change in direction-of-arrival and trace velocity due to the unique frequency response of an array using a least-squares technique. We present detailed results for IMS arrays IS26, IS53, IS56, and IS57, which provides a good sampling of different sensors and wind-noise reduction systems in the IMS. For IS53 (Fairbanks, AK), the deviation in the azimuth estimation is bounded below 2 degrees at all frequencies of interest (>0.02 Hz). Preliminary results suggest array parameter estimation at other arrays can be significantly affected by changes in frequency response.

9:20

5aPAa5. Infrasound signal coherence across arrays: Observations from the international monitoring system. David Green (AWE Blacknest, Brimpton Common, Reading RG7 4RS, United Kingdom, dgreen@blacknest.gov.uk)

Arrays of microbarometers are designed to exploit the coherence of infrasound signals between sensors in order to detect and characterize the impinging wavefield. However, signal coherence decreases with increasing distance between measurement locations due to effects that include, but are not limited to, signal multi-pathing, dispersion, and wavefront distortion. Therefore, the design of an array is a balance between ensuring the sensor separations are small enough to guarantee acceptable signal coherence, yet large enough to provide the required resolution when estimating signal azimuth and velocity. Here, we report coherence measurements from more than 30 events that have been recorded on the International Monitoring System microbarometer arrays that are being constructed as one of the verification measures for the Comprehensive Nuclear-Test-Ban Treaty. The results confirm those of Mack and Flinn (1971) that signal coherence is greater in directions parallel, and is less in directions perpendicular, to the direction of propagation. In contrast to earlier studies, we report larger inter-event variation in coherence structure and provide an assessment of how these findings may influence future microbarometer array design.

9:40

5aPAa6. Interferometry applied to the large aperture infrasound array in the Netherlands. Julius Fricke, Läslo Evers (KNMI, PO Box 201, De Bilt 3730 AE, Netherlands, evers@knmi.nl), Kees Wapenaar (Dept. of GeoSci. and Eng., TU Delft, Delft, Netherlands), and Dick Simons (Acoust. Remote Sensing Group, TU Delft, Delft, Netherlands)

It has been theoretically shown by Wapenaar (2006) that the non-reciprocal Green's function can be retrieved with cross-correlation. Thus, interferometric techniques can be applied to a moving medium such as the atmosphere. Numerical experiments have shown that the delay times of stratospherically refracted infrasound can be obtained from cross-correlation between pairs of microbarometers. Doing so, information about the wind and temperature around the stratopause can be passively gathered from the stationary phase with, for example, the continuous noise of microbaroms. Actual measurements have been used from the Large Aperture Infrasound Array (LAIA) in the Netherlands. LAIA consists of several microbarometers with inter-station distances ranging from a few kilometers to tens of kilometers and is ideally suited to assess the results from theoretical and numerical experiments in practice. Results will be shown on the correlation length of infrasound from microbaroms and the effect of wind and temperature on the delay times retrieved from cross-correlations.

10:00–10:15 Break

Contributed Papers

10:15

5aPAa7. Beamforming methods in infrasonic array processing—Continuous signals. Philp Blom, Roger Waxler, and William Garth Frazier (National Ctr. for Physical Acoust., Univ. of Mississippi, 1 Coliseum Dr., University, MS 38677, psblom@olemiss.edu)

It is often the case in analyzing infrasonic data that coherent "noise" due to natural and anthropomorphic sources obscures the phenomena of interest. Beamforming methods have been studied as a means of identifying continuous infrasonic signals and spatially removing them from a data record. An historical overview of frequency based array processing methods with be presented along with discussion of eigen-decomposition representations of various spatial spectral formulae. An application using spatial filtering to identify and extract microbaroms from an infrasonic data record will be demonstrated and discussed. Additionally, the framework for a robust, data-adaptive array processing method and the challenges associated with its implementation will be presented.

10:30

5aPAa8. Processing international monitoring system infrasound data to detect and locate global events using probabilistic algorithms. Stephen Arrowsmith, Omar Marcillo, George Randall (Los Alamos National Lab., 1711 Second St., Santa Fe, NM 87505, sarrowsmith@gmail.com)

Automating the detection and location of events using the International Monitoring (IMS) System infrasound network is a significant challenge. Any algorithm must reliably detect nuclear tests in the atmosphere with a minimum number of false alarms. Here, we report on the application of probabilistic techniques for detection, association, and location of infrasound events to data from the IMS network. We compare our results with the SEL3 automatic event detections obtained by the CTBTO.

10:45

5aPAa9. Consistent Wentzel-Kramers-Brillouin (WKB) approximation for acoustic-gravity waves in the atmosphere. Oleg A. Godin (CIRES, Univ. of Colorado and NOAA Earth System Res. Lab., Physical Sci. Div., Mail Code R/PSD99, 325 Broadway, Boulder, CO 80305-3328, oleg.godin@noaa.gov)

The ray and WKB approximations have long been important tools of understanding and modeling propagation of atmospheric waves. However, contradictory claims regarding applicability and uniqueness of the WKB approximation persist in the literature. Here, linear acoustic-gravity waves (AGWs) in a layered atmosphere with horizontal winds are considered, and a self-consistent version of the WKB approximation is systematically derived from first principles and compared to ad hoc approximations proposed earlier. Parameters of the problem that need to be small to ensure validity of the WKB approximation are identified. Properties of low-order WKB approximations are discussed in some detail. Contrary to familiar cases of acoustic waves and internal gravity waves in the Boussinesq approximation, the WKB solution contains the geometric, or Berry, phase. Put differently, knowledge of the AGW dispersion relation is not sufficient for calculation of the wave phase. Significance of the Berry phase is illustrated by its effect on resonant frequencies of the atmosphere for vertically propagating waves.