Understanding the daily variation

December 3 2008

Steve Ryan and Kevin Hamilton inspect one of the atmospheric pressure sensors at the Mauna Loa Observatory. Credit: The International Pacific Research Center, UH Manoa

For over two centuries, meteorologists were puzzled by the observation that atmospheric pressure in the tropics peaks at 10 a.m. and 10 p.m. nearly every day. In the late 1960s, a theory was proposed that these surface pressure variations result from waves that are generated by the sun's heating of the upper atmosphere.

The waves, called solar tides, propagate to the ground as they travel around the globe. Strong support for this theory has now been presented

in a study by a US-Japan team of scientists spearheaded by University of Hawai'i (UH) Professor Kevin Hamilton, Interim Director of the UH climate research center, the International Pacific Research Center.

Hamilton reasoned that if the proposed explanation was correct, then the pressure variations should be affected systematically by topography. Since mountains cast a kind of shadow for the atmospheric wave as it propagates westward (following the sun) and downward, he predicted that the pressure variations should be weaker on the west than the east side of steep mountains.

Working with Wataru Ohfuchi of the Japanese Earth Simulator Center in Yokohama, Hamilton was able to show that this topographic effect is seen in very sophisticated computer model simulations of the global atmosphere. One of the most dramatic examples of the shadow effect in the computer model results occurs with the tall mountains of the Big Island of Hawaii. Fortunately, the Mauna Loa Observatory (MLO) had deployed a network of pressure sensors on the Big Island in 2004. Together with MLO scientist Steve Ryan, Hamilton was able to show that the shadow effect is seen in these real pressure observations as well [photo: Ryan and Hamilton (right)]. The Hawaii results thus shed light on an important feature of the global atmosphere.

The findings are reported in a recent paper published in *Journal of Geophysical Research* - Atmospheres and was selected by the journal editors as a research highlight, a distinction accorded to only about 2% of the over 1000 papers published in the journal every year (http://www.agu.org/pubs/crossref/2008/2008JD010115.shtml).

Source: University of Hawaii at Manoa