GEOSAT

Combining VLBI, SLR, GNSS, and DORIS at the observation level

GEOSAT is a software being developed by the Norwegian Mapping Authority in cooperation with the Norwegian Defence Research Establishment. GEOSAT will contribute to a more accurate and stable reference frame. Such a reference frame is necessary for monitoring processes like changes in sea level, tectonic plate movements, and vertical land motions to the level of precision needed by current and future climate research.

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The GEOSAT Software

GEOSAT produces a consistent and long term stable reference frame. The software combines individual observations from VLBI, SLR, GNSS, and DORIS at the observation level one epoch at a time using an upper diagonal factorized Kalman filter and models common across the techniques. As a result the different data types can complement each other at each epoch in the determination of all common parameters.

GEOSAT can produce its own Terrestrial Reference Frame (TRF), or contribute to other reference frames like the ITRF, by estimating orbital parameters, station coordinates, and Earth Orientation Parameters (EOP) with high accuracy. Furthermore, GEOSAT can accumulate this information over time using a Square Root Information Filtering and Smoothing algorithm (SRIF/S) that allows for a stochastic evolution of the TRF.

One advantage of the GEOSAT approach is that technique-dependent systematic errors will be minimized, although this requires the identification and modeling of inter-technique discrepanicies. Furthermore, the use of one software for all techniques provides consistency, which is crucial to allow for comparisons of measurements at different locations and at different times.

Analyzing DORIS Observation Data

Two of the advantages of the DORIS technique are:

- The homogenity and global coverage of the DORIS network.
- Most satellites carrying DORIS receivers are also equipped with other instruments like GNSS and SLR, creating co-located stations in space.

Taken together, this gives valuable input to GEOSAT for transferring information between the different geodetic techniques.

The GEOSAT software can process data from any generation of DORIS receivers. The ionospheric propagation error is removed from the DORIS observation data in the usual way.

The software supports different methods for the analysis of the data:

- By modeling the accumulated difference range for each satellite pass over each beacon. This gives better information about the geometry of the satellite orbit, but is more vulnerable to cycle slips.
- By modeling successive range differences, which is more stable but yields somewhat less information.

Kartverket

Norwegian Mapping Authority