Mark Saunders gave up gazing into outer space to concentrate on the earthly science of predicting hurricanes. His discoveries led to a leap forward in climate research. He describes his average day to Simon Challis and explains why weather prediction is becoming increasingly important to insurance and business as a whole.

Mark Saunders

How did you become a hurricane predictor?

My original background was in space plasma physics [the study of how magnetic fields of charged particles interact in space to create phenomena like aurora and magnetic storms on Earth]. It is pretty pure research that looks at what is going on in outer space. But I changed to climate physics eight years ago to do work that I thought was more practical and of more benefit to humankind.

I started looking at sea surface temperature from space. That was at the time of the very active hurricane season in 1995, so I began to look if anything unusual was happening. I noticed that sea temperatures in the Atlantic were at near-record levels and realised that there must be a connection. My interest in hurricanes really took off from there.

Later, we had a paper published that featured in a front-page story in the *New York Times*. I got so interested in the subject that I set up a team looking into long-range forecasting of hurricanes and other weather extremes.

What does your average day entail?

My days are pretty varied. My top priority is the smooth running of my research group. I try to have daily meetings with members of my team, to discuss their research progress, new ideas and to ensure that forecasts are produced on time.

Another large part of my day involves keeping income flowing in. That includes writing lots of grant proposals.

Thirdly, I write lots of scientific papers and give presentations. After all, if you don't tell people what you're doing there's not a lot of point doing it.

Finally, being based at University College London means I have a pretty full teaching schedule.

"I believe that global warming is occurring. It seems likely that the number of Atlantic hurricanes will increase if tropical waters do warm to the level that climate models are predicting"

Grant Robertson

Are insurers the biggest donor to the climate prediction industry?

They are at the moment. Certainly my own group gets over half its funding from the insurance industry. Increasingly, climate groups in this country and abroad appreciate that extreme weather impacts insurance so much that there is plenty of scope for collaboration with the industry. I think there is tremendous potential for growth in this area too.

Is it not strange that the industry sponsors initiatives like yours, but takes very little notice of its findings in its pricing?

I would tend to agree. But we are working hard to try to overturn that view. Attitudes take time to change and I think that our forecasts are having an effect, by raising skills standards and by clearly defining what the uncertainties in any forecast are. It takes several years for people to have confidence in forecasts, but I believe that, within a few years, forecasts will have an impact on pricing.

Perhaps not the long-range forecasts, which look six to nine

months into the future, but those which are done as the hurricane season approaches. The skill in forecasts for two to four months out increases, which gives companies the opportunity to buy extra reinsurance as the season nears.

Are you looking to serve other industries as well as insurance?
Yes we definitely are. Surveys show that 70%-80% of industry is affected by the weather, particularly the energy, agricultural, food and retail industries. We are actively pursuing these opportunities with other industries, but insurance has really taken the lead.

What has been the biggest achievement of your career to date?
What I am proudest of is setting up a research group into long-range weather patterns. Linked to that is my belief that we are making predictions that are setting new skills standards and making the uncertainties within those predictions more transparent.

What has been your biggest disappointment?
Perhaps my biggest regret – rather than disappointment – is not switching earlier to climate physics. Working on climate has more practical benefits; it is also more enjoyable because I feel I'm doing something really useful.

The other slight regret is that pay levels working in the university sector are not higher. It would help me to attract and retain the best talent to work in this area.

Has there been a brain drain in climate physics?
One is starting. A few months ago, I lost one of my best researchers to a multinational energy company. He is doing very similar work to that which he was doing with me – but for twice the salary.

Companies are starting to wake up to the impact weather has on their businesses. They are now setting up their own in-house teams to look into this area. I keep getting calls from recruiting consultants asking me if I can help them recruit people in the long-range weather forecasting industry.

But the main reason that people stay in the academic sector is that they enjoy their work, partly because they get more freedom than they would in industry.

How do the various methods for forecasting hurricanes differ?
The two main methods for long-range forecasting are statistical and what is known as dynamical. The statistical method is based on predicting storm activity from the number and force of hurricanes and other climate parameters that have occurred in the past. Whereas the dynamical methods try to model the whole climate using the basic equations of physics to predict storms.

Most of the long-range forecasts to date have used statistical methods. Bill Gray and James Elsner at Florida State University use these methods. We at TSR [Tropical Storm Risk, a joint venture between CGNU, Royal & SunAlliance, Benfield Greig, University College London and the UK Meteorological Office] will introduce dynamical methods into our forecasting later this year. These methods are viable for forecasts out as far as four months so it seems that statistical methods are the only way of doing hurricane forecasts beyond that at this moment. Ours will be the first study to judge whether dynamical methods build on the statistical method. If they do, that will be of interest to many people. We will know the answer later this year.

How have hurricane predictions developed over the past five years?
Bill Gray [hurricane predictor at the University of Colorado] has set the standard in predicting Atlantic hurricanes for a decade or more. There have been clear advances made, however, as more groups get involved in this area. Competition breeds progress. For example, our Tropical Storm Risk venture looks at storm activity in all the main basins in the world. We publish forecasts with a lead-time of up to a year, which are what the insurance industry is really looking for. As well, we clearly show the levels of skill and certainty contained within those forecasts.

But we are also identifying new predictors to develop our forecasting skills. For example, we believe the sea surface temperatures in both the Atlantic and Pacific are crucial in predicting hurricane activity, as are the speed of the Trade Winds in the areas where the storms form. These differ from the so-called lagged predictors that Bill Gray has championed. We believe that if we can predict the general state of the climate ahead of the storm season then we can increase our level of forecast skill.

Career path

- **1978: Graduated with first class honours in Geophysical Sciences from Southampton University.**
- **1982: Obtained his PhD in Space Plasma Physics from Imperial College London.**
- **1983: Was a Royal Society University Research Fellow at Imperial College London.**
- **1983-1985: Was a European Space Agency Research Fellow at University of California, Los Angeles.**
- **1986-1993: Was a Royal Society 1983 University Research Fellow of the Department of Physics at Imperial College London.**
- **1993: Joined University College London, where he is now senior lecturer and principal climate physicist in the Benfield Greig Hazard Research Centre.**

How accurate are your predictions?
Over the past 15 years, we offer skills levels for Atlantic forecasts made in early June that are 20%-30% better than climatology forecasts, which are forecasts based on the long-term average conditions. For storms and hurricanes actually making landfall on the US mainland we offer skills levels that are 10%-20% better than climatology predictions. By the time the main hurricane season begins in August those skills levels would have gone up by 50%. So there are real predicting skills there.

Elsner has recently predicted that up to 11 hurricanes – which could devastate parts of South Florida, North Carolina or Texas – will hit the US in 2005. Do you agree?
I know he has been involved in predictions relating to weather patterns over decades, but I must admit that I'm not entirely convinced by his methods. It is a new area, but I can't see how anyone can predict with any confidence that a big one will happen in five years' time.

It is true we are going through a very active phase in the Atlantic at this time, so the numbers of hurricanes are likely to keep increasing because global warming is increasing the temperature of the Atlantic. But I don't think one can predict a truly catastrophic hurricane in five years' time. That really depends where the hurricane makes landfall – something one cannot predict until a few hours beforehand.

Do you believe that the climate is changing due to pollution?
Yes, I believe that global warming is occurring. The 1990s were the warmest decade in the last millennium, which I feel is almost certainly due to human actions rather than a changing output from the sun.

One of the members of my team is actually studying the impact of global warming on the number of hurricanes. It seems likely that the number of Atlantic hurricanes will increase during the next century if tropical waters do warm to the level that climate models are predicting. ●