Dissatisfaction of Compact Picard Condition (CPC) with GRACE satellite data and its treatment by Generalized Tikhonov in Sobolev subspace

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This paper is mainly aiming to prove that the stripy noises in the map of earth's surface mass-density changes derived from GRACE Satellites gravimetry, is due to a dissatisfaction of Compact Picard Condition (CPC) with the GRACE data in the inversion of the Newton Integral Equation over the thin layer of earth; and hence the paper proposes the regularization strategies as efficient tools to treat the Ill-posedness and consequently to de-strip the data.

First of all, we preferred to slightly modify the mathematical model of earth's surface mass-density changes developed creatively first by J. Wahr and et.al (1998), according to the all their previous assumptions plus taking into consideration the effect of the earth topography. By the modification we expect that some uncertainties in the prior model have been reduced to some extent. Then we analyzed the CPC on the model and we demonstrated how to perform Generalized Tikhonov regularization in Sobolev subspace for overcoming the instability of the problem. Then we applied the strategy in some simulations and case studies to validate our ideas. The simulations confirm that the stripy noises in the GRACE-derived map of the mass-density changes are due to the CPC dissatisfaction and furthermore the case studies show that Generalized Tikhonov regularization in Sobolev subspace is an influential filtering tool to de-strip the noisy data. Also, the case studies interestingly show that the effect of the topography is comparable to the effect of the load Love numbers on the Wahr's model; hence it may be taken into consideration when the load Love numbers have been taken into account.