

Infrasonic Detection of Atmospheric Turbulence

Qamar A. Shams, Allan J. Zuckerwar^{*}, and George R. Weistroffer^{*}
NASA Langley Research Center, Mail Stop 238, Hampton, VA 23681 USA
Qamar.A.Shams@nasa.gov

Acoustical studies of atmospheric events like convective storms, shear-induced turbulence, acoustic gravity waves, microbursts, hurricanes, and clear air turbulence (CAT) over the past thirty years have established that these events are strong emitters of infrasound. Several mechanisms for the production of infrasound have been proposed, for example by the acceleration of vorticity or by space-time correlations of the turbulent Reynolds stresses (Lighthill theory).

Electromagnetic (EM) sensors suffer two severe disadvantages in the detection of clear air turbulence and severe storms. The first is the inability to receive returns in clear air, where reflective targets (precipitation, particulate matter) are absent. The second disadvantage is that EM systems, being active, require scanning to locate an event, as opposed to a passive infrasonic array, which receives infrasonic radiation independently of event location. Further, EM systems, even weather radar ("NEXRAD"), do not have the extensive range (hundreds of miles) characteristic of infrasound.

The leading laboratory for studies on atmospheric infrasound over the past thirty years has been the Environmental Technology Laboratory of the National Oceanic and Atmospheric Administration. This laboratory conducted measurements of infrasound from many sources, among which clear air turbulence was but a small part of the overall program. The summary of the results of this program suggests for development of a practical detection system. In other words, despite the progress made in this area, there does not exist today a National network of stations to monitor infrasound from turbulence. Under Innovative Partnership Program, Researchers at NASA Langley Research Center have been working to achieve that goal. As a first step, NASA Langley has designed and developed a portable infrasonic detection system which can be used to make useful infrasound measurements at a location where it was not possible previously. The design and results of the compact system, based upon laboratory and field experiments, will be presented.

^{*}Analytical Services & Materials, Hampton, VA 23666 USA