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Preliminary analysis of the connection between ocean dynamics and the noise of gravity tide observed at the Sopronbánfalva Geodynamical Observatory, Hungary

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An experimental development of a PC controlled CCD ocular system applied for the LaCoste and Romberg G949 gravimeter of the Geodetic and Geophysical Research Institute of the Hung. Acad. Sci. made the continuous observation of time variation of gravity possible. The system was operated for half a year in the Sopronbánfalva Geodynamical Observatory to test its capabilities. The primary aim of this development was to provide an alternative and self-manageable solution for the standard/factory CPI reading of this type of gravimeter and use it for the monitoring of earth tide phenomenon. It, however, turned out that this system is sensitive enough to observe the effect of variable seismic noise (microseisms) due to the changes of ocean weather in the North Atlantic and North Sea regions at microGal level (1 μGal=10^{-8} m/s^2). Up to now much attention was not paid to its influence on the quality and accuracy of gravity observations because of the large distance ($>$ 1000 km) between the observation place (generally the Carpathian-Pannonian basin) and the source locations (centers of storm zones of the northern hydrosphere). Based on an elementary single wave surface deformation model the noise levels of gravity observations were compared to the spectral characteristics of seismic time series recorded at the same time in the Observatory. Although the sampling rate of gravity records was 120 s the daily variation of gravity noise level could be correlated to the variation of spectral amplitude distribution of the analyzed high pass filtered (cut-off frequency = 0.005 Hz) seismograms in the frequency band between 0.005 Hz and 10 Hz. Also available daily maps of ocean weather parameters were used to support both the correlation analysis and the parametrization of the source of microseisms for further statistical investigations. These maps which were processed by standard image processing algorithms provide numerical data about geometrical (distance and azimuth of the source relative to the observation point) and physical (mass of swelling water) quantities. The information can be applied for characterizing the state of ocean weather at a given day which may help the prediction of its influence in the future. Probably it is the first attempt to analyse quantitatively the effect of ocean weather on gravity observations in this specific area of the Carpathian-Pannonian region.