Airfares, or to book web fares, by quoting our convention number **CV 042138**.

By ensuring that the CV convention number appears on your ticket, you will be supporting our organisation. We thank you in advance for your support.

Air travel - WESTJET
WestJet offers 10% off their best air fare at the time of conference booking (except during seat sales). By quoting our convention number **QC2434**. The contact is their Specialty Sales Dept., at 1-888-493-7853 (toll free), or FAX 1-800-582-7072. Their local Calgary number is 403-444-2294.

Air Cargo
As official airline for the Congress, Air Canada will provide a discount of 25% off applicable air cargo rates (airport-to-airport) by quoting our convention number: **CV 042138.** Please contact your nearest Air Canada Air Cargo office for more information. For your information the Air Cargo web page is: www.aircanada.ca/cargo.

Hotel Information
The congress will be held at the Fantasyland Hotel (http://www.fantasylandhotel.com/home/) at the world-famous West Edmonton Mall (http://www.westedmall.com/home/homepage.asp).

We have been able to negotiate special rates for those attending the conference from the hotel. The hotel room rates are:

	Regular	CMOS 2004
Superior	$175	$109
Executive	$195	$129
Theme	$235	$149
Luxury Theme	$305	$199

A block of rooms have been reserved for the CMOS Congress at the Fantasyland Hotel, 17700 87th Avenue, Edmonton, Alberta, Canada T5T 4V4.
Tel: (780) 444-3000; Fax: (780) 444-3294.
Reservations: 1-800-737-3783.

When making your Hotel reservation, please ask for the CMOS Congress room rate under **Block Code CMOS**. Cut-off date for the special Congress rate is: May 1st, 2004.

Please reserve early to avoid last minute rush and/or disappointment.

38^{e} Congrès annuel de la SCMO

EDMONTON, ALBERTA

Du 31 mai au 3 juin 2004

Invitation et bienvenue
Nous sommes très heureux de vous inviter au 38^{e} Congrès de la Société canadienne de météorologie et d'océanographie qui se tiendra à l'Hôtel Fantasyland (http://www.fantasylandhotel.com/home/) du West Edmonton Mall (http://www.westedmall.com/home/homepage.asp) de renommée mondiale, à Edmonton du 31 mai au 3 juin 2004. Nous vous recommandons de participer à ce Congrès qui sera le meilleur jamais organisé en Alberta, c'est ce que nous espérons et planifions ! Le Centre de l'Alberta n'a été l'hôte du Congrès annuel qu'à trois occasions dans le passé (à Calgary en 1968, à Edmonton en 1972 et à Banff en 1983), donc nous croyons qu'il est temps pour nous d'être à la hauteur pour le retard à organiser un Congrès.

Le thème du Congrès 2004 de la SCMO portera sur *La dimension humaine de la météo et du climat,* mettant l'accent sur les impacts anthropiques sur l'environnement (et le climat) et les effets de rétroaction de notre atmosphère, des eaux et du climat sur le monde. Dans le contexte de ce thème, nous avons identifié sept domaines-clefs pour ce Congrès annuel : *le changement climatique ; la météorologie aéronautique ; les processus des latitudes septentrionales ; le temps violent et les conditions météorologiques dangereuses ; les océans dans les régions septentrionales (Arctique, Atlantique et Pacifique) et leurs liaisons ; les questions reliées à la sécheresse et à l'eau ; et la télédétection et les nouvelles technologies.* Nous souhaitons sincèrement que ces domaines-clefs spéciaux seront intéressés les météorologistes et les océanographes dans le programme de cette année, même si le Congrès aura lieu dans un endroit albertain enclavé. Nous mettons tout particulièrement l'accent sur les domaines reliés à l'hydrologie, mettant en valeur ainsi l'importance d'ensemble des trois aspects du cycle hydrologique. Nous encourageons fortement des présentations par les étudiants diplômés dans ces disciplines. Nous rappelons que les étudiants diplômés peuvent faire une demande pour une Bourse d'étudiant diplômé afin de les aider a défrayer leurs dépenses de voyage.

Conjointement avec le 38^{e} Congrès, on planifie de tenir plusieurs ateliers en même temps, incluant ceux de GEWEX/MAGS et du Programme canadien de recherche en météorologie («CWRP»). Il y aura aussi des séances traditionnelles de la SCMO reliées à d'autres domaines de la météorologie et de l'océanographie, et on s'attend encore une fois de tenir au Congrès la Journée des enseignants. Le Congrès donne l'opportunité à tous de se rencontrer dans différents comités nationaux afin de revoir les progrès de la société et de planifier le futur, et aussi de manifester, lors de la remises des récompenses au banquet et au dîner, tous les honneurs de reconnaissance à nos collègues. Toutes ces activités démontrent pourquoi le Congrès de la SCMO représente une rencontre annuelle primordiale à la fois pour la recherche et les météorologistes opérationnelles, pour les océanographes, les climatologues, les hydrologistes et pour les autres disciplines qui y sont reliées. Nous vous invitons à assister à ce Congrès et nous aider à en faire un grand succès.

Pour des renseignements ou des questions additionnels en rapport avec notre programme scientifique, n'hésitez pas à contacter : geoff.strong@shaw.ca. Pour des renseignements sur le Comité local d'organisation, contacter : brian.paruk@ec.gc.ca.

Geoff Strong
Président, Comité du programme scientifique

Invitation toute spéciale aux océanographes
Même si Edmonton n'a pas de littoral, le Comité du Programme Scientifique (CPS) du Congrès aimerait vous assurer que la communauté océanographique canadienne y est toujours bien représentée avec plusieurs sessions spéciales planifiées qui devraient être d'un grand intérêt. Le groupe en mécanique des fluides/océanographie (Andy Bush, Paul Myers, Bruce Sutherland et Gordon Swaters) reflète bien ce sentiment et il fait appel à toutes les communautés canadiennes de recherche en mécanique des fluides et en océanographie d'assister au Congrès 2004 et d'en faire une bonne conférence.

Le thème du congrès de cette année porte sur *La dimension humaine de la météo et du climat*, avec l'objectif d'intégrer la recherche faite sur tous les aspects du système climatique (incluant les océans) et de les reliés à l'impact sur les gens. Des sous-thèmes obligatoires ont été aussi identifiés et plusieurs parmi eux sont orientés sur l'océanographie. Le sous-thème : les océans dans les régions septentrionales (Arctique, Atlantique et Pacifique) et leurs liaisons, examinera, lors de présentations d'articles, chacun des trois importants océans qui bornent le Canada ainsi que les liaisons entre les océans. On souhaite recevoir des présentations concernant la glace marine, les interactions air-mer et air-mer-glace. Le deuxième sous-thème du Congrès qui a un lien très grand en océanographie, se rapporte aux nouvelles technologies. À ce sous-thème, on ajoutera quelques sections spéciales axées vers la prévision et la visualisation actuelle des océans, et la modélisation à grille non structurée.

Le CPS du congrès est heureux de faire l'annonce de la confirmation de deux excellents conférenciers qui traiteront des deux thèmes mentionnés plus haut lors des plénières du congrès. De l'Institut des sciences de la mer, Eddy Carmack parlera de l'océan Arctique et de ses liaisons avec les autres bassins. De l'université Rutgers des États-Unis, Dale Haidvogel discutera des développements récents de la modélisation et des modèles océaniques.

Des sessions additionnelles suivantes seront aussi mises de l'avant : le lien climatique avec le carbone (mesures et modélisation antérieures et actuelles) ; l'assimilation des données ; l'océanographie opérationnelle ; les interactions air-mer et les vagues ; la cryosphère et le climat ; et la dynamique géophysique des fluides.

La communauté canadienne en océanographie est donc plus que la bienvenue d'assister au Congrès 2004 de la SCMO à Edmonton et de participer au succès de ce Congrès.

Paul Myers
Membre du Comité du programme scientifique
Département des Sciences atmosphériques et de la terre
Université de l'Alberta

Voyage par avion - Air Canada
Air Canada a été désigné le transporteur officiel du Congrès de la SCMO à Edmonton. Contacter simplement Air Canada en Amérique du Nord au numéro téléphone sans frais 1-800-361-7585 ou au numéro local suivant : 514-393-9494 ou encore votre agent de voyages et profitez des tarifs spéciaux avantageux, ou réservez votre billet sur le site Web, en mentionnant le numéro de l'événement **CV 042138**.

Voyage par avion - WESTJET
WestJet offre une réduction de 10 % de leur meilleur tarif au moment de la période de réservation du congrès (à l'exception d'une période de vente). Assurez-vous de mentionner le numéro de l'événement **QC2434**. Contactez le Département du service des ventes au numéro sans frais 1-888-493-7853, ou par télécopieur au numéro 1-800-582-7072. Le numéro local à Calgary est le suivant : 403-444-2294.

Fret aérien
Comme transporteur officiel du Congrès, Air Canada offre une réduction de 25 % sur les tarifs applicables au fret aérien (aéroport à aéroport), en s'assurant de mentionner le numéro de l'événement **CV 042138**. S.V.P., contactez le bureau du fret aérien d'Air Canada le plus près pour des renseignements additionnels. Consultez également la page du site Web d'Air Canada: www.aircanada.ca/cargo.

Renseignements sur l'hôtel
Le Congrès se tiendra à l'Hôtel Fantasyland (http://www.fantasylandhotel.com/home/) du West Edmonton Mall (http://www.westedmall.com/home/homepage.asp) de renommée mondiale, à Edmonton.

Nous avons obtenu des taux spéciaux pour les gens qui demeureront à l'hôtel lors du Congrès. Les prix pour une chambre d'hôtel sont :

	Régulier	SCMO 2004
Chambre Supérieure	$175	$109
Chambre exécutive	$195	$129
Chambre thématique	$235	$149
Chambre thématique de luxe	$305	$199

Un groupe de chambres a été réservé pour le Congrès de la SCMO à l'Hôtel Fantasyland, 17700 87th Avenue, Edmonton, Alberta, Canada T5T 4V4.

Tél. : (780) 444-3000 ; Télécopieur : (780) 444-3294. Réservations : 1-800-737-3783.

Lorsque vous ferez votre réservation à l'hôtel, s.v.p., demandez les prix pour une chambre offerte lors du Congrès de la SCMO en mentionnant le code de l'événement **Block Code CMOS**. La date limite pour les prix spéciaux offerts lors du Congrès est le 1er mai 2004.

S.V.P., réservez tôt afin d'éviter la bousculade des derniers moments et/ou la déception.

FREE PUBLICATIONS AVAILABLE

As part of an international publications exchange, CMOS has started to receive some Russian publications, specifically Meteorology and Hydrology (monthly), as well as a book which seems to be Oceans and Tides Modelling. These books are 100% written in Russian. Anyone interested can contact Richard Asselin at Publications@cmos.ca

PUBLICATIONS GRATUITES DISPONIBLES

En vertu d'un échange international de publications, la SCMO a commencé à recevoir une revue mensuelle russe Météorologie et Hydrologie, de même qu'un livre qui semble porté sur la Modélisation des océans et des marées. Ces livres sont totalement écrits en russe. Toute personne intéressée doit contacter Richard Asselin à Publications@scmo.ca

Canadian National Committee for SCOR
Comité national canadien pour SCOR

Scientific Committee on Oceanic Research

Call for New Working Groups

The Scientific Committee on Oceanic Research (SCOR) is accepting proposals for new working groups, from now until April 30, 2004. SCOR considers several proposals for new working groups each year. It is expected that two such proposals may be funded to start in 2005. Working groups are usually formed of not more than 10 members, to deliberate on a narrowly focused topic and develop a publication for the primary scientific literature. The intent is to have their work completed within 4 years or less. SCOR has sponsored (alone or with other organizations) over 120 working groups, including the current ones. Selection of new working groups will be made at the 36th SCOR General Meeting in Venice, Italy on September 27-30, 2004. The intervening May-August timeframe will allow for proposal review and modification. A model proposal and other information about working groups may be found at www.jhu.edu/scor/wkgrpinfo.htm

National SCOR committees are an important aspect of SCOR's operation and play a key role in reviewing working group proposals. Proponents should submit their proposals through their national committees, although SCOR will also accept proposals from individuals and other organizations. Information regarding the Canadian National Committee for SCOR may be found at www.cncscor.ca

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Arctic Climate Impact Assessment (ACIA)

International Scientific Symposium on Climate Change in the Arctic, Reykjavik, Iceland 21-24 September 2004

The ACIA scientific symposium will be convened at Nordica Hotel Sudurlandsbraut 2, in Reykjavik, the capital of Iceland, on 21-24 September 2004, just prior to the Fourth Arctic Council Ministerial Meeting.

The May 2004 announcement will include programme details, logistics, and registration information. Updates about the symposium will be posted on http://www.acia.uaf.edu, http://www.amap.no, http://www.iasc.no, and http://www.caff.is.

The fee of the symposium has provisionally been set at 200 USD (early registration 150 USD). For more information, please contact Svanhvit Bragadottir, Ust. (svanhvit@ust.is) or Nirna B. Berndsen, Congress Reykjavik (birna@congress.is)

SHORT NEWS / NOUVELLES BRÈVES

CANADA'S CLIMATE IS CHANGING

A report entitled "Climate, Nature People: Indicators of Canada's Changing Climate" describes changes to Canada's climate during the 20th century and reviews trends and implications for twelve climate change indicators. Temperature, precipitation, and other trends identified in the report suggest that climate in many regions of Canada is changing. The report can be accessed at http://www.ccme.ca/initiatives/climate.html

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MODIS: NEAR REAL-TIME IMAGERY

The Moderate Resolution Imaging Spectroradiometer (MODIS) is a 36-band spectroradiometer measuring visible and infrared radiation. Derived data products include: vegetation, land surface cover, ocean chlorophyll fluorescence, cloud and aerosol properties, fire occurrence, snow cover, and sea ice cover. MODIS near real-time imagery is now available online at http://rapidfire.sci.gsfc.nasa.gov/realtime/

PROCEEDINGS of the 2003 CANADIAN COASTAL CONFERENCE

The Canadian Coastal Science and Engineering Association (CCSEA) is a non-profit association dedicated to the promotion of Canadian coastal science and engineering. The Association acts as a forum for research and development related to coastal issues and as an advocacy group. The proceedings of the 2003 CCSEA Conference held in October 2003 in Kingston, Ontario are now available at http://www.cciw.ca/ccsea/ccc03proc/

A NEW OCEANS ACTION PLAN for CANADA

The Speech from the Throne which opened the 3rd Session of the 37th Parliament of Canada on 2 February 2004 outlined the Government's priorities. These include "opportunities to maximize the potential of our vast coastal and offshore areas through a new Oceans Action Plan". The full Speech is available at http://www.pm.gc.ca/eng/sft-ddt.asp. The Action Plan was on the agenda of the federal Deputy Ministers' Interdepartmental Committee on Oceans, which met on 10 February for the first time in several years.

The Sea's Enthrall: Memoirs of an Oceanographer

EcceNova Editions qre proud to announce the publication of *The Sea's Enthrall: Memoirs of an Oceanographer*, by Tim Parsons, PhD, Winner of the Japan Prize. Copies are now available for special order through bookstores, and is also available on Amazon and other online stores. The Sea's Enthrall recounts Dr. Parson's fascinating life story, from his early years in Ceylon and England, to his formal scientific training in Canada, and beyond, to an audience with the Emperor of Japan, as Canada's first recipient of the Japan Prize for Marine Biology. Paul Kennedy from CBC said: *"Timothy Parsons is an unknown national treasure--possibly because he's always dared to say what nobody wants to hear. But if you love our ocean planet, you'll need to read this book."*

INCORPORATING CLIMATE CHANGE into the EIA PROCESS

ClimAdapt (http://www.climadapt.com) is a partnership involving private sector environmental firms, non-governmental associations, and three levels of government. Some ClimAdapt members have developed a methodology for integrating climate change into an environmental impact assessment (EIA) process that forms the basis for the "Practitioner's Guide to Incorporating Climate Change into the Environmental Impact Assessment Process" - available http://www.climadapt.com/Climatapt%20PDFs/EIA%20Guide%20Oct20%202003.pdf

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