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Results of Infrasound Interferometry in Netherlands

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The travel time of infrasound through the atmosphere depends on the temperature and the wind. These atmospheric conditions could be estimated by measuring the travel times between different receivers (microbarometers). For such an estimation an inverse model of the propagation of infrasound through the atmosphere is essential.

In the first step it is useful to build a forward model. The inputs of our raytracing model are the atmospheric conditions and the positions of source and receiver. The model consists of three elements the source, the channel and the receiver. The source is a blast wave or microbaroms. The channel is the atmosphere and it takes into account the travel time along the eigen ray, the attenuation of the different atmospheric layers, the spreading of the rays and the influence of caustics. Each receiver is reached by different rays (eigen rays). To determine the eigen rays is part of the receiver element. As output the model generates synthetic barograms.

The synthetic barograms can be used to explain measured barograms. Furthermore the synthetic barograms can also be used to evaluate the determination of the travel time. The accurate travel time is for the inverse model as input essential. Since small changes of the travel time lead to big changes of the output (temperature and wind). The travel time between two receivers is determined by crosscorrelating the barograms of these two receivers. This technique was already successfully applied in the troposphere (Haney, 2009). We show that the same can be achieved with more complicated stratospheric phases.

Now we compare the crosscorrelation of synthetic barograms with the crosscorrelation of measured barograms. These barograms are measured with 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