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Oral

Determination of precise orbits of artificial Earth satellites is a complex and challenging task. The accuracy of precise orbits
of altimetry satellites depends on many factors, such as diverse models

and algorithms, the reference frame realization, various corrections and tracking data, the applied parameterization and
some minor effects. Since the orbits of altimetry satellites are of altitudes between 700 and 1400 km, the motion of these
satellites is strongly effected by the inhomogeneous structure of the Earth gravity field. In this paper we present the results
of the investigation of the influence of the recent time variable geopotential models EIGEN-6S and EIGEN-6S2 on altimetry
satellite orbits. Furthermore two modified versions of EIGEN-6S2 (EIGEN-6S2A and EIGEN-6S2B), a static version of
EIGEN-6S and the static model EIGEN-GL04S were included in our investigations. All these models have been jointly
developed by GFZ German Research Centre for Geosciences and Space Geodesy Research

Group (GRGS) Toulouse. We computed precise orbits of the altimetry satellites ERS-1, ERS-2, Envisat, and
TOPEX/Poseidon over 20 years time between 1991 and 2011 using Satellite Laser Ranging (SLR), single satellite
altimeter crossover and Doppler Orbitography and Radiopositioning Integrated by Satellite (DORIS) data. We evaluated in
particular the influence of the different geopotential models on the root-mean-square (RMS) fits of the observation data as
well as on two-day orbital arc overlaps in radial direction, RMS and mean of single satellite altimeter crossover differences,
geographically correlated errors, range biases, center-of-origin realization, stochastic properties of radial errors, global and
regional mean sea level trends. A key aspect is the consistency of the derived orbits over the full length of the altimetry
series. From our detailed study, we conclude, that EIGEN-6S2A time variable geopotential model performs best for all four
satellites tested. This model provides, besides the geopotential coefficients up to degree and order 260, also a yearly time
series of the drifts of the geopotential coefficients for degrees 2 to 50 for the Gravity Recovery And Climate Experiment
(GRACE) period (2003 - 2012) and a yearly time series of the drift of three geopotential coefficients of degree 2 from 1985
till 2003 computed using LAGEOS-1 and LAGEOS-2 SLR observations and zero drift before 1985 and after 2012. This
model includes also annual and semiannual variations of the geopotential coefficients for degrees 2 to 50 over the whole
possible time span (1950 - 2050).

We recommend this model also as a background geopotential model for precise orbit determination to compute individual
solutions to be used for the generation of a new realization of the International Terrestrial Reference Frame ITRF2013.

OSTS session

Precision Orbit Determination

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