Kartverket

VLBI analysis with GEOSAT

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NKG General Assembly 2014

Photo: Bjørn-Owe Holmberg

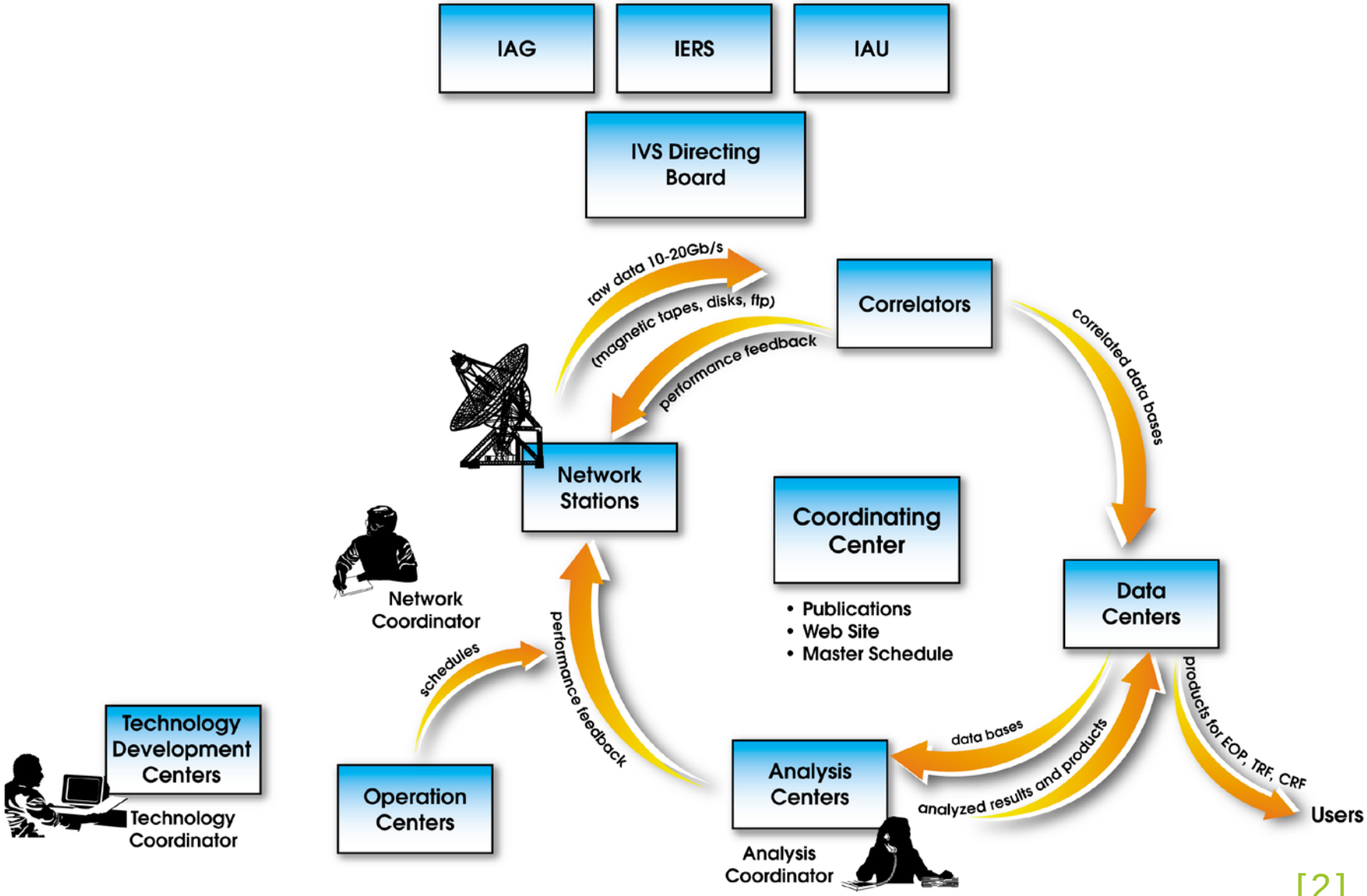
Outline

- VLBI at the Norwegian Mapping Autorithy
- GEOSAT and analysis concept
- Analysis progress
- Current challenges and future plans

VLBI at the Norwegian Mapping Autority

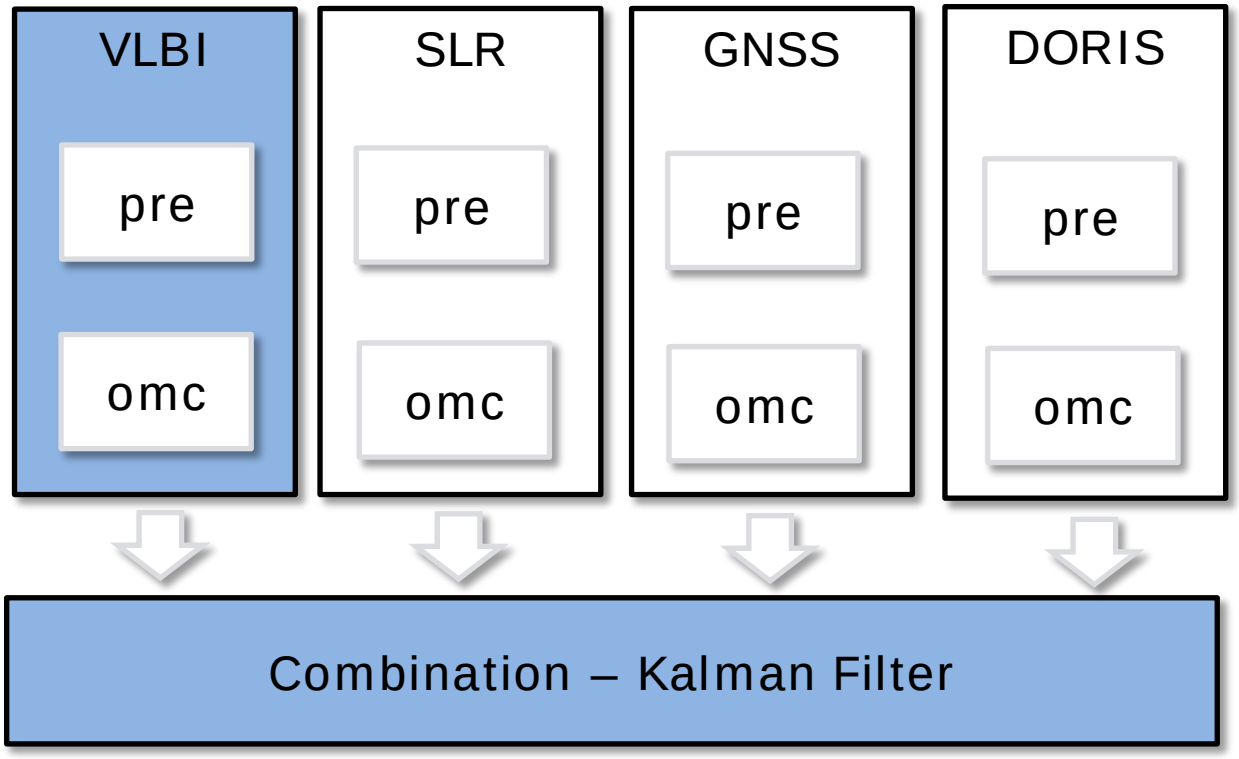
- Observatory at Ny-Ålesund was built in 1993 and started observing in 1994.
- Two new VLBI antennas will be finished in 2018.
- In 2010 NMA signed an agreement with Norwegian Defence Research Establishment for the use and ownership of the software Geosat.
- NMA became an Associate Analysis Center within the IVS in 2010.

ORGANIZATION OF INTERNATIONAL VLBI SERVICE



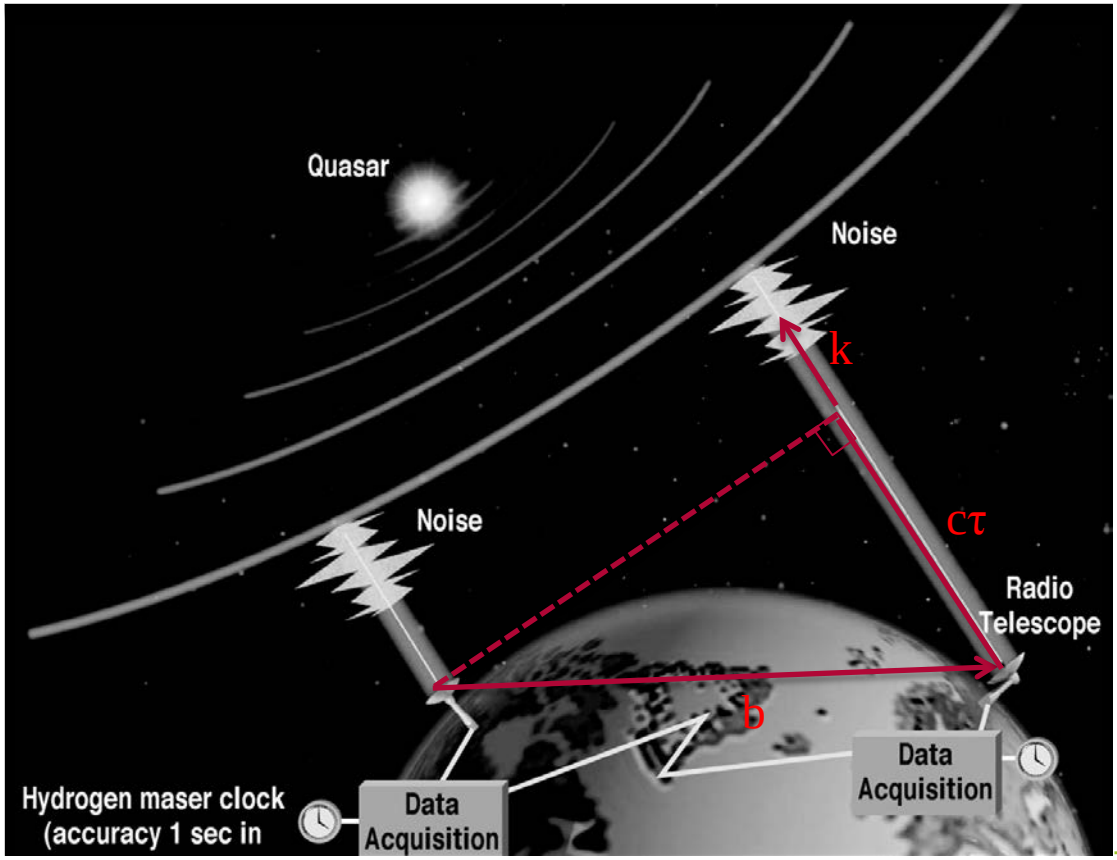
[2]

GEOSAT architecture



VLBI analysis – observation (1/3)

$$\tau_g = \frac{-b \cdot k}{c}$$ [1]



[2]

VLBI analysis – calculation (2/3)

$$\tau = \tau_g + \tau_{ab} + \tau_{clk} + \tau_{inst} + \tau_{trop} + \tau_{iono} + \tau_{rel}$$ [1]

- **g**: geometric delay
- **ab**: delay caused by diurnal abberation
- **clk**: delay caused by relative clock difference
- **inst**: delay through on site instrumentation
- **trop**: delay through the troposphere
- **iono**: delay through the ionosphere
- **rel**: relativistic corrections to geometric delay

VLBI analysis – estimation (3/3)

Based on the residuals and the partial derivatives the following parameters are estimated using a Kalman Filter:

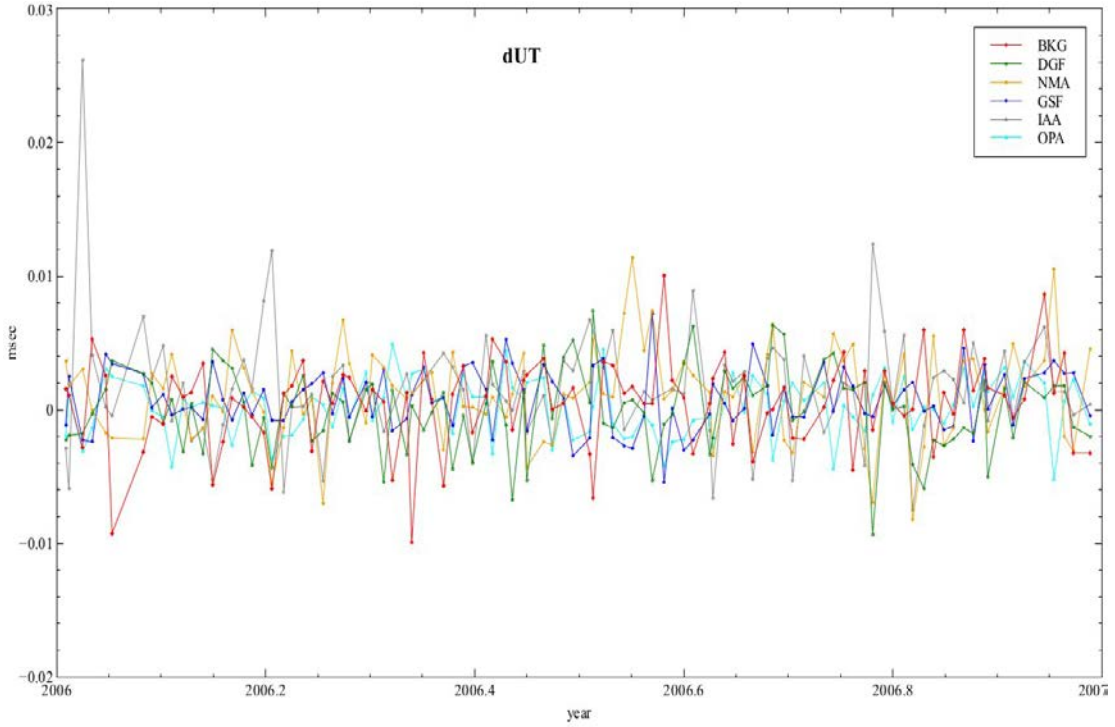
- Station coordinates
- Radio source coordinates
- Troposphere
- Relative clock model
- EOP

Analysis progress (1/2)

- Cooperating with the analysis center at BKG (Bundesamt für Kartographie und Geodäsie).
- Submitted one year (2006) of processed R1 and R4 sessions earlier this year.
- "... IVS-R1 and IVS-R4 sessions is to provide twice weekly EOP results on a timely basis." [2]

WRMS with respect to combined solution [3]

- **Xpole:** 0.064 mas
- **Ypole:** 0.068 mas
- **dUT:** 0.003 msec
- **XPoleRate:** 0.219 mas/day
- **YPoleRate:** 0.214 mas/day
- **LOD:** 0.026 ms/day
- **dX:** 0.050 msec
- **dY:** 0.044 msec



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Analysis progress (2/2)

- Were encouraged to contribute to the ITRF2013.
- Delivered approximately 2000 sessions from the period of 1998-2013
- There were some offsets in some of the station coordinates in the range of 1-1.5cm.
- New solution were submitted early in august
- Still waiting for feedback

Current challenges

- The project has a very large scope and will take a long time to materialize.
- Author of the software is retiring in the summer of 2015.
- Very little focus on geodetic measuring techniques (VLBI, SLR, DORIS) at Norwegian universities.

Future plans

- Teach and document as much as possible
- Finish a working version of GEOSAT
- Validate GEOSAT
- Contribute to operational IERS products
- Contribute to research

References

[1] **H. Schuh & D. Behrend**: ”VLBI: A fascinating technique for geodesy and Astrometry” (J Geodyn 61, DOI 10.1016/j.jog.2012.07.007, 68—80, 2012)

[2] **IVS**: http://ivscc.gsfc.nasa.gov

[3] **S. Bachmann, L. Messerschmitt, D. Thaller**: IVS combination center at BKG – ITRF2013 preparations and source position combination (IVS GM 2013)