

Leibniz

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**Parameter** 

Arc length

**Output address:** 

Numerical integration approach

# Introducing GRACE Follow-On mock data challenge project



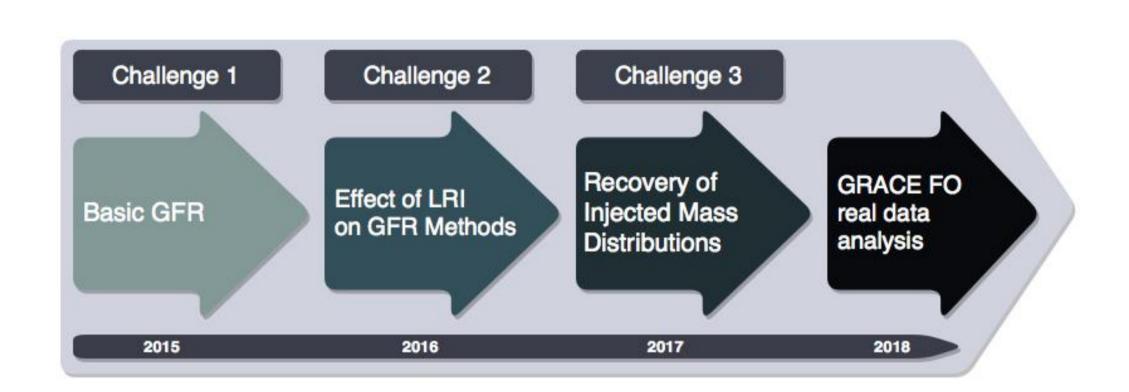
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### **Abstract**

The GRACE Follow-On satellites will be launched in 2018 equipped with a Laser Ranging Instrument (LRI) that will improve the spatial and temporal resolution of Earth's gravity field measurements. Analyzing the complex data set from this mission is a significant challenge that will require a new generation of data analysis algorithms and capabilities. Here we introduce the GRACE Follow-On mock data challenge (MDC) which will release a number of simulated data sets to help research centers around the world develop and test their new tools. The data challenges range from simple gravity field recovery (GFR) to more advanced forms involving the LRI noise models.



# **Orbit Integrator**

The twin GRACE Follow-On satellites fly a GRACE like polar orbit. In order to simulate the orbit, we used our numerical orbit integrator with the following set up:

Description

Gauss-Jackson

Go!

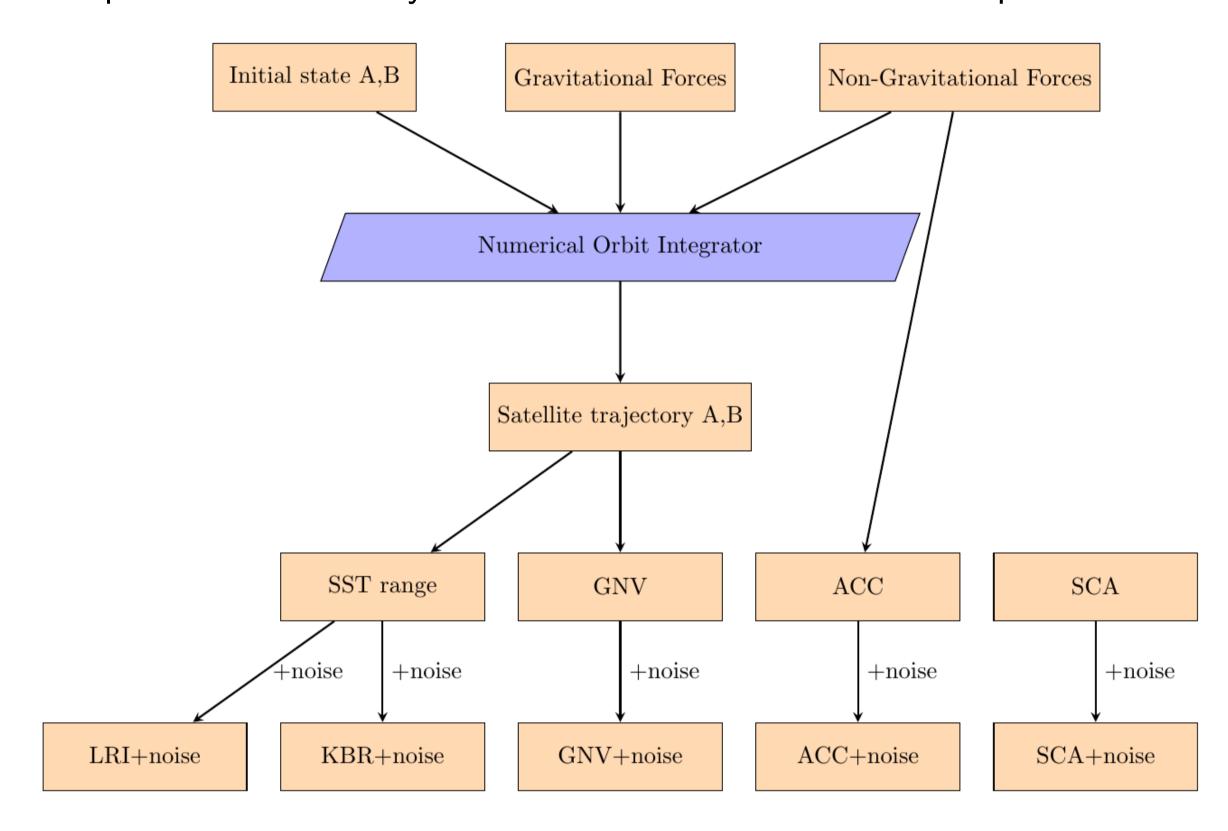
30 days

	Sampling inte	rval		5 seconds
		Orbit	propagator v	ersion 1.0
Step 1: Set up initial conditions  Give the state vector in inertial frame: Position and Velocity				Step 2: Select rotation type  • IERS conventions (2010)
X=	4860408.0325	Vx=	-4942.2590	Z-only Rotation
Y=	1502000.0082	Vy=	-1341.1127	Step 3: Select the disturbing forces  Direct tides (Sun and Moon)
Z= -4613863.2669			Solid Earth tides  Ocean tides	
Step size in seconds				Solid Earth pole tides
Orbit length in hours				Ocean pole tides  Atmospheric tides
Select a gravity model Select EGM				Air drag
Maximum degree				AOD1B (Aliasing)
Select the integration Select Integrator wethod				Solar radiation pressure  Relativistic effects

Browse

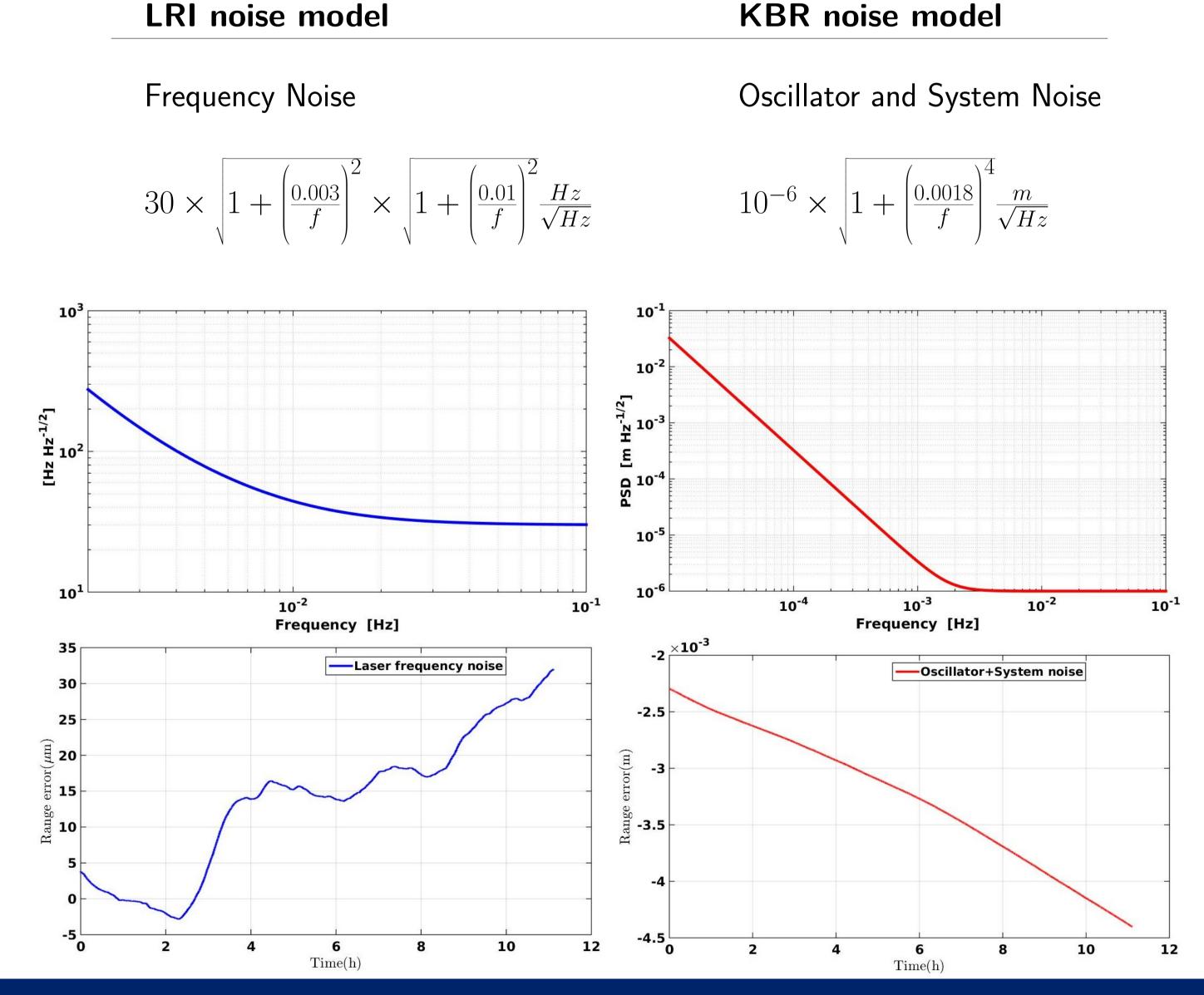
# **Simulation procedure**

The primary step of the MDC is generating GRACE Follow-On type data. The simulation procedure started with generating simulated orbit using an orbit integrator with the truth dynamic models (gravitational and non-gravitational forces). Noise free GPS position and velocity and KBR measurements are the output of the orbit integrator.



#### Generation of the instrument noise

GRACE Follow-On design and instruments will be very similar to GRACE. Accordingly we used the same noise models proposed by Kim (2000) for GRACE instruments. For new LRI addition, we used noise models suggested by (Heinzel et al. 2012). With a given power spectral density (PSD) of the noise, a time series of the noise was generated with LISA Technology Package Data Analysis (LTPDA) MATLAB toolbox. Here is a comparison between LRI and KBR noise models.



# Using the GRACE Follow-On MDC

The MDCs are available via the website:

#### www.geoq.uni-hannover.de/mock

Here is a snap shot of the website, where the users can download the data and upload the result. Each challenge will be announced for a certain period of the time, and the result will be compared and published in a peer reviewed journal.



## References

- ► Kim J (2000) Simulation Study of A Low-Low Satellite-to-Satellite Tracking Mission
- ▶ Heinzel G, Sheard B, Brause N, Danzmann K, Dehne M, Gerberding O, Mahrdt C, Müller V, Schütze D, G Stede, Klipstein W, Folkner W, Spero R, Nicklaus K, Gath P, Shaddock D (2012) Laser Ranging Interferometer for GRACE follow-on, Proceedings of the ICSO (International Conference on Space Optics), Ajaccio, Corse, France, Oct. 9-12

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