



Degradation of geopotential recovery of GRACE monthly solutions due to orbit resonances

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Besides the GRACE solution for mean (static) Earth gravity field, there are published monthly solutions to access its variability (Bettadpur, Tapley, Flechtner, etc). They all go (in general) to degree and order $(L,m)=120 \times 120$. The accuracy of these solutions degraded, however, from 2003 to summer 2004. It was already discussed in (Wagner et al, 2006, J. Geod, in print) that the degradation is related to the strong low order orbit resonance $R/D = 61/4$ of GRACE A/B which occurred in September 2004 ($R=61$ satellite's nodal revolutions per $D=4$ synodic days). Similar situation may be encountered by free (not-maneuvred) orbit of GRACE in future. First we present and comment on a diagram of all stronger resonances of GRACE since its launch. There was the $76/5$ resonance (Sept. 2002), then the $61/4$ (Sept. 2004), the $107/7$ can be expected in summer 2006, the $46/3$ might be a problem in 2007/2008. We make use of recent models of the atmospheric density to estimate min/max drag and the orbit decrease of GRACE. The result is a warning before a further degradation of the monthly solutions in specific time intervals. We summarize derivation from Wagner et al (2006) about the requirements for the ideal (not degraded) solution of the monthlies. It holds that $R > 2L$ (where L is maximum degree of the solution) is necessary for a well conditioned recovery. For GRACE far from any strong low order resonance, we can take $R > 240$ and we get $L=120$, but at the $61/4$, $L=30$. The density of the ground tracks of GRACE is investigated as a function of time since the launch. The results are surprising: we found that the density depends not only on a "distance" from a R/D resonance, but also (strongly) on geographic latitude and longitude. This poses additional problem to objective global solutions of the variable gravity field. We discuss a number of

strategies for monthly recoveries in future to get maximum information from the data with homogenous accuracy of the products.