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Towards an enhanced picture of the detection capability of the IMS infrasound network

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A global scale analysis based on available detection lists for all operating IMS infrasound stations confirms that the primary factor controlling signal detectability is the seasonal variability of the stratospheric wind circulation. At most arrays, $\sim$80% of the detections in the 0.2 to 2 Hz bandpass are associated with downwind propagations. The seasonal transition in the bearings and number of detections between easterly and westerly directions is presented.

The detection capability of the IMS network is assessed using near-real time atmospheric updates (G2S-ECMWF) and realistic background noise levels. Compared with previous studies based statistical wind noise analyses, a significant enhancement of the predictions is achieved using Power Spectral Density (PSD) calculations at various times of day for each month. This information is useful in determining global network detection capability and quantifies its spatial and temporal variability (hourly, daily, seasonal and yearly).

Additional physical insights into detailed propagation information are also needed. The detectable energy highly depends upon the empirical correction for stratospheric wind speed. Although this empirical correction reduces the variance in the yield versus pressure relationship, strong variability remains. More realistic amplitude yield relations can be achieved using operational propagation tools, such as wide angle parabolic equation methods, as they provide detailed propagation information with reasonable computation time. Such methods have been intensively used in order to generate more realistic scaling relations.

Comprehensive ground-truth databases provide a statistical approach for evaluating the potential of infrasound monitoring. In order to evaluate this approach, accidental and calibration explosions are analysed and used here as benchmark for validating the calculated threshold maps. Such studies would help to optimize the siting and maintenance of infrasound arrays with respect to both the number and configuration in order to monitor infrasonic sources of interest. They are an important step to enable a successful monitoring regime for atmospheric or surface events to act as an effective verification tool in any future.