Yale group to study atmospheric 'tsunamis'

January 26 2006

The new Gulfstream V research aircraft owned by the National Science Foundation and operated by the National Center for Atmospheric Research.

Yale researchers have recently received funding from the National Science Foundation to observe, describe and explain severe atmospheric turbulence over mountains, and the effect of "gravity waves" on the stratosphere.

The project, "Terrain-induced Rotors Experiment" (T-Rex), will launch this March and April in the vicinity of the Sierra Nevada Range in California. Professor Ronald B. Smith in the Geology and Geophysics Department at Yale will accompany a team to the project led by Vanda Grubisic of the Desert Research Institute in Reno, Nevada. Grubisic previously received her PhD from Yale in 1995.

The first goal of the project is to measure properties of these whirlwinds, or rotors, that form in the lee of major mountain ranges. The Owens Valley, just east of the Sierras, is one of the most common places on earth for such phenomena. These rotors have been responsible for many aircraft accidents over the years.

The second goal of T-Rex is to monitor the "gravity waves" generated by the mountains and the rotors as they spread upwards into the stratosphere. An atmospheric "gravity wave" bears some resemblance to an ocean wave or tsunami, except that it moves vertically away from its generating source.

The T-Rex project installed a dense array of weather stations, balloon launching sites and laser Doppler sensors to map the three-dimensional structure of the rotors. In addition, two instrumented research aircraft -- from the University of Wyoming and the Meteorological Office in the UK -- will be surveying the skies, hoping to get close, but not too close, to the rotors.

As a gravity wave enters the stratosphere five to 30 miles above the Earth it amplifies, steepens and then breaks down into turbulence -- like an ocean wave crashing on a beach. According to current theory, this wave breakdown can transport pollutants into the upper air and add momentum that promotes the slow north-to-south overturning of the stratosphere. Study of this process requires a research aircraft with unusual range and altitude capability.

"Commercial jets flying at 35,000 feet are generally below the level of major turbulence -- like riding the crest of a wave," said Smith. "At higher altitudes, where gravity waves break up, the air turbulence is like a wave crashing on the beach."

T-Rex will be the first atmospheric science project to utilize a

remarkable addition to the nation's fleet of research aircraft -- a Gulfstream V. Recently purchased by the National Science Foundation for $80 million and managed by the National Center for Atmospheric Research, it is well suited to the T-Rex objectives. It can reach altitudes of 50,000 feet and stay aloft for more than 12 hours. Equipped with state-of the-art instruments measuring winds, turbulence, temperature, humidity, pressure, ozone, aerosol and carbon monoxide, it will carry out 12 stratosphere-probing flights during T-Rex.

Source: Yale University