LARGE-SCALE DENSITY STRUCTURE IN THE EARTH'S MANTLE AND CORE: ITS SIGNATURE IN SG DATA

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The seismic free oscillations of the Earth can be observed in the frequency band from 0.3 to 20 mHz and estimates of their frequencies constitute the principal constraints for spherically symmetric Earth models such as the preliminary reference Earth model (PREM) by DziewonskiAnderson:81. While the bulk of the mode observations rely on recordings of the spring gravimeters deployed in the IDA network and more recently on STS-1 seismometers deployed in the Global Seismic Network (GSN), we show here that the most recent generation of Superconducting Gravimeters (SGs) can achieve lower noise levels than either one of the above sensors at frequencies lower than $\sim$0.8 mHz.

While the splitting of modes above 1 mHz is largely due to structural heterogeneities in P- and S-wave velocities, the modes below 1 mHz are unique for two reasons: firstly, the destabilizing effect of self-gravitation leads to a high sensitivity to density heterogeneities and secondly, the vicinity of these modes to the frequency of the Earth's rotation leads to pronounced Zeeman splitting which in turn depends on spherically averaged density structure. Thus it is argued that SG meters can make a significant contribution to the illumination of long wavelength density heterogeneities in the Earth's mantle.

At frequencies above 1 mHz current SG meters exhibit higher noise levels than the quietest seismometers deployed in the GSN. Furthermore we show that above 3 mHz even the Streckeisen STS-2 seismometer compare favorably against the SG meters if the former are installed with elaborate shielding from environmental effects.