INFRASONIC INDUCED MESOPAUSE TEMPERATURE PERTURBATIONS: AS AN EARLY INDICATOR FOR THE DETECTION OF TSUNAMIS AND OTHER GEO-HAZARDS

MICHAEL BITTNER, Kathrin Höppner, Christoph Pilger, Carsten Schmidt, Julian Meyer-Arnek

German Aerospace Center (DLR-DFD), Oberpfaffenhofen, Germany, michael.bittner@dlr.de, kathrin.hoeppner@dlr.de, christop.pilger@dlr.de, carsten.schmidt@dlr.de, julian.meyer-arnek@dlr.de

Many geo-hazards such as earthquakes, tsunamis, volcanic eruptions, severe weather etc. cause infrasonic waves which can travel over large distances (several thousand kilometers) in the atmosphere. These longitudinal pressure waves contribute to the coupling of the various atmospheric altitude layers and directly lead to temperature perturbations.
Temperature fluctuations connected with the abovementioned 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 (~87 km height) signal intensities should be about four to five orders of magnitude larger than on the ground. The modeling structure of infrasound propagation as well as of acoustic heating is presented.
Subject of the present study is to show the potential of the GRIPS (Ground-based Infrared P-branch Spectrometer) measurement system which is currently used at DLR-DFD to monitor climate signals in the mesopause region, to better understand the impact of atmospheric dynamics on larger-scale circulation, to validate satellite-based measurements and to evaluate climate and atmospheric models. GRIPS utilises the airglow phenomenon. Mesopause temperatures (at ~87 km height) are currently and routinely derived night by night from observations of hydroxyl (OH*) emissions in the near infrared using two ground-based infrared spectrometers (GRIPS 3 and GRIPS 5). The main idea of the presentation is to demonstrate the feasibility of using the modulation of OH*-temperatures caused by infrasonic waves travelling through the airglow layer, which are generated by geo-hazards such as tsunamis and to quantify acoustic heating rates. The system is expected to add value to multi-hazard early warning systems.

OH*-temperature, infrasound, mesopause, hazards

Michael Bittner, DLR, Münchner Straße 20, 82234 Wessling, Germany, phone: +49 8153 28-1379, fax: +49 8153 28-1363, email: michael.bittner@dlr.de