



Modeling Monsoons

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Adam Sobel once bought a plane ticket to the city of Darwin in Australia's tropical north based on a colleague's weather prediction. That in itself is nothing new—people do it all the time. But the prediction he followed was for the start of the monsoon rains three weeks hence, a prediction that was virtually unheard of just a decade earlier for the length of its foresight. When he got off the plane, no one was happier to see the sky open up and the rain begin right on schedule.

"We had half a meter of rain in 10 days," said Sobel. "It was exciting."

For more than one billion people, the seasonal monsoons are both a life-giving annual event and a potential disaster. Although much is known about how the monsoons occur, very little is understood about how they vary.

Monsoons are an atmospheric circulation pattern that develops in the tropics at fairly well-defined times of year. The sun warming the surface of the earth draws moisture from ocean waters and forms the iconic, seasonal rains of South and Southeast Asia or sub-tropical Africa and South America. The people who live in these regions, particularly the rural poor, rely on the monsoon rains to water crops and recharge aquifers.

When the monsoons are weak, drought and famine can result; if they come with too much gusto, flooding and disease occur. The fine line between life and death makes monsoon forecasting one of the most important topics within climate modeling these days. Sobel is trying to develop models to predict the variations within a monsoon season, known as "active" and "break" cycles, which have so far been beyond the ability of climate modeling. Recently, he helped demonstrate the central importance of heat stored in the oceans on the formation of active and break cycles.

The atmospheric patterns that drive the monsoon are also responsible for spawning tropical storms in distant ocean basins and may influence the formation of El Niño and La Niña cycles in the western Pacific. As a result, Sobel's work may one day have an impact on people who live well beyond the reach of the monsoon rains.

"We need a central theory that can be stated simply that explains the variations we see," said Sobel. "Weather prediction can look two weeks in the future, max. Climate models can give us the probability for a strong or weak monsoon a year in advance. This is in between. It's kind of the Holy Grail right now."

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