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Simulation of realistic instrument noise for GRACE follow-on.

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Computer simulations have been an indispensable tool in assessing and predicting the performance of gravity recovery satellite missions, both present and future. Future satellite missions like GRACE follow-on will measure Earth's gravity with a much higher precision than their predecessors. This increased precision makes it necessary to reevaluate the applicability of current simulation strategies to future gravity missions.

In past simulation efforts, effects that are known to be relevant factors for mission performance are often approximated or modeled incompletely. One such effect is the noise applied to simulated observables like precise orbits or K-Band ranges. These noisy observables are generated by adding simple white noise of a specific power to noise-free raw measurements. The noisy observables are then used in closed-loop simulations to quantify the performance of specific instruments, or a mission scenario as a whole.

This work presents strategies to generate more realistic noise for satellite missions as implemented in the GROOPS (Gravity Recovery Object Orientated Programming System) software package. A generic interface for different noise generators is implemented in GROOPS. This interface is used to add different types of noise, such as white noise, colored or correlated noise, or noise with a given power spectral density to generated observables. It is thus possible to study the effect of the chosen noise model on the generated observable, and conversely the recovered gravity field as a whole.

A better knowledge of the noise characteristics of the instruments on GRACE and GRACE follow-on will allow us to improve our understanding of their complex interactions. It will also allow us to improve our processing strategies for both simulated and real data, and will thus lead to a more precise and better understood recovered gravity field.