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Effective localized mass distribution after pattern-recognition technique: extracting more informations from GRACE data

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GRACE mission has been providing snapshots of the time variable gravity field of the Earth for about seven years, with constantly improving data quality.
Nonetheless, two main issues still make the use of GRACE data difficult, in Solid Earth field. The first is that the measured gravitational field variations are integrated in depth, so atmospheric, surface and solid Earth phenomena are superimposed.
The second is the lack in localization due to the limited (though high) spatial resolution, enhanced by the truncated spherical harmonic representation of the field, and by the post-processing filtering required by most application.
We describe here the solution we designed to address both these problems. It consists in an integrated approach that combines a reasoned "pattern recognition" technique with the solution of an inverse problem in order to obtain a representation of the gravitational field in terms of an effective localized-masses distribution.
The pattern recognition allows one to recover the information concerning localization, and the field reconstruction enables to recover the information concerning intensity.
The reconstructed field can then be used to better analise local and global scale phenomena on the basis of their purely gravitational signature. Additional careful analysis allows to isolate solid Earth from surface phenomena in many regions, as well as to address the time evolution of the gravitational phenomena in selected areas.
The technique can be easily extended to deal with any set of data lacking in localization.
It has been successfully applied to GRACE R04 data to clear the PGR signal from disturbing present day phenomena in the northern hemisphere, and partially in Antarctica.
It will be further refined to be used in the analysis of the data that will come from the GOCE mission.
We present here a detailed description of the technique, with some selected applications.