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What have we learnt about seismic cycle with Grace ?

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Although signatures of large earthquakes in Grace data were expected, satellite gravity were mostly only used to study the very large 2004 and 2005 Sumatra earthquakes. Indeed we showed that with the current accuracy of Grace data, little could be expected for events with magnitude smaller than 8.5 even if in favorable cases magnitude 8.0 events could be detected. In the case of the Sumatra events, Grace provided unique information that complement ground based geodetic data as seismological ones. In order to extract significant information we developed several approaches. We first implemented direct modeling of the gravitational effect of the displacement in a spherical earth. We also developed specific methods for identifying signals. The first is a wavelet based approach that allowed extracting both the co- and post-seismic signals. We also applied EOF analysis. The December 2004 Sumatra-Andaman event is associated with a large co-seismic signal in the Andaman sea and very fast post seismic relaxation that is well monitored by Grace. Comparison of Grace data with the sparse GPS available information allowed us to refine a relaxation model and to discuss the amount of afterslips. We discuss here all these results and focus on what they tell us about the seismic cycle but also on the mantle viscosity in the considered area.