GEOSAT

PHOTO: ESA – J. HUART

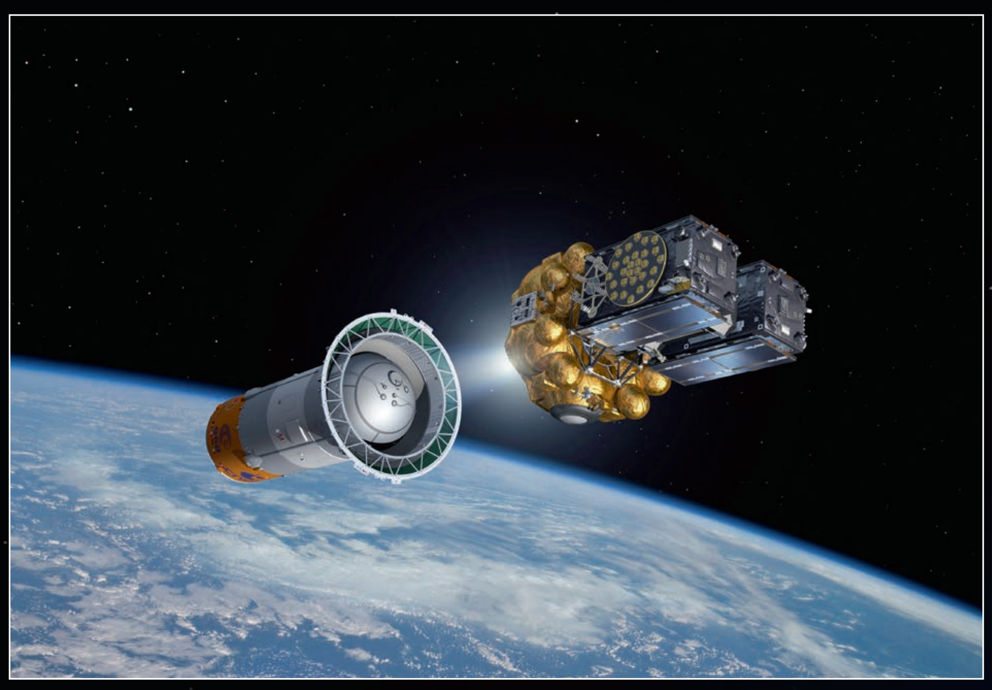
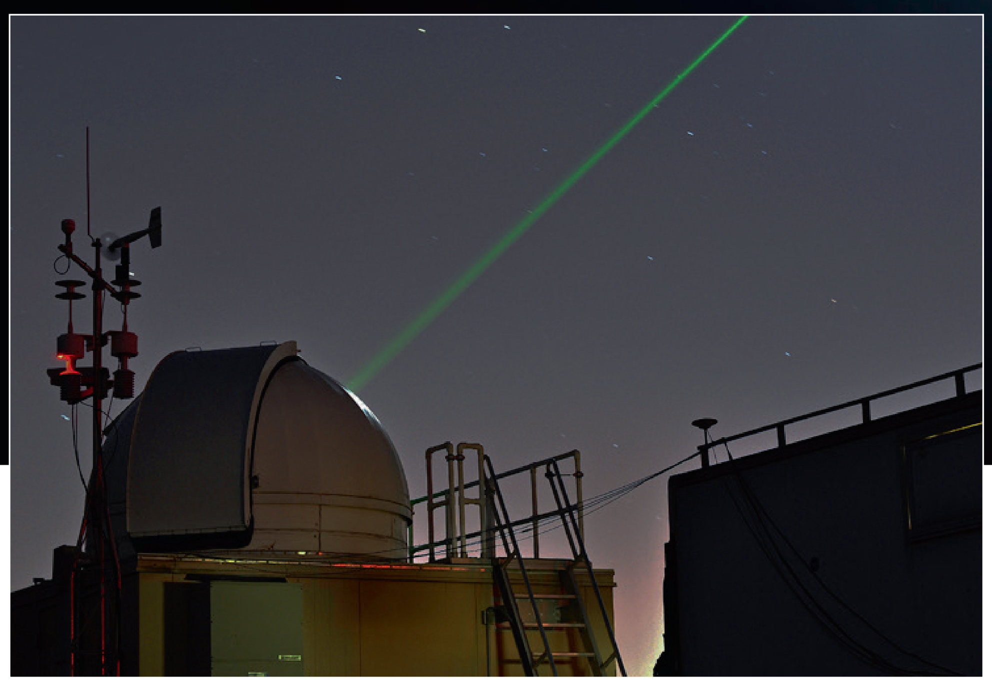


PHOTO: ESA – J. HUART

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 SLR Observation Data

Satellite Laser Ranging (SLR) is a geodetic technique which measures the time of flight of laser pulses to satellites equipped with retroreflectors. A global network of observation stations with short-pulse lasers and optical receivers provides range measurements of millimeter level precision which can be accumulated to provide accurate measurements of the geocentric position of a satellite.

GEOSAT can process normal point data from several satellites:

- Passive SLR-dedicated satellites: Ajisai, Blits, Etalon, Lageos, Larets, Starlette, and Stella.
- Low Earth Orbit (LEO) satellites like Jason, GOCE, GRACE, and Envisat, which are equipped with other technologies in addition to SLR.

The orbits of the SLR-dedicated satellites, are computed by integration over a time span of one week. For the LEO satellites we compute a one day solution. All satellites with sufficient amount of data are included in the GEOSAT analysis.

Kartverket

Norwegian Mapping Authority