Studying atmospheric gravity waves and infrasonic sources
using the USArray Transportable Array

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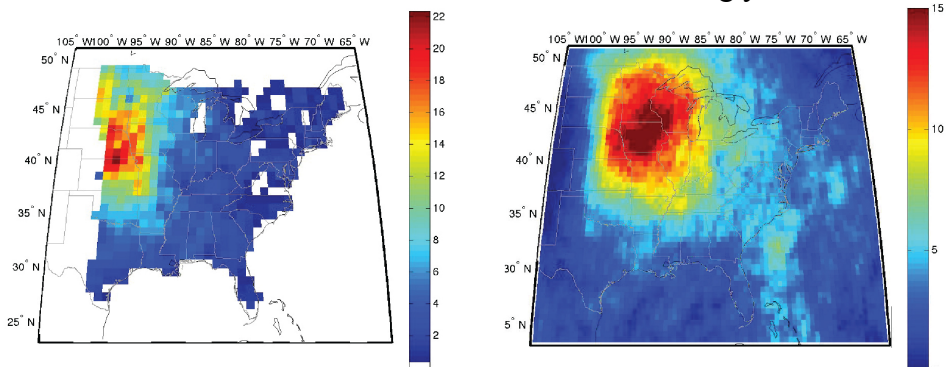
In 2011, the eastward-migrating USArray Transportable Array reached an area just west of the Great Lakes. This is one of the most active source regions of atmospheric convective gravity waves on Earth. Gravity waves in this region are observed most frequently at night during the thunderstorm season, from May through August. Although the TA was designed for studies of the Earth's interior, each of its stations had just been instrumented with a suite of atmospheric pressure sensors. This new barometric and infrasonic equipment is sensitive to the entire spectrum of variations in air pressure from DC to 20 Hz. Given the design of the TA – with a station on a 70 km spaced Cartesian grid that spans almost 2,000,000 km^2 - this network provides unparalleled coverage of atmospheric dynamics at ground level. Although convective gravity waves are a key mechanism by which the atmosphere distributes energy and momentum, their nature is still not fully understood. There is a pressing need for more observational data, which the TA now provides.

This talk will give an overview of the TA upgrade, our collaborative study of gravity waves using the TA and satellite data. A new processing method that recasts the TA as a massive collection of 3-element arrays has been developed to study TA data at long-periods. An extended version of the method that employs incoherent processing to detect and locate higher frequency sources has been used to generate a national catalog of infrasonic activity. Other than satisfying a basic curiosity of what parts of the country are most active acoustically at frequencies from 0.5 to 8 Hz, this catalog provides a large number of events that we can use to probe atmospheric structure – in particular heterogeneity due to gravity waves.

In the recent past our research has been presented to the general public via televised lectures and seminars. This outreach will continue in the coming year.



Here we show the occurrence rate of gravity waves at ground-level using barometric data collected by stations in the TA (left) and also the occurrence rate of gravity waves detected at stratospheric altitudes by the AIRS (Atmospheric Infrared Sounder) instrument aboard the Aqua satellite from 2010-2014 (Lars Hoffmann - Juelich Supercomputing Centre). The two images show general agreement between TA and satellite observations.