LAIA - A LARGE APERTURE INFRASOUND ARRAY FOR INTERFEROMETRIC STUDIES

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The traveltime of infrasound through the atmosphere depends on the temperature and the wind. We could estimate these atmospheric conditions by using a manmade infrasound source and measuring arrival times at different microbarometers. Alternatively, we could use ambient noise. Ambient noise is caused by waves of the oceans, i.e, microbaroms, and has the advantage that it almost continuously present. The traveltime between two microbarometers could be obtained by crosscorrelating the ambient noise detected at these two microbarometers. This technique was already successfully applied in the troposphere (Haney, 2009). We show that the same can be achieved with more complicated stratospheric phases.

First we test the technique using synthetic data. To estimate the temperature and the wind of the atmosphere, with the traveltime, we implement a model of the infrasound propagation. With this model, we calculate synthetic barograms for arbitrary distributions of microbarometers and sources. The synthetic barograms take into account the traveltime along the eigenray, the attenuation of the different atmospheric layers, the spreading of the rays and the influence of caustics. By calculating the crosscorrelation of the barograms, we show that it is possible to determine the traveltime this way.

Now we are in the process to apply the crosscorrelation to measured data of the 'Large Aperture Infrasound Array' (LAIA). LAIA is being installed by the Royal Netherlands Meteorological Institute (KNMI) in the framework of the radio-astronomical 'Low Frequency Array' (LOFAR) initiative. LAIA will consist of thirty microbarometers with an aperture of around 100 km. The in-house developed microbarometers are able to measure infrasound up to a period of 1000 seconds, which is in the acoustic-gravity wave regime. The results will also be directly applicable to the verification of the 'Comprehensive Nuclear-Test-Ban Treaty' (CTBT), where uncertainties in the atmospheric propagation of infrasound play a dominant role.

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Haney, M., 2009. Infrasonic ambient noise interferometry from correlations of microbaroms, Geophysical Research Letters, 36, L19808, doi:10.1029/2009GL040179