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Comparing infrasound measurements of a ground truth source at regional distances with modeling results

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The infrasound stations of the International Monitoring System (IMS) have a relatively coarse geographical coverage. Even when taking national infrasound stations which are not part of the IMS into account, the inter-station spacing is still in the range of several hundreds of kilometers. For tasks involving the recovery of dynamic properties of the source and hence the understanding of the atmospheric propagation conditions of the infrasonic waves, it is important to validate the methods applied in infrasound modeling, in particular for shorter distances. The shadow zone that exists for paths between the tropospheric and stratospheric ducts thereby poses the most significant difficulty.

A field study has been performed utilizing six single infrasound sensors along the great circle path between a known source (DLR engine test facility, Lampoldshausen) and a nearby receiver (BGR infrasound array I26, Bavarian Forest) covering a distance of about 320km in total. The recordings gathered give new possibilities in studying the evolution of the infrasonic wave-field to regional distances and, in particular, through the shadow zone by comparing measured signals with modeling results. In this study we thus aim at testing and improving our infrasound modeling, especially the prediction of shadow zones in ray-tracing.

For numerical modeling the ray-tracer HARPA/DLR is used. Compared to its original version HARPA/DLR was improved by the integration of adequate atmospheric temperature and wind fields (ECMWF weather forecast data for altitudes up to 80km, statistical values given by the MSISE00 (temperature) and HWM07 (horizontal wind) climatologies for greater heights).

The modeling shows shadow zones which extend from about 20-40km to some 130-170km for the months from December 2011 to March 2012, in good agreement with the observations. However, the modeling effort for April and May 2012 shows a much broader shadow zone, which is less conforming to the observations. Our focus will therefore be directed towards including other factors of atmospheric dynamics, such as gravity waves, which influence the propagation of infrasound, and whether they would allow us to resolve any of the discrepancies observed.