ESC2016-474, 2016
35th General Assembly of the European Seismological Commission

35th General Assembly of the European Seismological Commission
4–10 September 2016 Trieste

A comparison of different filtering procedures of superconducting gravimetry data for time-series analysis of the IGETS sensing network

Arthur Valencio, Celso Grebogi, and Murilo Baptista

Institute for Complex Systems and Mathematical Biology, SUPA, University of Aberdeen, Aberdeen, United Kingdom (a.valencio@abdn.ac.uk)

The original time-series data from superconducting gravity stations presents large gravity fluctuations, mainly related to solid-Earth tides, ocean-tidal loading and atmospheric pressure. These in general need to be filtered in order to analyse the small contributions in the time-series related to events of geophysical interest such as the groundwater fluctuations, co-seismic gravity changes, different types of low-frequency seismic events, or some statistical properties of the time-series. In this study, we consider three techniques for filtering such large gravity fluctuations: frequency filtering, physical modelling, and data-based modelling. For the frequency filtering, we compare two approaches, one based on Fourier analysis and another based on rejection of selected frequency bands. For the physical modelling, the large gravity fluctuation is simulated taken into consideration each related physical phenomena using procedures detailed in Refs. [1-5] and, this generated data is used to filter the original data. Different models for each physical phenomenon are also considered. Where model differences are relevant, these are described. For the data-based modelling, the local tidal profile of the large fluctuations is extracted from aseismic data periods [5] and this profile is used for the filtering. Time-series gravity data samples of 1-10-second and 1-minute rate were obtained from the GFZ-Potsdam Information Systems and Data Center as part of the International Geodynamics and Tide Service (IGETS) [6]. Results among the three filtering techniques are compared and the filtered data-series is applied for time-correlation analysis in aseismic and seismic intervals, aimed at the construction of a complex network representation of gravity correlation measurements from the IGETS sensing network.

[1] V. Dehant, P. Defraigne, J.M. Wahr. Tides for a convective Earth. Journal of Geophysical Research, 104(B1), pp. 1035–1058, 1999.
[2] F. Lyard, F. Lefevre, T. Letellier, O. Francis. Modelling the global ocean tides: modern insights from FES2004. Ocean Dynamics, 56(5), pp. 394-415, 2006.
[3] J. Hinderer, D. Crossley, R. J. Warburton. Superconducting gravity meters, in Treatise on Geophysics, G. Schubert (Ed.) (Elsevier, Oxford, 2007).
[4] B. Ducarme. Comparison of some tidal prediction programs and accuracy assessment of tidal gravity prediction. Bull. Inf. Marées Terrestres, 141, pp. 11175–11184, 2006.
[5] H.-G. Wenzel. The nanogal software: Earth tide data processing package ETERNA 3.30. Bulletin d'Information des Marées Terrestres, 124, pp. 9425–9439, 1996.
[6] http://igets.u-strasbg.fr/