GAMBLE theme 3:
Orbit determination and satellite tracking

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Main issues

What level of orbit accuracy can be reached for the GAMBLE missions?

- Impact of orbit and constellation choices?
- Impact of recent and future force model improvements?
- Using different tracking systems?
- Using (multi-satellite) crossovers?

Methodology

Precise orbit determination and tracking workshop

- Bringing together representatives of the European orbit determination and tracking system community

Inputs:

- Requirements from Sea Surface Height and Sea State Error Budgets workshops

Outputs:

- Orbit and tracking recommendations for the GAMBLE missions

Example 1: Topex/Poseidon and Jason

Relatively high orbit altitude (1336 km)

- Small aerodynamic and gravitational perturbations

Consistent orbit accuracy for T/P: 2-3 cm

- Dynamic SLR/DORIS orbits
- Reduced dynamic GPS orbits

Initial Jason-1 results

- Improved DORIS and GPS receivers
- Even better tracking fits and consistency

DEOS

Example 2: ERS-2 and Envisat

Lower orbit altitude (800 km)

- Large aerodynamic and gravitational perturbations

ERS radial orbit accuracy: 5 cm

- SLR tracking needs to be augmented by altimeter data for operational POD
- Orbit error increases during periods of high solar activity and sparse SLR tracking

Improvements expected (goal < 3 cm):

- New gravity models
- Improved surface force models
- Dense DORIS tracking for Envisat

DEOS

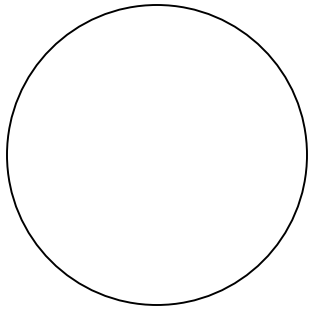
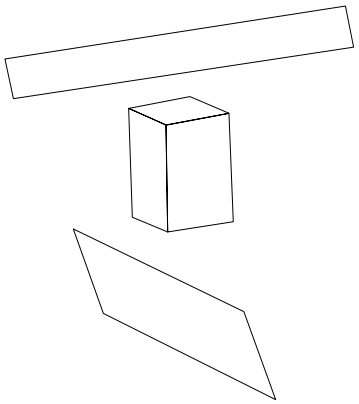
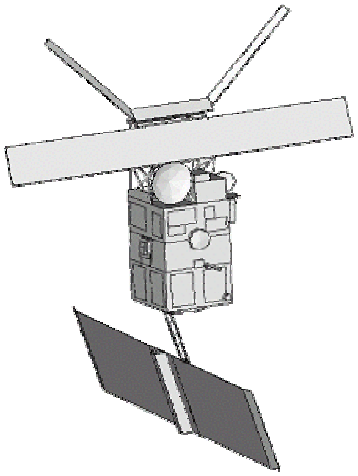
Force model improvement for ERS-2

Comparison of RMS residuals from 11 SLR tracking stations during April 18 - May 18, 2000.

Gravity models:

DGM-E04	DGM-E11	EIGEN1S
3.2 cm	2.9 cm	2.6 cm

Surface force models:

Constant area	Box-wing panels	Angara
		
3.0 cm	3.0 cm	3.0 cm

Force model improvement (continued)

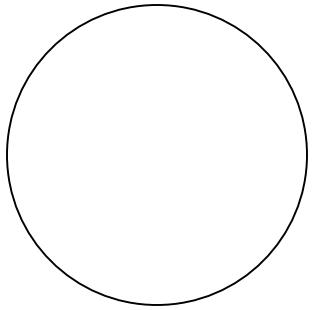
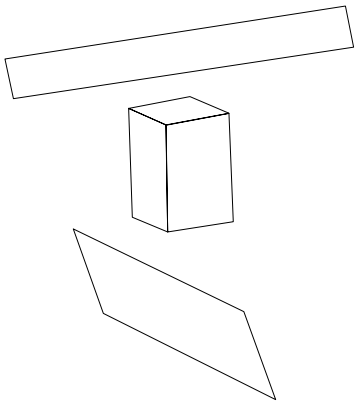
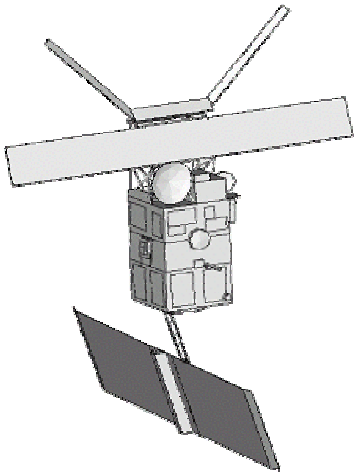
Comparison of RMS residuals from 11 SLR tracking stations during April 18 - May 18, 2000.

No estimation of one cycle-per-revolution empirical accelerations.

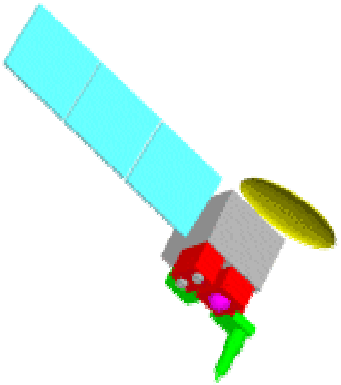
Gravity models:

DGM-E04	DGM-E11	EIGEN1S
16 cm	11 cm	8.8 cm

Surface force models:

Constant area	Box-wing panels	Angara
		
30 cm	14 cm	9.4 cm

Implications for GAMBLE missions



Tracking data and orbit determination approach

- What will be the accuracy of the GPS receivers on Gander?
- Force model deficiencies might be overcome using extensive parameterisation and high density tracking.

Force models

- Drag forces most important for low altitude missions (Altika: 600-800 km, Gander: 650 km, Swimsat: 450-600 km)
- Low orbit POD will benefit greatly from gravity field improvements.