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Mesopause temperature perturbations caused by infrasonic waves as a potential indicator for the detection of tsunamis and other geo-hazards

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Abstract. Many geo-hazards such as earthquakes, tsunamis, volcano eruptions, severe weather, etc., produce acoustic waves with sub-frequency, so called infrasound. This sound propagates from the source in the middle and upper atmosphere causing pressure and temperature perturbations. Temperature fluctuations connected with the above mentioned events usually are very weak at the surface, but the amplitude increases with height because of the exponential decrease of atmospheric pressure with increasing altitude. At the mesopause region (80–100 km height) signal amplitudes are about two to three orders of magnitude larger than on the ground.

The GRIPS (GRound-based Infrared P-branch Spectrometer) measurement system operated by the German Remote Sensing Data Center of the German Aerospace Center (DLR-DFD) derives temperatures of the mesopause region by observing hydroxyl (OH) airglow emissions in the near infrared atmospheric emission spectrum originating from a transmitter at approximately 87 km height.

The GRIPS instrument is in principle suited for the detection of infrasonic signals generated by e.g. tsunamis and other geo-hazards. This is the fact that the infrasound caused by such events should induce observable short-period fluctuations in the OH airglow temperature. Results obtained during a field campaign performed at the Environmental Research Station "Schneefernerhaus", Zugspitze (47.4° N, 11.0° E) from October to December 2008 are presented regarding potential sources of meteorological and orographical origin.

An adequate distinction of the overlapping infrasonic signatures caused by different infrasound sources in the OH temperature record is needed for the ascription to the proper source. The approach presented here forms a contribution to a hazard monitoring and early warning system.

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