

Predicting the unpredictable

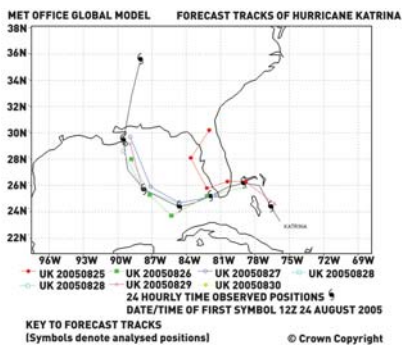
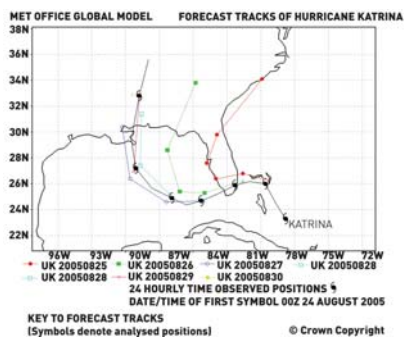
Officially for the US, GoM and Caribbean, the forecast centre in The National Hurricane Center in Miami has ultimate responsibility for hurricane prediction. They take information from a vast array of sources including US [The UK Met Office], and they have various tools that enable them to process that information and provide what they consider to be the best forecast product,' says Julian Heming from the UK Met Office.

The Met Office is one of the leading centres worldwide that do seasonal predictions. There is a solid scientific basis for all the predictions.

Similarly, Colorado State University, NOAA (National Oceanic & Atmospheric Administration) and the Tropical Storm Risk Agency, which is based in University College London, all use methodologies that are scientifically based. Heming told *The JOT*: 'Some years they will do better than others and some years they will fail to predict the number of storms. Last year they were all predicting an above average season but nothing like what actually occurred. They are going for the same again this year.'

The cycle of tropical cyclone activity in the whole of that region – the North Atlantic, including the Caribbean and the Gulf of Mexico (GoM) is regulated on a very long time scale and they do go through, in some cases, decades of high activity. 'For there to be another prediction for above average activity is hardly surprising considering that we have been in a more active phase for about the last ten years or so,' explains Heming. 'There are a lot of variations from year-to-year but if you look at the long-term trends there

The US, and Gulf of Mexico (GoM) region in particular were hit hard by the highest number of hurricanes ever recorded and the forecast this year is for another above average season



Katrina forecast charts (right) for the Met Office global model showing the predicted hurricane tracks at the start on August 24 and 12 hours later on the same day. The storm hit New Orleans on the morning of August 29 as predicted



Hurricane Katrina eyewall images taken on Sunday, August 28, 2005, during a NOAA P-3 hurricane hunter flight at the time the storm was a Category Five hurricane
Photo credit: NOAA

are cycles that tend to be followed.' However, there are other factors that will have an effect on what will happen from one year to the next in terms of more precise numbers.

Huge increase

The number of storms last year saw a huge increase on the year before. Is this the peak and will we see a big drop off in the number this year? 'That is a very difficult question to answer. We are looking at long term trends and for this you need long term records detailing multiple decades of cycles. Effectively, we have only one long term complete cycle in terms of what we have in the historical records,' explains Heming. The current active period has been around since about the mid 1990s, with a quieter period in the previous 25 years, and greater activity in the previous 30 or 40 years. He told *The JOT*: 'Once you start going back that far into the records there are errors because there wasn't the quality of data back then. For example, we didn't have the satellite coverage, so in some cases, we would have missed

storms altogether. With these long-term cycles there will be blips where there are seasons like last year. Whether that was just a one-off in terms of the absolute extremity or whether it is something that will happen again is very difficult to tell.'

GoM focus

While this article focuses on the GoM region, Heming is keen to point out that 'the thing to bear in mind when you are looking at seasonal forecasts for the North Atlantic is that there can be a lot of variety in terms of the geographical distribution.'

He explains that 'one of the reasons why 2004 and 2005 were particularly costly in terms of insured damage is because in those seasons, yes there were a lot of storms in total in the Atlantic, but there was a dominant high pressure located higher than the tropics, which tended to force the hurricanes on a more westerly track.' In other words through the Caribbean and the GoM and up towards the US coast. 'In 1995, which was a very active season, we saw 19 tropical storms



A satellite image of Katrina at full power Photo credit: NOAA

but there was very little damage in the Caribbean/GoM area because the vast majority of the storms turned northwards while still out at sea.'

Heming elucidates, 'so, when we are looking at the seasonal forecast on an Atlantic wide scale, we have to bear in mind that even in a year where you may get high activity, it doesn't necessarily mean it is going to be bad in the GoM and the reverse can be true as well. Even in a relatively quiet season, if all the hurricanes tend to track into the GoM it is still possible that there will be problems from the odd one or two.'

Another case in point is the 1992 season. The Atlantic hurricane season was very quiet that year but it was the most costly of any season up until last year because of one hurricane, Andrew, which hit Miami.

'This tropical storm hit a populated area and skewed the damage statistics beyond all recognition despite that fact it was a quiet season,' he says.

No direct correlation

Heming says that there is no direct correlation between the number and the intensity of tropical storms. However, there is a correlation in the sense that last year we had more than twice the average number of category five hurricanes. 'But there is no direct link to say that you will get a greater proportion of hurricanes reaching a higher intensity if you have a greater number of cyclones.'

All that can be said is if you get twice as many hurricanes, you are likely to get twice as many intense ones, he says.

However, this depends where they track. 'Last year we had several really intense ones in the GoM/Caribbean but, probably the reason for that was the sea temperatures are warmer in those regions than in other parts of the Atlantic,' he told *The JOT*. 'So if a greater proportion of your hurricane tracks are going into those areas where either the sea temperature, or the depth of the warm layer of the ocean is greater, then there will be a greater proportion of intense tropical cyclones.'

He emphasises this by saying, 'Hurricane Rita for example, which followed about three weeks after Hurricane Katrina, had a similar intensity and that is not entirely surprising as there was a warm ocean in the GoM. In the loop current, there was an area of very deep warm water, which is as important as the actual temperature of the ocean surface.' That had an impact on Hurricane Katrina and the conditions didn't change much in the following three weeks.

He believes, it was not surprising that as soon as the second storm tracked into that area it was bound to develop into something very severe. In this context a succession of events in

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one season are not unrelated if they are tracking into the same areas and the conditions have remained constant.

Improved tracking

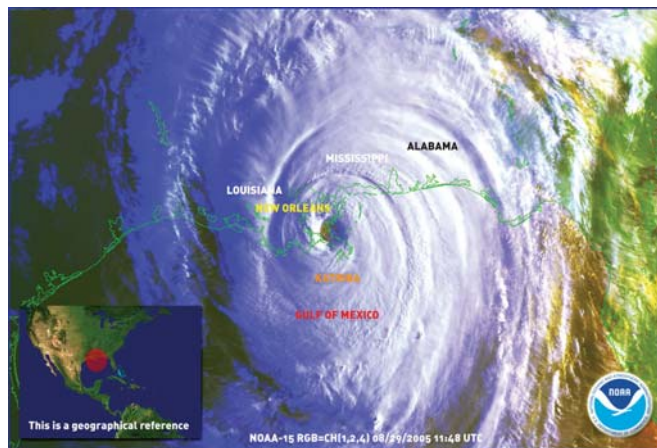
'Hurricanes are no more difficult to track as they approach land as when they are out at sea' says Heming. Certainly, in the Atlantic region the quality of the forecast tracks is very good compared with what it used to be. The marked improvement means that there are now relatively small forecast errors but sometimes, for people on the ground, a small error can seem large.

A good example is Hurricane Charley in 2004, which was approaching the Florida coast at a very oblique angle and the forecast error was relatively small from a statistical perspective. But, because of the angle it approached the coast, it ended up not hitting the populated area predicted and it came ashore further down the coast,' Heming explains adding, 'to the people on the ground it seemed like a catastrophic error in the forecast but it actually wasn't. Sometimes it is very difficult as perception can give the appearance that it is worse than it is.'

In the case of Hurricane Katrina, early forecasts did have some significant errors as to

Hurricane Katrina has hit land and is moving north at 15 mph. It has maximum sustained wind speeds of 143 mph and gusts up to 165 mph

Photo credit: NOAA



whether it would track into the New Orleans area five days in advance. But once it got down to three days or 60 hours before the event, the official forecast from The National Hurricane Center, which was predicted by a number of computer models, were excellent. 'All the models were very accurate in predicting the track of the storm,' he says.

Ensemble forecasting

The UK Met Office doesn't currently use ensemble forecasting (which is based on chaos theory), to track hurricanes, but is using the method when it comes to general forecasting. However, Heming says that the Met Office did a one off run using the method during the hurricane season 'although it is not something that we are specifically working on to produce anything for an operational environment in the short term.'

However, the US National Hurricane Center and the European Centre for Medium-Range Weather Forecasting (ECMWF) routinely produce ensemble forecasts for tropical cyclones. Heming believes 'it is a very useful product because it gives some indication of whether a forecast is sensitive to small changes. Operationally it is done by ECMWF at present.'