intervew

"The accuracy and timeliness of information provided by SMN may save lives"

Michel Rosengaus Moshinsky

Head of the Servicio Meteorológico Nacional de México (SMN – Mexican National Meteorological Service)

"The main challenge for SMN is to keep up to date in the race for technological progress, without neglecting its necessary everyday tasks"

Education

- Degree in Civil Engineering, National Autonomous University of Mexico (1980).
- Master's degree in Hydraulic Engineering, National Autonomous University of Mexico (1982).
- Doctor of Science (Hydrodynamics & Coastal Engineering), Massachusetts Institute of Technology (1987).

Career Path

- 1988-2002: Researcher in the Mexican Institute of Water Technology, founder of the "Hurricane Group", appointed the first Deputy Coordinator on becoming Hydrometeorology Coordination.
- 2002 to date: Head of the Office of the National Meteorological Service of the National Water Commission.
- 2002 to date: Permanent Mexican Representative at the UN World Meteorological Organization.
- Author of Destructive Effects of Tropical Cyclones. Mapfre, 1998.
- Co-author of Climatological Atlas of Tropical Cyclones in Mexico. CENAPRED, 2002.

Source: NOAA

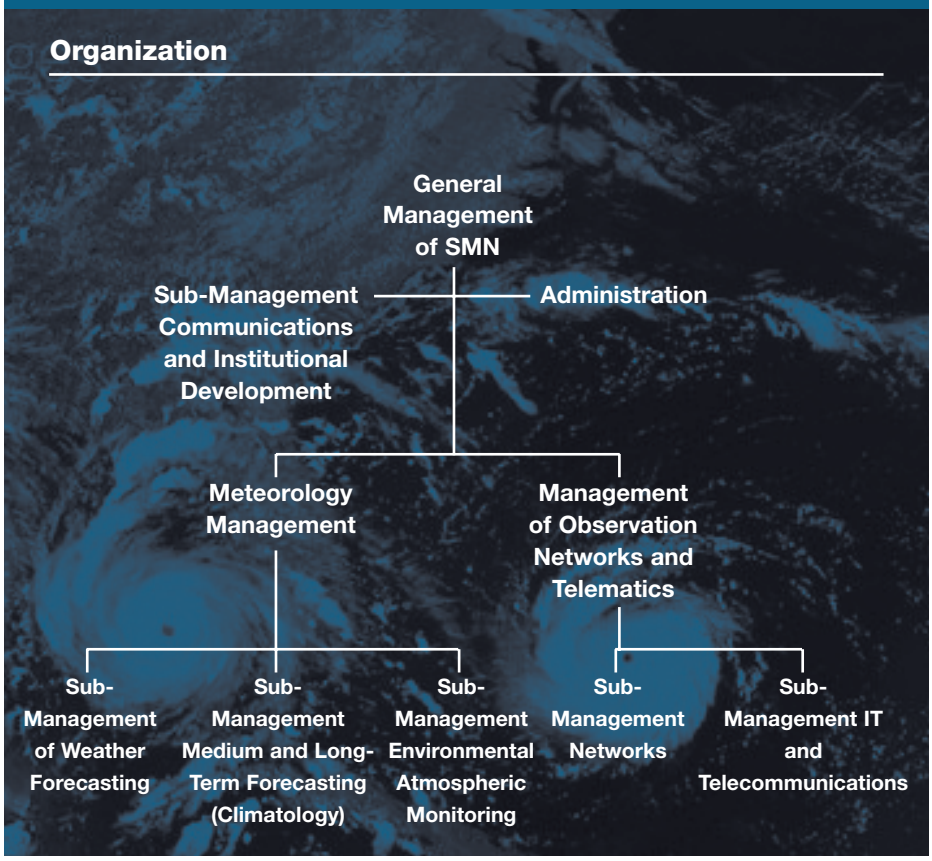
What are the principal duties of the Mexican National Meteorological Service (SMN), as a subordinate body of the National Water Commission? Under what circumstances does the SMN have to report on its activities?

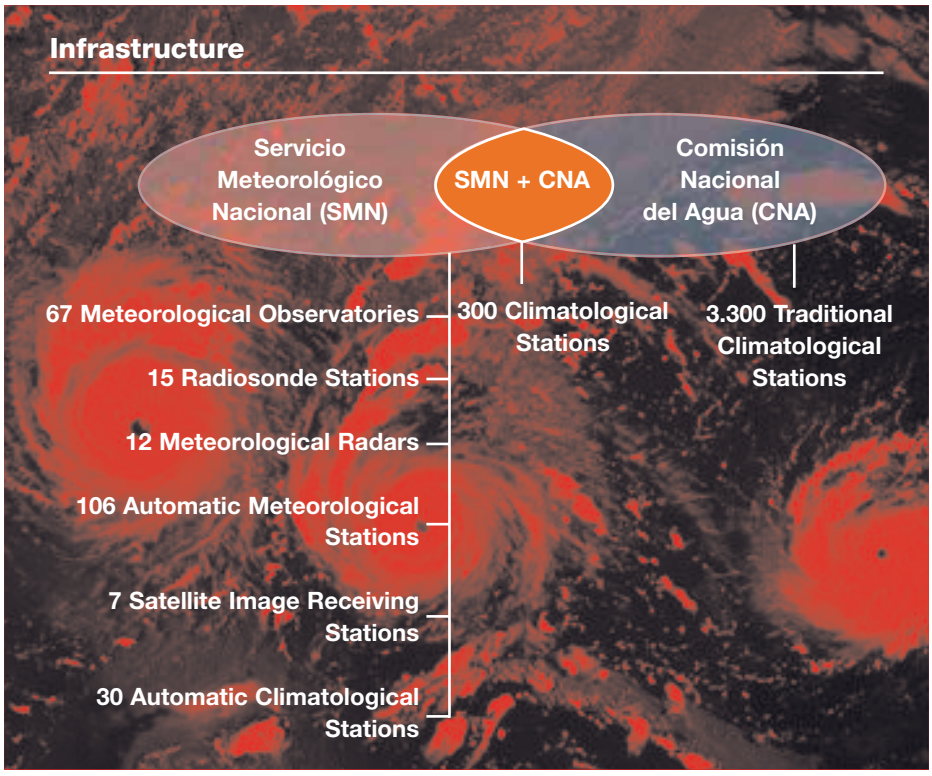
The three main duties of the SMN are as follows:

- To maintain the National System for Civil Protection opportunely informed on significant hydrometeorological phenomena that threaten the lives, infrastructure or means of production of any sector of Mexican society, and to support the system technically in the decision-making process in the context of the physical phenomenon itself.
- To operate on behalf of the National Water Commission (CNA), and the environmental sector in general (the system for observation, measurement, analysis, diagnosis and forecasting of meteorology and climatology), backing the assessment of the country's water resources and also operating the nation's water infrastructure.
- To prepare, publish and broadcast a number of meteorological and climatological products that are of use to Mexicans in their daily life.

It is important to note that the order of importance of these three tasks is precisely the opposite of what the public usually associates with its National Meteorological Service. Giving forecasts on whether to take an umbrella or not is in fact of secondary importance today compared with SMN's other activities.

Organization and infrastructure of Mexico's National Meteorological Service.





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How does SMN contribute to the Mexican and international community? In emergency situations does SMN participate in any crisis committees? Are there any cooperation agreements in place with similar bodies in other countries, such as the Miami National Hurricane Centre, in the USA?

SMN represents the initial stage of the National System for Civil Protection's action under emergency hydrometeorological conditions. The accuracy and timeliness of information provided by SMN may save lives. Even exemplary work by SMN cannot ensure that there are no fatalities, however a poor job significantly increases the probability that this will occur. Furthermore, SMN is the guardian of the national climatological database, which is an essential public asset for undertaking many human activities, including risk calculation in the insurance sector.

"SMN participates in the Hurricane Committee of Regional Association IV (North America, Central America and the Caribbean), that has been meeting once a year for the past 28 years to coordinate the next tropical cyclone season."

SMN represents the country at the World Meteorological Organization (WMO) and maintains special direct contact with the neighbouring countries of USA, Belize and Guatemala. One of the most important committees in which it participates is the Hurricane Committee of Regional Association IV (North America, Central America and the Caribbean) that has been meeting once a year for the past 28 years to coordinate tasks and communications for the next tropical cyclone season. It is in this WMO body that there is a special relationship with the US National Hurricane Centre, which for this international task is the WMO's Specialized Meteorological Forecast Centre. It is also frequently consulted by the Ministry of Foreign Affairs when it wishes to carry out international atmospheric tests within the country.

"Today, with satellites, it is unimaginable that a hurricane could catch the population unawares."

During crises relating to tropical cyclones, SMN plays a vital role in the group of government institutions that meet to take decisions and coordinate actions. In recent years this role has grown from that of an informant to that of an advisor on technical decision making. In the latest tropical cyclone season it began to participate in other CNA matters such as videoconferences between central offices and various authorities (of CNA and state governments) in the danger zone. It also sits on operating committees for water projects and undertakes evaluation of schemes for disaster prevention and climate forums.

How have climate study and the ability to forecast it improved throughout the world? What are the principal challenges that SMN faces in the near future?

Although scientific meteorology is a relatively modern science, it has shown systematic progress over time. Given the immediate application of its

results to human daily activities, these advances may not seem sufficiently rapid, however they are consistent. Two of the most significant advances in recent decades have been the advent of weather satellites (which in the 60s allowed man for the first time to view meteorological phenomena that until then had only been guessed at, deduced or observed in an inadequate manner). Prior to these advances, something as basic as knowing whether or not a tropical cyclone was situated or not in the Gulf of Mexico was unclear – it required careful analysis of the scant available meteorological information. Today, with satellites, it is unimaginable that a hurricane could catch the population unawares. And now new and exciting advances are coming with satellite sensors (although it is still incorrect to claim that satellite information is sufficient to make forecasts).

The other great recent development is the accelerated increase in the calculation speed of modern computers. And the correct word in this context is "calculation" or "computation" as opposed to the more common "information technology". The numerical models of the atmosphere are perfect examples of the "creation of new information" (computation or calculation) as opposed to "the

Source: SMN/CNA-México

transfer and automatic handling of information" (or information technology). It would be of little use to know the equations that have governed atmospheric dynamics for centuries if we were unable to solve them even approximately.

Today, with joint forecasting techniques, the moment approaches when it will be possible to give a useful weather forecast (although far from perfect) 14 days in advance. In the field of climatology we are beginning to have the real ability to forecast beyond the horizon of a single season (for example, we can estimate the general conditions for the coming year), something which is also important for the insurance sector.

The main challenge for SMN is to keep up to date in the race for technological progress with a size, budget and structure which, frankly speaking, are inadequate for the country's size and complexity; this must be achieved without neglecting its necessary everyday tasks.

Mexico has just hosted the "IV World Water Forum", in which there was an attempt to raise awareness about water problems throughout the world. What were the conclusions of this IV Forum? In your opinion, what basic challenges does society face in the management of this asset?

I think that too much is always expected as regards conclusions from a forum of this nature. In fact, the main benefit is to have gathered together many different participants to talk about water, and for the purpose of meeting each other and getting to know the way they think. No, of necessity the only measure of success is to obtain a broad consensus and formal agreements. Some of the principal conclusions reached are as follows:

- Population growth is leading the planet to crisis point with regard to water resources.
- It will be impossible to give the entire world population water supplies similar to those that the developed countries give their inhabitants; innovative solutions that allow more to be done with less water will be essential in the immediate future.
- Intelligent use of desalination; local collection of rainwater; use of so-called underground reservoirs or more efficient agricultural irrigation techniques and a reduction in leakages in urban distribution are some of the concepts that will allow for progress to be made.
- Although water is something that can never be considered to be merely a product for social, political and economic reasons and because of its status as "essential for life", in general the user public will have to pay for the true costs of operation, distribution and treatment; if this is not the case the sector will become decapitalized and the problems, serious now, but alarming for the future, will not be resolved.
- Water problems are closely associated with other environmental problems and the solutions are interrelated; they include: deforestation, change in soil use, wetlands, fair and equitable water distribution throughout the basin, interconnection of the water cycle between atmospheric water, surface water, underground water and even sea water. As an example, although desalination is now achievable at competitive costs, most of the world's desali-

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Source: SMN/CNA-México

nation plants are still powered by non-renewable energy sources and pump large quantities of greenhouse gases into the atmosphere. Over the coming years it will be an enormous technological challenge to make these costs competitive with renewable sources such as solar or wind power. These are the solutions that offer a sustainable future because they do not create further problems.

With regard to the insurance sector, it is important to remember that one of the Forum's main themes was "Risk Management", and in this connection a discussion document was drawn up which, although general, proved to be a good reference point on the specific problem that we face on water as a danger and a source of risk.

In my view, one of the main challenges for society is to convert the numerous NGO initiatives, well intended as they may be, but short on technical, scientific and financial backing, into schemes that when applied on a massive scale do not produce the same negative results that traditional technology has produced in the past.

"It is to be hoped that we can change our way of life to make it more in keeping with the environment, although history does not show that we are taking this path."

Planet Earth has experienced climate change on many occasions. Can you tell us what makes the current climate dynamics different from the preceding ones? Has man's involvement been key in accelerating this change?

It is true that we are not experiencing either the highest or the lowest atmospheric temperature in the planet's history, but we are probably at the point at which temperature conditions have increased most rapidly, largely due to emissions of greenhouse gases by various human activities. This is precisely where the difficulty lies, because living beings are able to adapt themselves to different environmental conditions; to achieve this however we need enough time so that down the generations those that adapt themselves best to the new conditions are the most successful and hence reproduce more. This time, the speed at which these changes are occurring does not give those living the necessary time to adapt and as a result there will be massive breakdowns or relocations of different plant and animal species. Man, due to his intelligence, has other alternatives with respect to the rest of the living beings. And so, it is to be hoped that we continue to demonstrate our intelligence as human beings, under increasingly hotter conditions and rising average sea levels, by not opting for more powerful air conditioners, which will use more energy and emit more greenhouse gases than is currently the case, but rather by deciding to build more dykes to hold back the sea, like those that failed in New Orleans during Hurricane Katrina.

It is to be hoped that we can change our way of life and adapt it to types of building and locations, means of transport and even styles of dress that are more in keeping with the environment, even though recent history does not show that we are taking this path. Suffice it to say that a bank in a tropical city at sea level has exactly the same design as in a city at higher altitude or at intermediate latitude, or that western clothing (suit and tie) has become

almost universal irrespective of the local climate. As a result, a meeting of bank executives looks exactly the same in Helsinki as in San Juan, Puerto Rico, and exactly the same in summer as in winter. As a general rule we resist adapting ourselves to nature and we try to get our immediate environment to adapt itself to us. This generates extremely high energy expenditure and intensifies the development of the processes that are driving us toward global climate change.

How has knowledge and prediction of cyclone activity progressed in the short, medium and long term since the use of satellites for tracking tropical storms?

Tropical cyclone forecasts are generally short term. The fact is that a true forecast of trajectory and intensity cannot be undertaken until the system has formed. Normally current directional forecasts are available 120 hours in advance, although with some element of uncertainty, especially when the timescale of the forecast is increased. With regard to intensity, forecasts only cover a 72-hour period, and as in the case of the forecast, advances over the years have been modest but consistent over time. Today the trajectory of a tropical cyclone can be forecast up to 72 hours in advance; 10 years ago we could forecast the trajectory 48 hours in advance with the same level of uncertainty - we gain about a day's warning for every decade. In the case of intensity, improvements have not been so evident because we still have serious problems in identifying systems that will become more intense (such as Wilma) or sharp declines, with any degree of anticipation.

In the long term it is not possible to forecast individual tropical cyclones but rather the expected level of cyclonic activity throughout the season, some months in advance. Performance is moderately good, i.e. it is useful to consider these predictions instead of using the alternative (normal climatological values). The forecast of the total expected cyclonic activity in any given area is not very useful for the local decision-making process. As an example, 2004 was a very active season in the North Atlantic and at the same time extraordinarily inactive as regards Mexico directly.

"Some models are beginning to appear, however, that are statistically competitive with the official version."

One important change that has occurred relates to the inroads made by numerical models in forecasts. Currently, the official forecast of a centre like Miami is a subjective combination (by specialized meteorologists) of the objective results of about 15 different numerical models. Until recently, the official forecast (with human intervention) was statistically superior to any of the individual models. Some models are beginning to appear, however, that are statistically competitive with the official version. These are, generally speaking, models that are in turn an optimized combination of several individual models (now prepared without direct human intervention).

I believe that this is the future – the use of "assembled models", each of them with "sets of figures" with data that deviate slightly from the measurements. In fact, this technique, although not so called, began to be used intuitively in respect of tropical cyclones before being used in the general weather fore-

Source: SMN/CNA-México

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cast. If computer manufacturers believe that they can produce faster hardware than any human being requires, here is the acid test. We can still use much more computing power on this type of problem than that which is currently available.

Mexico is especially vulnerable to tropical storms, on both the Pacific and Atlantic coasts. What are SMN's estimates of the frequency and intensity of tropical cyclones in Mexico in 2006? What are the likely trends for future years? What predictions can be made about the frequency and intensity of tropical storms around the world?

The forecast bulletin on cyclonic activity that SMN issued at the beginning of April 2006 indicated that the 2006 season would be significantly more active than normal in the North Atlantic with 17 named systems (i.e. that would attain the category of "tropical storm"), in comparison with the 9 or 10 that is considered normal, measured as an average over many years. In the Northeastern Pacific a slightly less active season than normal is expected, with 11 named tropical cyclones as opposed to a normal figure of 14 to 15. The forecast issued for the North Atlantic agrees exactly with the specialized group founded by Dr William Gray of Colorado State University and agrees qualitatively with NOAA's forecast from USA. In the case of the Northeastern Pacific, this is our own methodology, however it agrees qualitatively with the forecast that NOAA has prepared for this area.

"On a global basis, the total number of tropical cyclones that occur each year is surprisingly constant, as if the variation in one region were absorbed by opposite behaviour in others."

Source: SMN/CNA-México

Looking beyond 2006 it should be noted that the current temperature of the surface of the North Atlantic, which is higher than normal and obtained from a long-term average, is set to remain high for at least a further few years, given the behaviour of this fluctuation in the North Atlantic. Some researchers believe that it will continue for more than a decade. Under these conditions, seasons are expected to be more active than normal on average, although, naturally, each one may be affected by key factors (if, for example, there were to be an intense "El Niño", that season would tend to be of lower activity in the North Atlantic). With regard to the Northeastern Pacific, frequently this behaves in the opposite manner to the North Atlantic, and as a result the forthcoming seasons should be between normal and low in that ocean region.

On a global basis, the total number of tropical cyclones that occur each year is surprisingly constant, as if the variation in one region were absorbed by opposite behaviour in others. From this point of view, therefore, I expect the number of tropical cyclones around the world to remain constant in the next decade. Global warming may well have a marginal effect and tend towards greater frequency, greater intensity, or both; as yet there is still no clear evidence in this regard.

I am aware that the opinion that I have just expressed flies in the face of what (sometimes rashly) is widely commented on in the media and even in some scientific journals. However I am a firm believer that the increase in natural disasters that we are witnessing (number, frequency, cost, etc.) is largely due to the fact that the vulnerability

and exposure of society are increasing much faster than any effect that climate change and specifically tropical cyclones may bring about. There is a single exception: the almost certain increase in sea levels will have a direct effect on the severity of the damage from storm tides, even when this is at the very lowest estimated level (say 10 to 100cm by 2100).

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Tropical storms cause damage not only by strong winds, but also by surges, storm tides and the heavy rainfall that accompanies them. In 2005, Hurricane Wilma dumped rainfall of more than 1,000 litres/m2 in less than 12 hours and more than 1.500 litres/m2 in 24 hours on certain areas of the State of Quintana Roo. To what extent do you view the Saffir-Simpson scale, based on the maximum sustained wind speed, as adequate for classifying tropical storms?

In addition to wind there is also damage caused by surges, storm tides and rain. In the case of the first two causes there is a strong correlation with wind strength, however they are also influenced by the size of the storm, speed of passage and by the coastal geography and the depth of the waters in the coastal region. In the case of rainfall,

Source: SMN/CNA-México

the matter is considerably more complicated and for this very reason there is a need for an index to classify a tropical cyclone according to its danger, as this is not closely related to wind strength.

"The problem lies in finding an objective and reliable method of assessing a given tropical cyclone's capacity to generate rain. For the moment no reliable way of measuring a cyclone by its rain has been found."

The problem lies in finding an objective and reliable method of assessing a given tropical cyclone's capacity to generate rain. Measurements over the sea are not always maintained on land (in fact, radar measurements seem to show that rain intensifies once the cyclone reaches land). Furthermore, total accumulated rainfall in a given point depends inversely on the speed of passage, but also in dramatic fashion on the topography and relative orientation of the mountains and the local trajectory of the wind. For the moment, therefore, no reliable way of measuring a cyclone's capacity to generate rain has been found. It remains a pending task for both researchers and on an operational level.

Hurricane Wilma lashed the Yucatán Peninsula in October 2005 and turned out to be the most economically costly insured hurricane in Mexico to date. Can you enumerate the lessons learnt from Wilma?

The most important lesson is that decision taking with sufficient time to carry out the necessary actions, even though this means taking them when there is significant uncertainty, makes the population feel safe. In this specific case the toll was practically zero, even though when it came ashore it was a category 4 hurricane on the Saffir-Simpson scale, similar to Katrina when it hit New Orleans. But this is not always so. A year previously, Hurricane Ivan passed by with a trajectory similar to that of Wilma, although at a distance of 200km from Cancún. Given that it was forecast that it would veer

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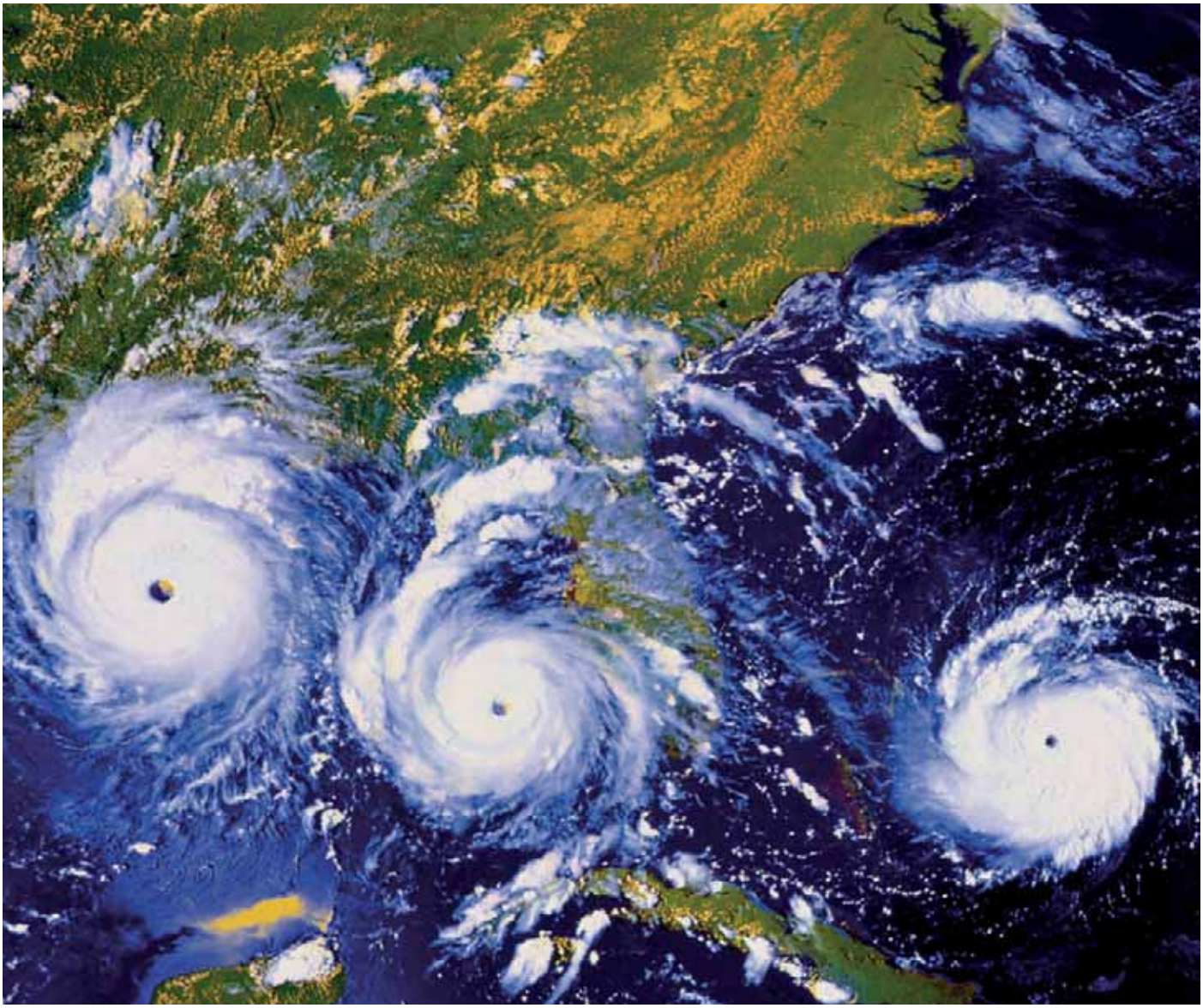

towards the Yucatán Channel, the necessary evacuations did not take place. Fortunately at the last moment Ivan veered off in an asymmetrical fashion to the right, only causing dangerous conditions in Cuba. Had this not been the case the population in the extreme northeast of the Yucatán Peninsula would have been in serious danger. It is important to note that in both cases uncertainty indicated the need for evacuation.

"Not all damage can be blamed on the instantaneous maximum wind speed as the phenomenon develops. Some progressive damage is magnified by the duration of the dangerous conditions, in addition to the extensive accumulated rainfall."

Another lesson is that the extraordinarily slow speed of passage (as low as 3kph), which allows the dangerous conditions to remain for long periods in the same place, have a bearing on the damage. Not all damage can be blamed on the instantaneous maximum wind speed as the event develops, as some progressive damage is magnified by the duration of the dangerous conditions, in addition to the extensive accumulated rainfall.

The level of damage was also surprising as a result of the surge/storm tide in the business sector of the island of

Cozumel, which runs along the island's coast facing the continent that lies only 20km away. For this small area lashed by wind and sea the damage was surprisingly high – tropical cyclones always cause surprises.

In comparison with Hurricane Gilbert in 1988, which is analysed in your book Destructive Effects of Tropical Cyclones, Mapfre, 1998, which human, financial, urban and scientific aspects do you feel have changed?

Many things are different. In 1988 when Gilbert struck the same region of Mexico there was a nascent National System of Civil Protection, which until that moment had in no way highlighted the risk of tropical cyclones. Today Cancún, with its tourist area, is probably one of the best prepared regions against tropical cyclones in the world, almost certainly the best in the Caribbean.

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With Wilma, although the financial damage was quantitatively very high, in terms of quality the damage was less "structural" than in the case of Gilbert in 1988. Generally speaking, construction quality in the area has improved significantly, although now, with much greater economic value exposed than in 1988, the value of the damage has surpassed that historic case. Cancún's principal vulnerability remains its original one: the extraordinary proximity of man-made structures to the coastline. In the new Riviera Maya area, to the south of Cancún, this situation has been largely rectified.

The global community is experiencing ever more natural disasters with high human, financial and insured costs, and climate and weather are the causes of many of them. Mexico is not a stranger to this situation. What can SMN do to prevent, anticipate or mitigate the damage caused by natural disasters? Is there an exchange of information between SMN and the insurance sector?

In order to reduce the danger to the population itself, SMN above all else should continue to improve the quality of its human resources and also ensure that it has the appropriate equipment to carry out its duties efficiently. To reduce material damage and increase development sustainability, it should be even more involved in government decisions relating to the areas exposed along the length of the coastline. One of the ways of achieving this greater involvement is by impressing on the minds of all decision takers and local authorities the physical realities of the phenomenon that they will face sooner or later. This should be done concisely and in clear language, ideally before the decisions leading to vulnerability have been taken or implemented. This includes the tourist sector, relevant bodies of the federal, state and municipal governments and even executives of private sector organizations.

With regard to cooperation with the insurance sector, the most common relationship is that of supplying past and/or current information to enable them to assess the applicability of an insurance policy. There has also been cooperation with an insurance agency of the federal government for the purpose of making the policies offered to some Mexican agricultural sectors more precise, and this has produced excellent results for both parties.

There is also a large quantity of studies that it is necessary, advisable and possible to execute and which would give valuable results for the insurance sector. SMN knows what needs to be done and how to do it, however most of these studies have been unable to be executed for lack of internal human resources, or alternatively, lack of budget or appropriate guidelines to outsource them. In this regard, by means of cooperation agreements with the insurance sector, many of these studies could be carried out. Clearly there would need to be respect for SMN's philosophy and policies on the public nature of the data and the resulting products. ■