Simultaneous measurement of ionospheric parameters using LOFAR and GNSS satellite receivers

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- Context
- GNSS receivers at two LOFAR stations
- Installing the receivers
- Observations
- Test observation
- Full observation
- Schedule
- Skymodel from MSSS
- Data processing
- Absolute TEC 3C196
- Exloo-Steenwijk baseline
- Conclusions

Context

European GNSS Evolutions Programme (EGEP) from ESA consists of

- Galileo navigation satellites
- EGNOS improved ionospheric model for GNSS

Project for ESA by NLR and Astron to study the potential of LOFAR ionospheric measurements for GNSS applications

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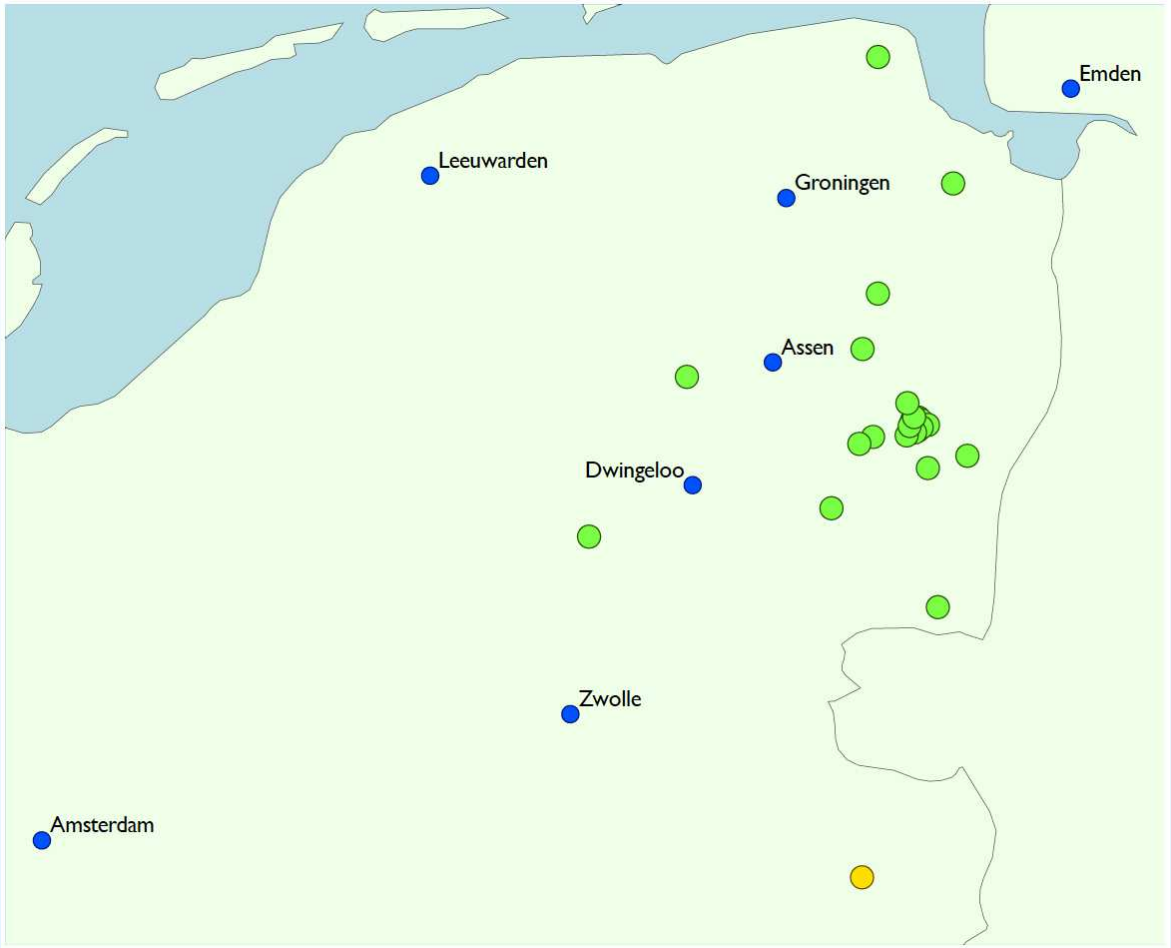
Receiver in Exloo (Core) and Steenwijk (RS310)



Installing the receivers

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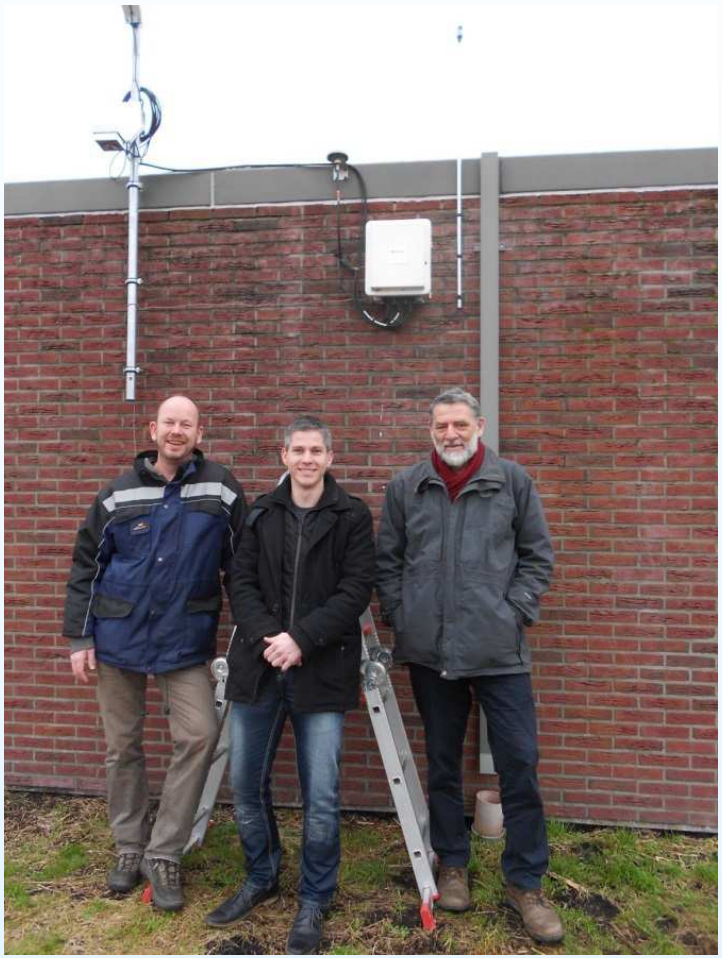

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Observations

- existing 3C196 data
- test observation: tracking a single satellite, total of 32 pointings
- full observation: interleaving, 1min observing, 1min switching time total 21 satellites, interleaving between 7-9 satellites at a time, 285 pointings in 10 hours.

Test observation

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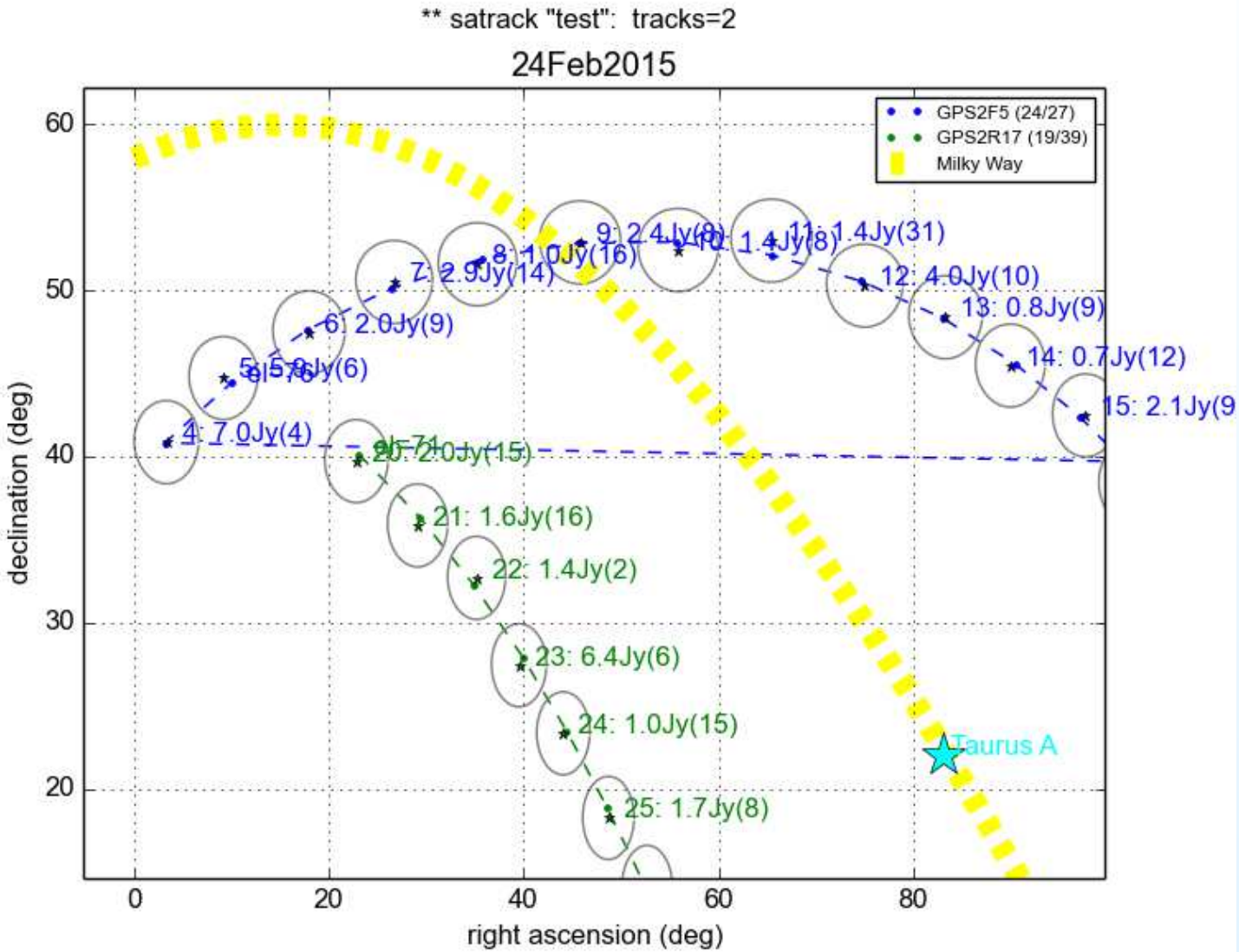

Full observation

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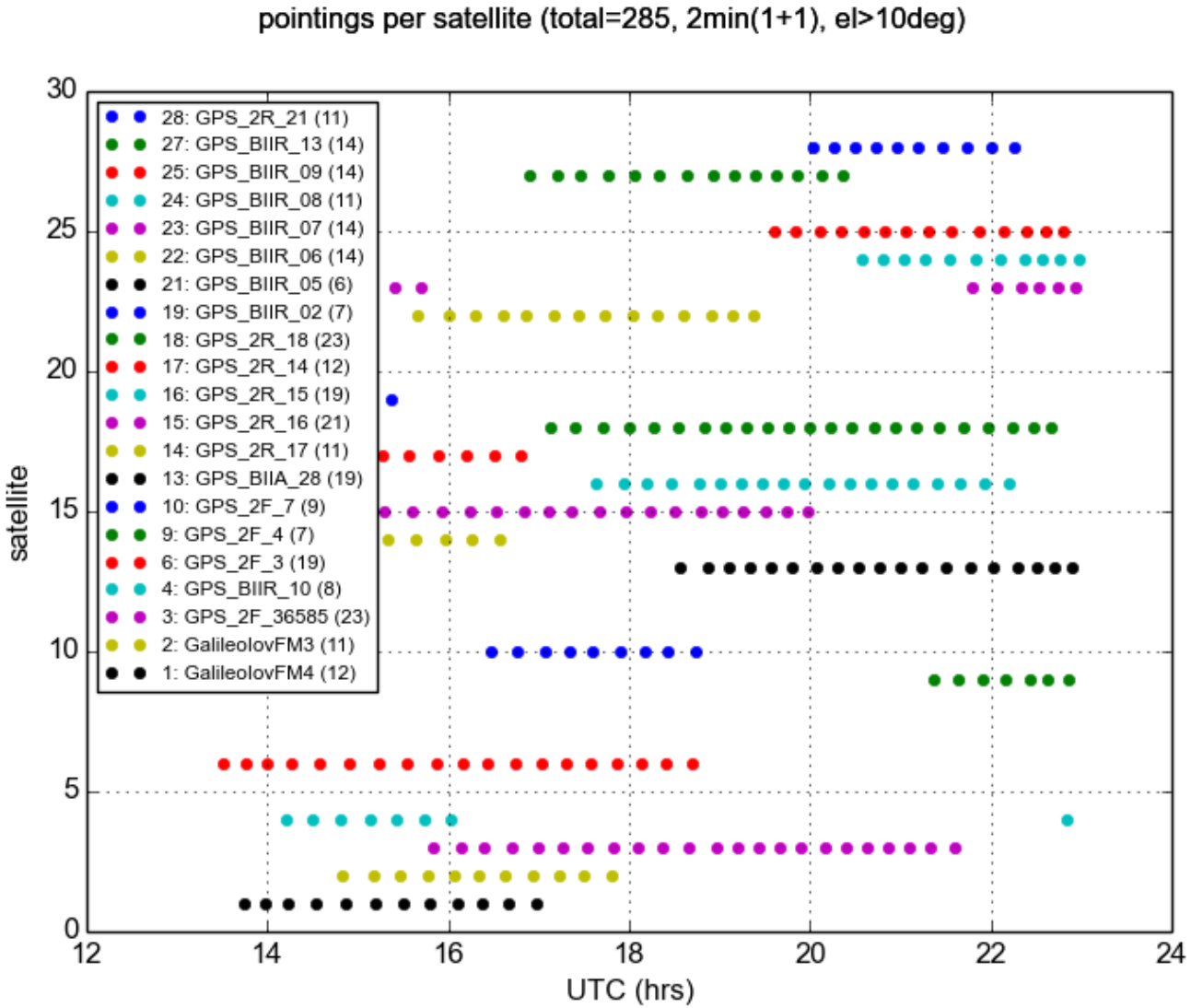

Schedule

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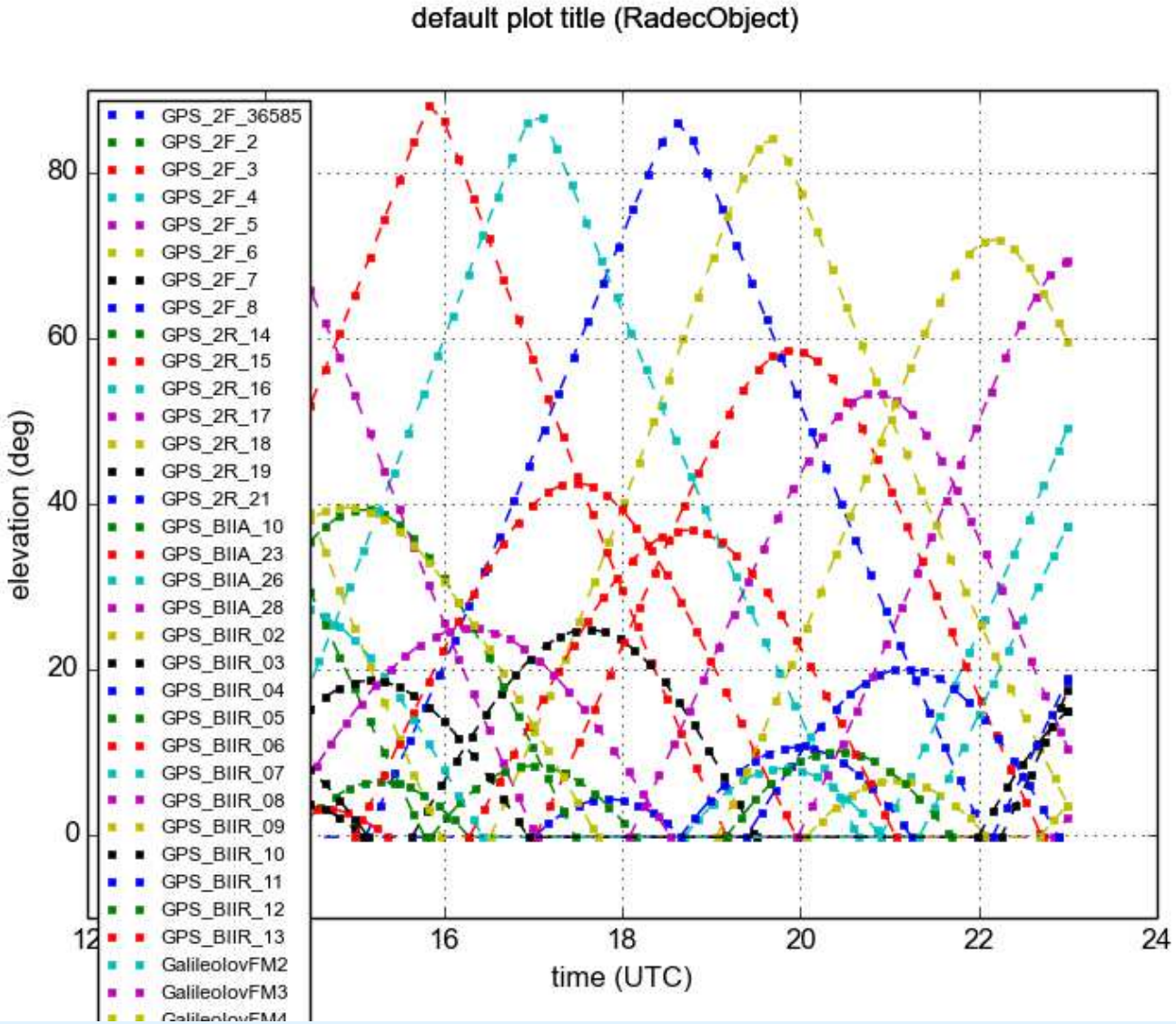

Skymodel from MSSS

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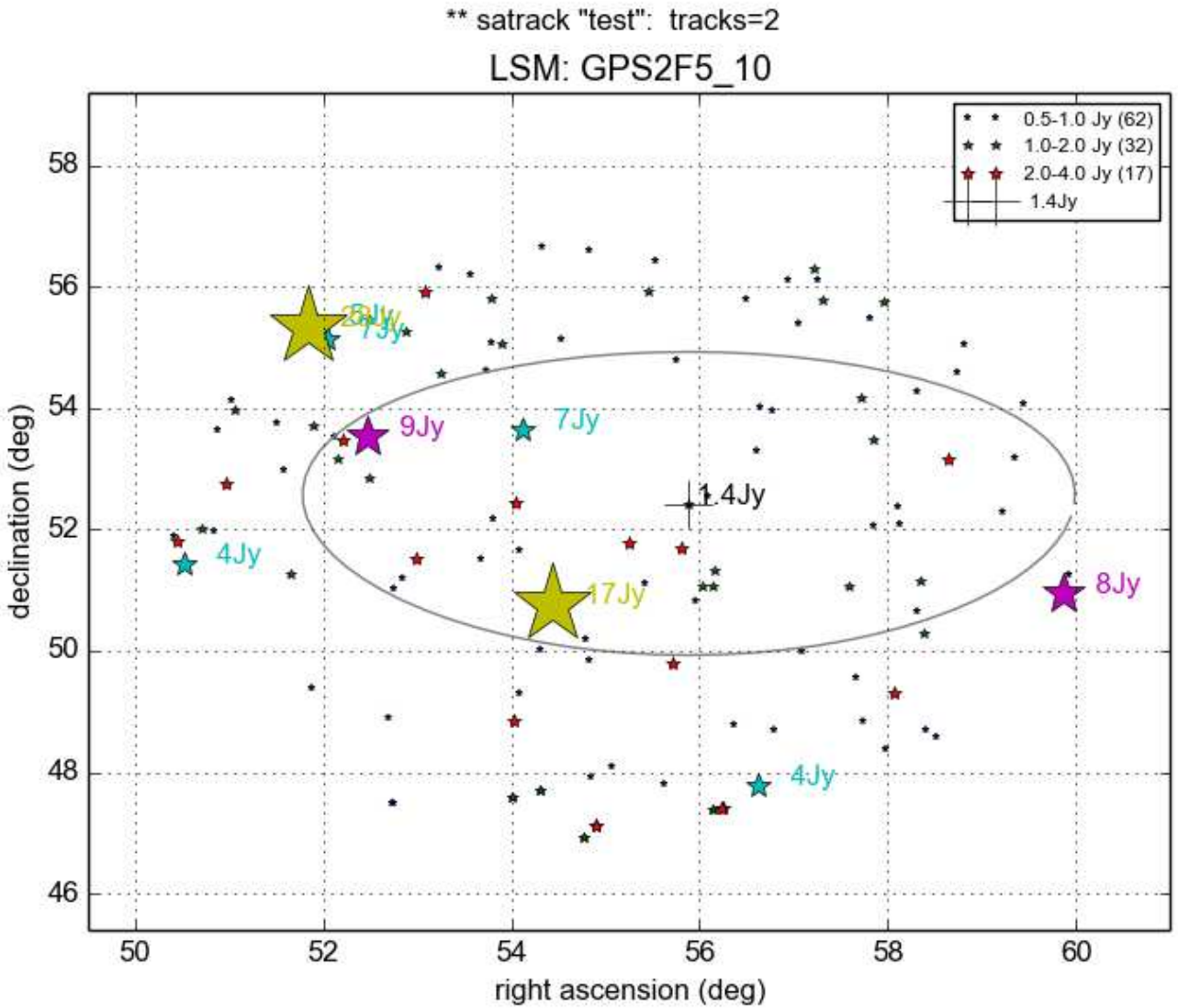

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Data processing

- Calibrate with BBS for phase, rotation, amplitude per 10 subbands
- phase $\Rightarrow$ clock, tec
  using continuity of clock
- rotation angle $\Rightarrow$ rotation measure
- fit a global model (MIM) to the measured TEC
- fit absolute TEC to relative TEC and RM using a geomagnetic model

Absolute TEC 3C196

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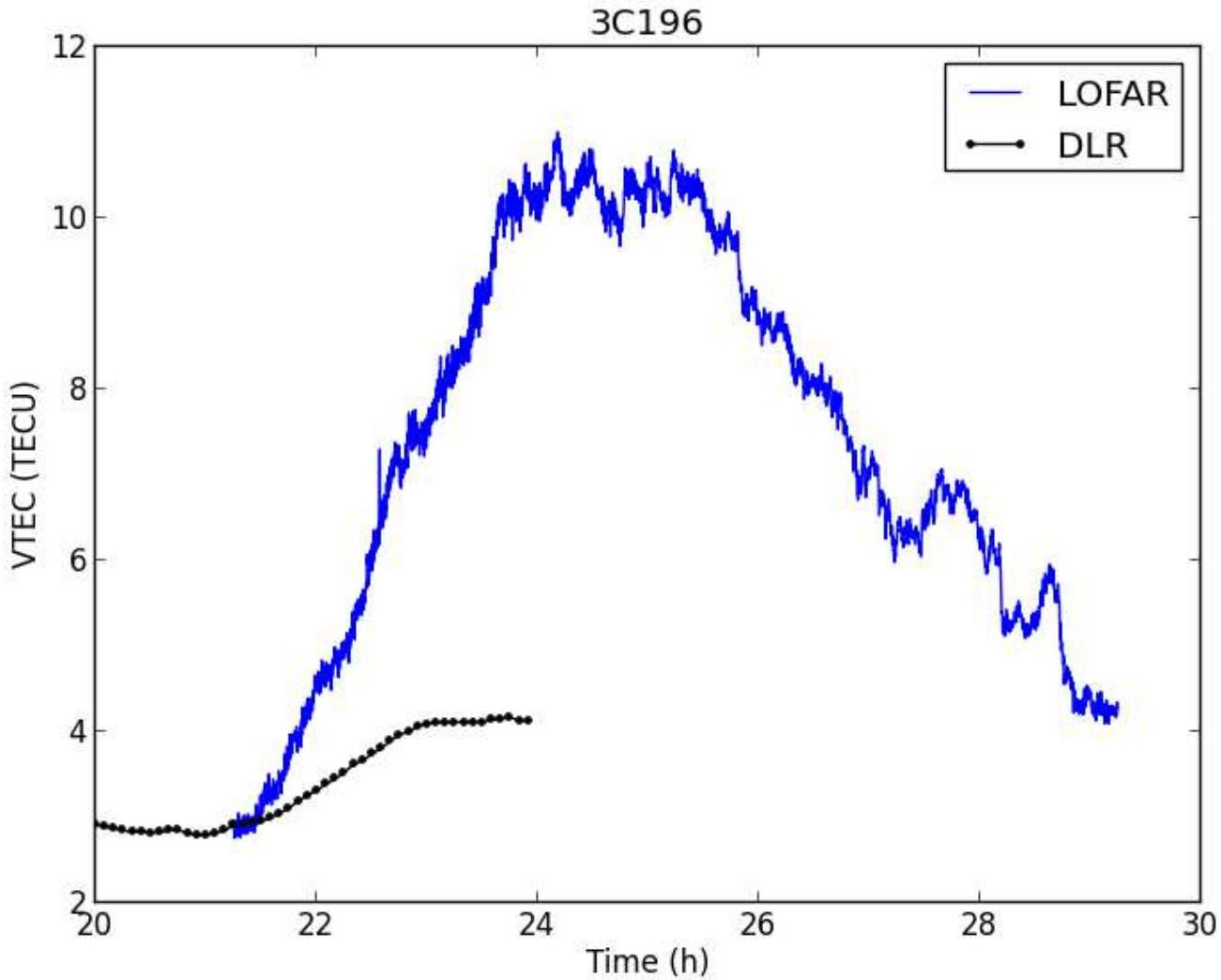

Exloo-Steenwijk baseline

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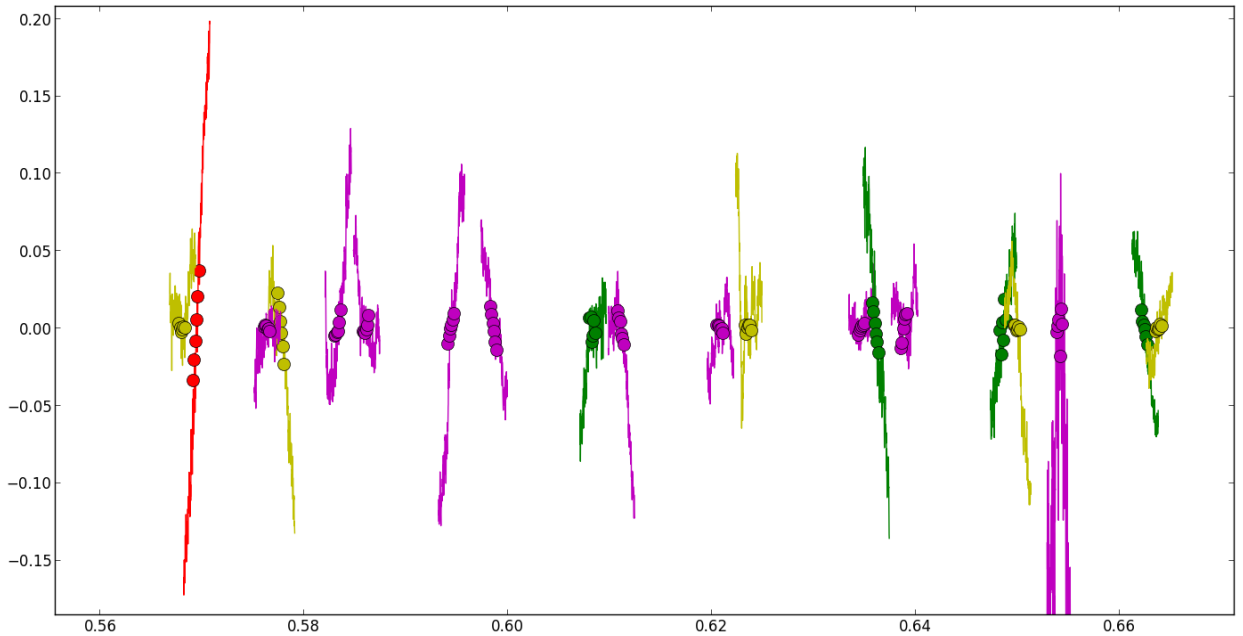

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Conclusions

- Can LOFAR data be used to improve GNSS? That's too early to tell, but we have found that...
- LOFAR is a very flexible instrument and
- Support from the Radio Observatory, Engineers, MSSS team, to do an out of the ordinary observation has been great