New Models of Weather Pattern

December 9 2005

For a mathematician, Joseph Biello spends a lot of time thinking about the weather. But the UC Davis assistant professor isn't looking out the office window. He is using mathematical theory to build a model of the Madden-Julian Oscillation, a tropical weather pattern that influences drought and rainfall in the western U.S.

The Madden-Julian Oscillation was discovered in 1972 when researchers looked closely at meteorological data. It lasts 30 to 60 days and appears as clusters of tropical thunderstorms over the Indian Ocean before sweeping eastward into the Pacific, where it dissipates.

Measured in weeks, the Madden-Julian Oscillation lies in a gray area between short-term weather forecasts and long-term climate studies, said Bryan Weare, a professor of meteorology at UC Davis who also studies the phenomenon. A better understanding of the weather pattern would help with medium-range weather and climate forecasting.

Weare is trying to understand, for example, the conditions that cause the oscillation to begin over the Indian Ocean. Once the oscillation is under way, you can use it to make predictions about weather phenomena over a month or so, he said. But how it occurs in the first place is not well understood. So far, his work supports theories that link surface moisture over the ocean to thunderstorms, he said.

The phenomenon has subtle effects on weather in the U.S. There is a link between days of very intense rainfall on the West Coast and rainfall associated with a Madden-Julian Oscillation near the equator, Weare

said. On the other hand, Biello said that there also seems to be a link between a strong oscillation and a general drought on the West Coast.

So far this winter, the Madden-Julian Oscillation appears to be weak, according to data from the National Weather Service. But the oscillation can occur several times over the winter months.

To understand the weather, you have to look at processes at vastly different scales of space and time, Biello said.

"To understand the Earth, you have to understand raindrops," he said. Biello's specialty is to build mathematical models that incorporate these different scales. Often, weather and climate models divide the planet into a grid of squares, kilometers across, and look at how those squares interact. But that means making assumptions about what is going on within the squares, Biello said.

Source: UC Davis