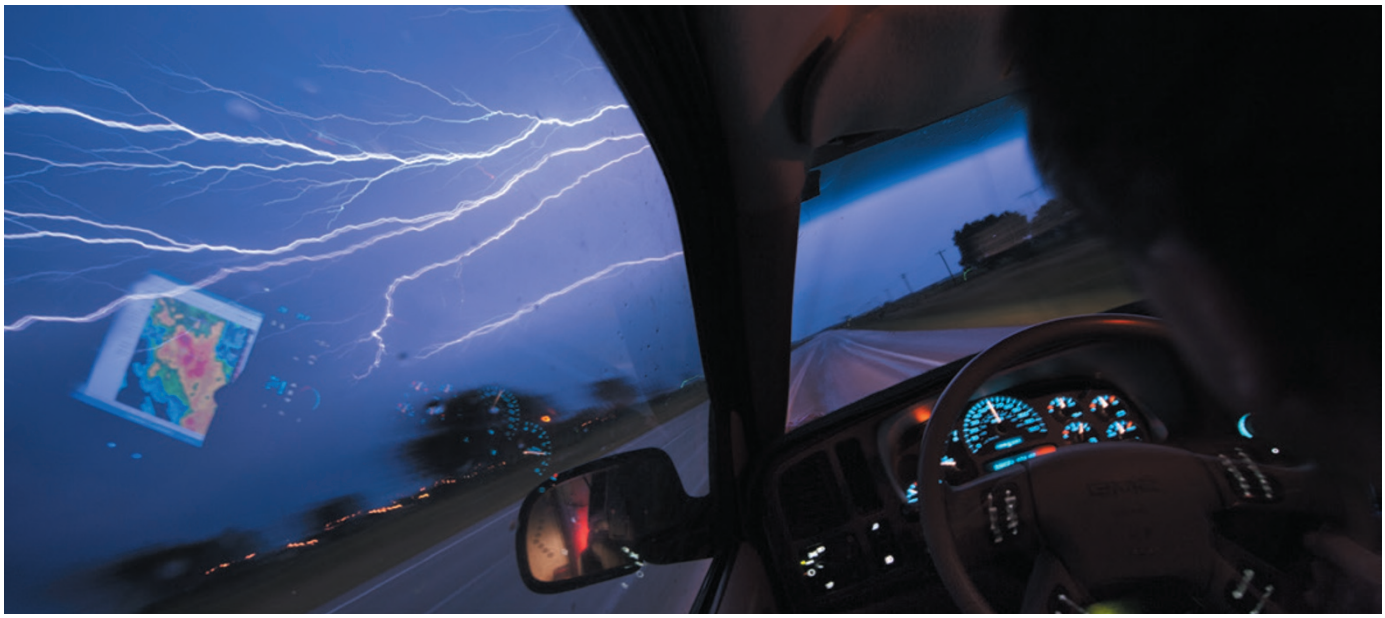
NEWS IN FOCUS

CARSTEN PETER/NATIONAL GEOGRAPHIC CREATIVE



Meteorologists cruise country roads at night to put their instruments in the path of heavy weather.

METEOROLOGY

Night-time storm chasers stalk their prey on US Plains

Violent nocturnal thunderstorms are hard to explain and even harder to forecast.

BY ALEXANDRA WITZE, STRONGHURST, ILLINOIS

Sheets of rain pummel the Illinois countryside as Jacey Wipf and Kyle Morganti haul a 60-kilogram weather station out of their pick-up truck. They rotate the metal cylinder on the roadside gravel, level it and step back to photograph its surroundings. Then they dash for the safety of their truck as bolts of lightning strike uncomfortably close, illuminating the pitch-black June night.

As technicians with the Center for Severe Weather Research in Boulder, Colorado, Wipf and Morganti are accustomed to this sort of extreme fieldwork. They are two in an army of researchers who have descended on the US Great Plains this summer for a massive research programme that ends on 15 July. The 45-day, US$13.5-million Plains Elevated Convection At Night (PECAN) project aims to unravel the mystery of how thunderstorms form and evolve at night, long after the solar heating that fuels daytime thunderstorms has vanished.

These night-time storms bring hail, flash floods and strong winds that can damage homes and cars. Because they occur in the dark, even experienced weather-watchers cannot detect their development. And they continue to elude nearly all attempts at forecasting.

"We really cannot predict, even on a 12-hour notice, where these storms are going to be," says Bart Geerts, a PECAN principal investigator and an atmospheric scientist at the University of Wyoming in Laramie.

Understanding night-time thunderstorms could help to improve forecasts of dangerous weather events on the Great Plains, he says. The research could also apply to other parts of the world that have meteorologically similar storms, such as those on the plains of eastern South America. A project to study similar thunderstorms in Argentina is slated for 2017. These storms start during day and night in the province of Mendoza, near the Andes foothills, where sudden hailstorms can wipe out economically important vineyards, says Jorge Rubén Santos, an atmospheric scientist at the National University of Cuyo in Mendoza.

All the textbook theories to explain thunderstorms have been developed with reference to daytime conditions, when heat rises from the ground to produce a well-mixed layer of air that feeds burgeoning storms above. PECAN is ▶

testing alternative ideas to explain how things might be different at night, when a stable layer of cool air typically prevents warm air from rising and churning to generate storms.

One idea involves a fast-moving ribbon of air called a low-level jet, which can form when air over higher elevations cools relative to that at lower elevations, setting up a pressure gradient. Computer simulations suggest that these jets can lift moist air above the stable layer, where they can feed storms (A. J. French and M. D. Parker *J. Atmos. Sci.* **67,** 3384–3408; 2010).

"But sometimes there are just nights when you have no obvious forcing like a low-level jet," says Rita Roberts, an atmospheric scientist at the National Center for Atmospheric Research in Boulder. Other atmospheric patterns may be at play, such as wave-like structures called bores that PECAN is also hunting this summer.

Project storm-chasers have had only mixed success, observing lots of low-level jets but not as many full thunderstorm complexes as they would have liked. "It's been a frustrating year," says Matthew Parker, an atmospheric scientist at North Carolina State University in Raleigh.

Each day, the team decides where to deploy an armada of trucks, vans and aeroplanes laden with instruments including radar, radiosondes and balloons. The scientists fan out ahead of where they think the storms will move, and hope to intercept them as they sweep through.

"If we could forecast them precisely, we wouldn't need to be out here."

"We have to wait for nature to provide us with storms of different types," says Joshua Wurman, president of the Center for Severe Weather Research.

Since PECAN began on 1 June, Wipf and Morganti have clocked up long hours collecting meteorological data ahead of approaching storms. This means a lot of driving along country roads in the dark and the rain — not exactly the glamorous stereotype of storm-chasing. "Everybody always thinks it's just like *Twister*," Wipf says. "It's not."

On 24 June, they find themselves in western Illinois, swerving to avoid low-hanging trees that could take out the towering measurement mast fixed to the front of their truck. "Tree tree tree!" Wipf shouts, just before Morganti swings the wheel yet again.

At 11:29 p.m., Wipf gets a text ordering them to deploy five stations along the side of the road, spacing them every 2 kilometres to gather data on temperature, relative humidity, wind speed and pressure. They wrestle two stations out of the truck before lightning begins hitting too close and they are forced to stop for the night.

In the end, it doesn't really matter that the stations are not up and running. The worst storms pass about 80 kilometres west of the pair, because PECAN forecasters have failed once again to predict how the night's events will unfold.

"If we could forecast them precisely," says Wurman wistfully, "we wouldn't need to be out here." ■

COMPUTING

Europe sets its sights on the cloud

Three large labs hope to create a giant public–private computing network.

BY ELIZABETH GIBNEY

From astronomy to genomics, scientists are increasingly storing and studying their data sets on shared remote 'cloud' computing servers, accessed through the Internet. Three of Europe's biggest research labs now want to help academics by working with commercial firms to create a continent-wide cloud-computing portal — and they are hoping to get backing from the European Commission.

Many researchers find cloud computing to be more flexible and efficient than buying expensive hardware — they can rent servers from firms such as Amazon and Google when they need a burst of power for an intensive computation, for example (see *Nature* **522,** 115–116; 2015). Despite the advantages, some academics are concerned about security and reliability when storing their data on outside servers, says Bob Jones, a computer scientist at CERN, Europe's particle-physics lab near Geneva, Switzerland.

Jones thinks that a single portal combining offerings from commercial providers and publicly funded infrastructure could solve some of these problems, and ultimately increase access to key data sets. Since 2012, CERN — with the European Space Agency and the European Molecular Biology Laboratory (EMBL) in Heidelberg, Germany — has been developing a test-bed system called the Helix Nebula. Run for two years with funding from the European Commission, and coordinated by Jones, the initiative has since evolved into a portal involving 30 different cloud providers, known as the Helix Nebula Marketplace (HNX). CERN has simulated particle collisions on the platform, and EMBL has used it to analyse genetic sequences, including some moved from Amazon's cloud, says Rupert Lück, EMBL's head of IT services.

Ambitions to expand were bolstered when, in May, the European Commission announced plans to fund a Europe-wide 'research cloud'. "The commission likes the idea of open science," Jones said on 26 June at a meeting in Geneva to discuss a European Open Science Cloud. "What we have to do now is take that enthusiasm from the public sector, the private sector and European institutions, and put it in place."

The commission is not specifically backing Jones' plan: it will launch its call for proposals in 2016 and says there are "a range of possibilities for business models". It wants a virtual platform to host data and encourage their analysis and reuse across disciplines and borders. Climate and satellite data, for instance, "represent a goldmine for research, innovation and new business opportunities", says the commission.

A European cloud for researchers built around the HNX would be a single gateway through which users could access cloud services and open research data from existing public infrastructure — for example, through

MORE ONLINE

Q&A

How will BP's deal help to restore the Gulf of Mexico? go.nature.com/hiovyl

MORE NEWS

- Gene responsible for tastier rice identified go.nature.com/uwebbb
- Ultrasound scanners read fingerprints go.nature.com/8vxtg2
- Seafaring spiders use silk as sail go.nature.com/nofbfx

NATURE PODCAST

Unicellular eyes, ethical robots and sex-morphing lizards nature.com/nature/podcast

CHERYL NEMAZIE/UMD CENTER FOR ENVIRONMENTAL SCIENCE/CC