Scientist Profile – Paul D Williams

Dr Paul Williams is a Royal Society University Research Fellow based at the University of Reading. His research interests lie in the questions concerned with small-scale features in the atmosphere and ocean. Paul is motivated by making new discoveries about how the atmosphere and ocean work.

Paul studied at the University of Oxford for his undergraduate degree in Physics, and then stayed on to study for a DPhil (PhD) degree in Atmospheric, Oceanic and Planetary Physics. I asked Paul to answer a few questions about his work.

Imagine you are speaking to a child. How would you describe your work?
I develop computer models of the atmosphere and ocean, and I use the models as virtual laboratories to answer scientific questions about weather and climate.

How did you end up in your present job?
Following my doctoral degree in geophysical fluid dynamics at Oxford, I moved to Reading to work as a post-doctoral researcher on a project studying rapid climate change. I have been at Reading ever since. When the rapid climate change project ended, I was lucky enough to win a NERC Fellowship, followed by a Royal Society University Research Fellowship.

What do you do on a normal day at work?
On most days, I'll be in the office doing research. This could involve writing some computer code, running a simulation, or analysing some data. Other tasks include supervising PhD students and writing scientific papers and research proposals. I am currently an editor of Geophysical Research Letters, which also keeps me busy. I do some university lecturing and I often give public talks about climate science. I also frequently travel to conferences, because they are a great opportunity to exchange new scientific ideas.

What are you working on at the moment?
Small-scale features in the atmosphere and ocean are my main research interest. Examples include gravity waves and eddies, which are important for weather and climate, and clear-air turbulence, which is costly to airlines and injures passengers. How are these features generated, how do they interact with the large-scale flow, and how should they be represented in models (including stochastically)? Numerical modelling is another key research interest. How can numerical errors be minimised when the dynamical equations for the atmosphere and ocean are stepped forward in time? These are challenging scientific questions with important societal implications.

What was the last conference you attended?
The American Geophysical Union (AGU) Fall Meeting was the most recent conference I attended. This conference is held every year in San Francisco, just before Christmas. It is one of my favourite conferences, because it covers all the Earth sciences and is attended by over 20,000 scientists from around the world.

How does your work contribute to UK atmospheric science?
My research helps to improve our understanding of the atmosphere and how to model it. For example, I recently helped to develop a better method for predicting atmospheric turbulence, which is an important and expensive concern for the aviation industry. Also I have developed a method for reducing the errors that creep into computer simulations when the equations are stepped forward in time. This helps to improve the models, giving more accurate simulations.

What is it about the atmosphere, weather or climate that interests you?
What interests me most is that the atmosphere and ocean are nonlinear. Mathematically speaking, this means the equations have complicated terms in them, involving the multiplication of one variable by another. This property makes the atmosphere and ocean chaotic and (to some extent) unpredictable, but it is also what makes them interesting to study.

What advice would you give someone considering a career in atmospheric science?
My advice would be to get a solid grounding in basic science first, by studying physics or another science or mathematics at university. Your understanding of atmospheric science will be much deeper with this broad training.

How do you think NCAS research improves weather and climate forecasts?
I can give you a direct example from my own research. The new time-stepping method I developed in NCAS has been shown to improve the skill of tropical medium-range weather forecasts. In one atmospheric model, predictions of the weather five days ahead with the new method were found to be as accurate as predictions of the weather four days ahead with the old method. The new method is currently being included in various other atmosphere and ocean models around the world, including models of storms, clouds, climate, and tsunamis.

What is the best thing about your job?
The best thing is that I don't really have a boss telling me what to do! One of the privileges of holding a personal research fellowship is that you are the captain of your own ship. I can set my own scientific priorities and choose my own research projects.

What are the big challenges for science in the next decade?
One of the biggest challenges will be communicating with the general public. The scientific method brought us from an age of folklore to an age of reason. Increasing the public's understanding of science will be crucial if society is to make decisions based on evidence and not superstition.

Interview conducted January 2013.