Source Structure effects in the next-generation of VLBI observations

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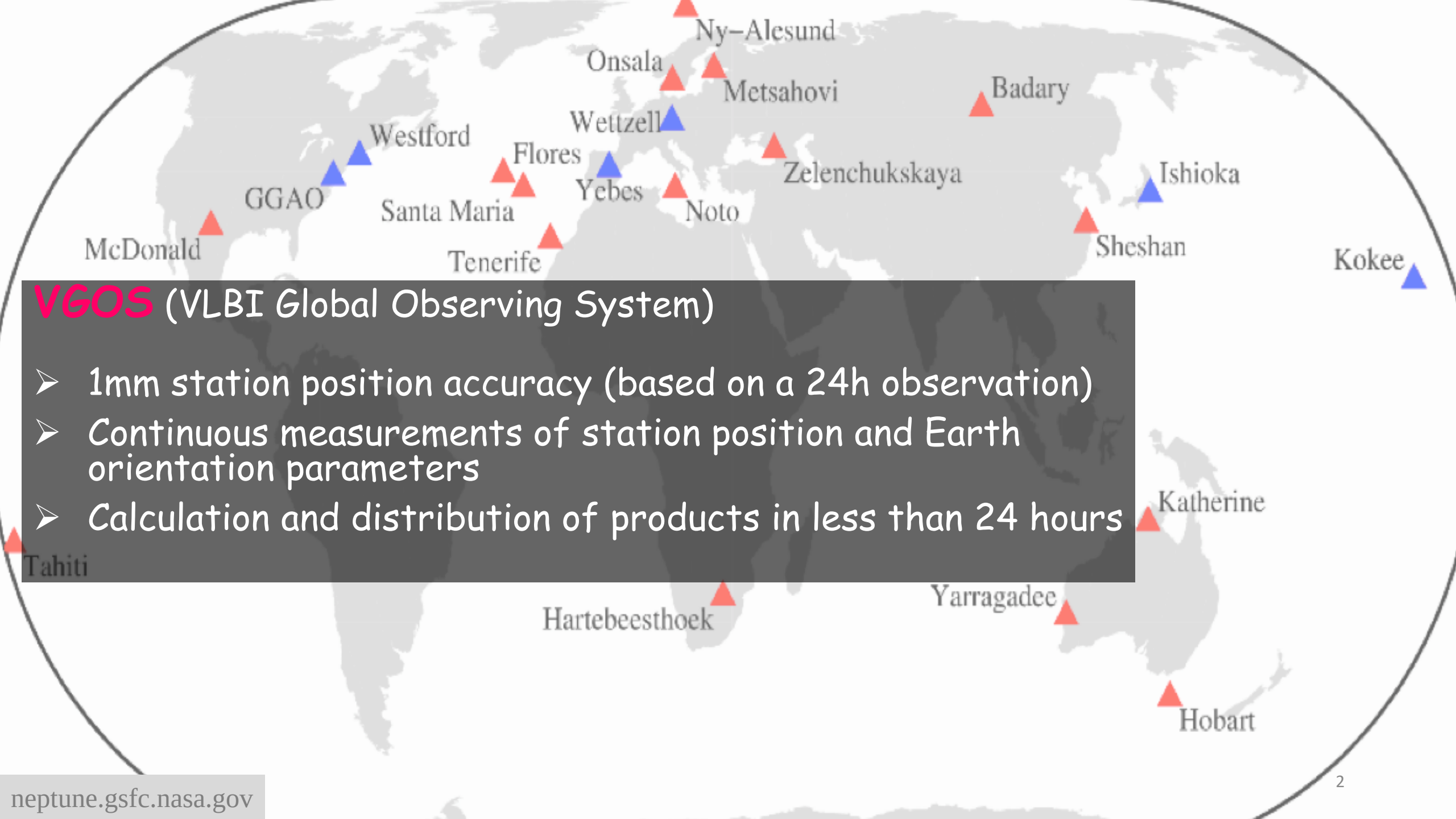


VGOS (VLBI Global Observing System)

- 1mm station position accuracy (based on a 24h observation)
- Continuous measurements of station position and Earth orientation parameters
- Calculation and distribution of products in less than 24 hours

Source Structure

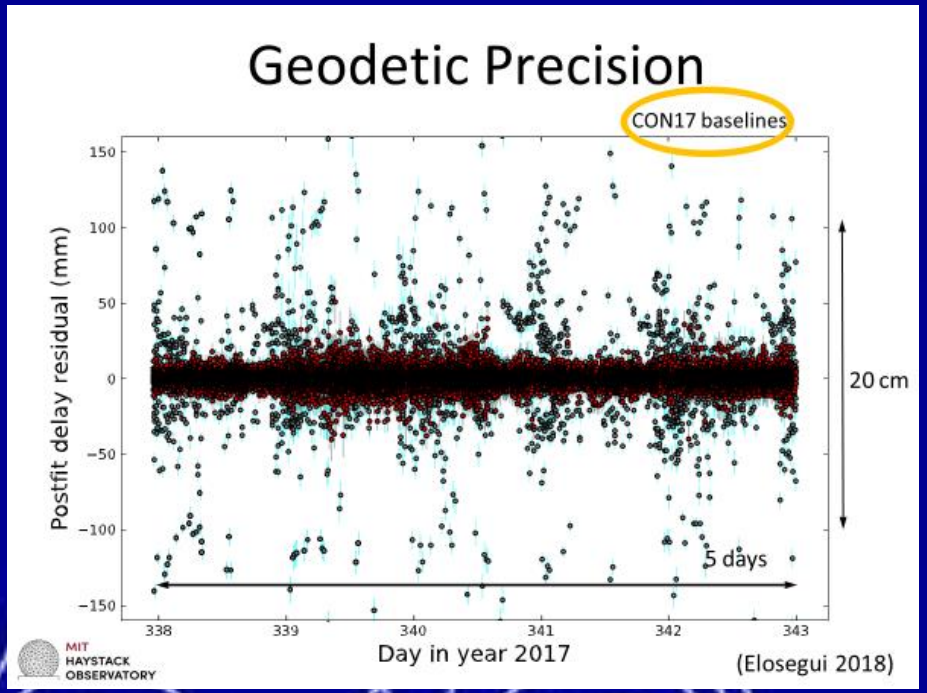
- Most sources have structures
- Position error ≥ 1 mas
- Varies with time and frequency
- Pose limit on reference frame accuracy
- Make problems for geodesy measurements

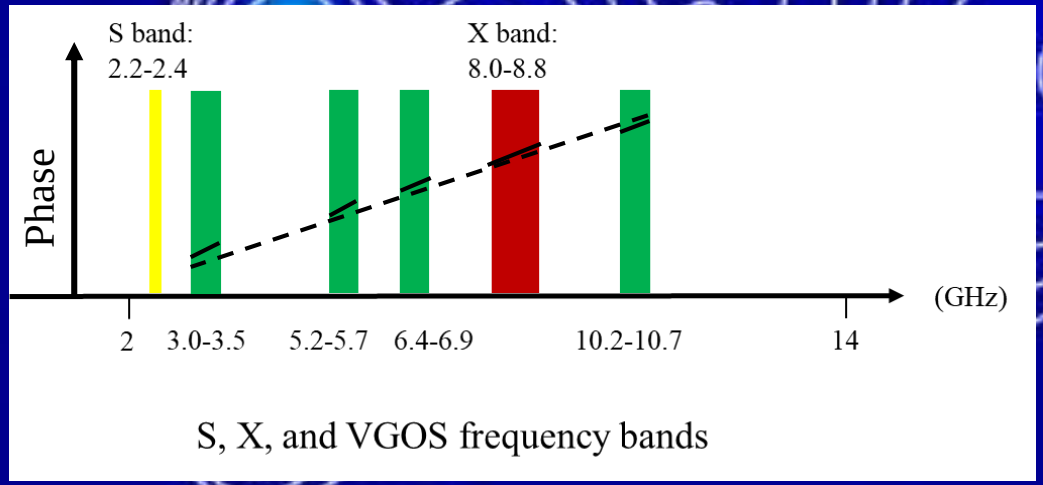
Legacy VLBI

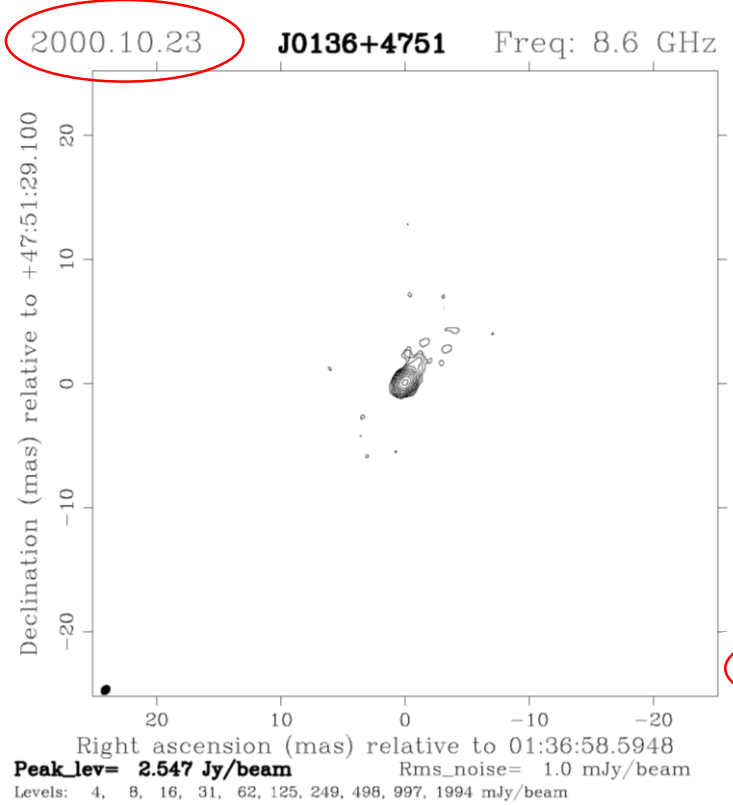
- S band (2.2–2.4 GHz)
- X band (8.0–8.8 GHz)

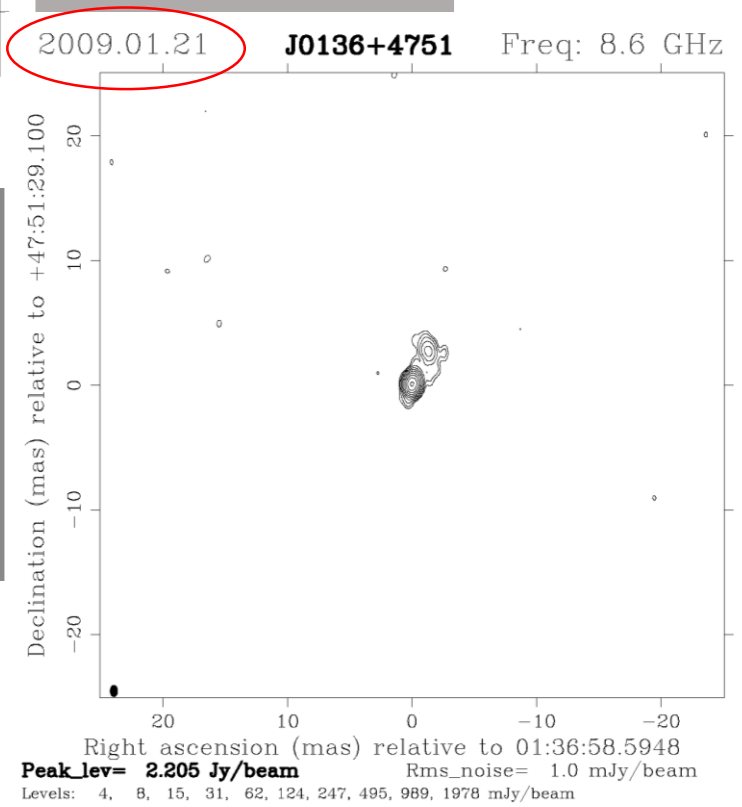
VGOS

- Broad bandwidth (2-14 GHz)









Source Selection

- Source 0133+476 (J0136+4751)
- ICRF2-defining, well observed IVS source
- Images in S, X and U bands (2.3, 8.6 and 15.4 GHz)
- Variable structure over time

Astrogeo.org

Image Processing

Astrogeo Center
(VLBI image database)

171 images of 0133+476 in S, X and U bands

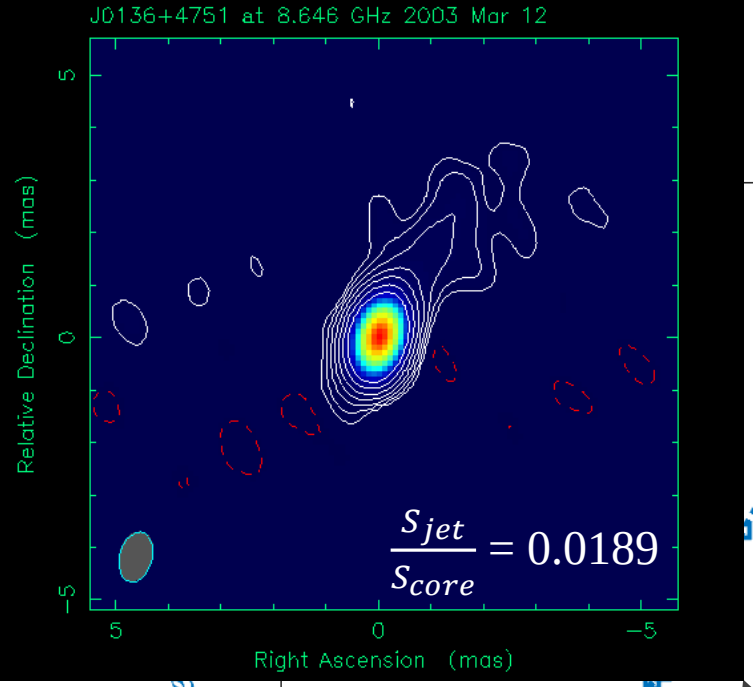
Total and unresolved flux densities from image header

Automated script
(Fitted Components)

Components position parameters

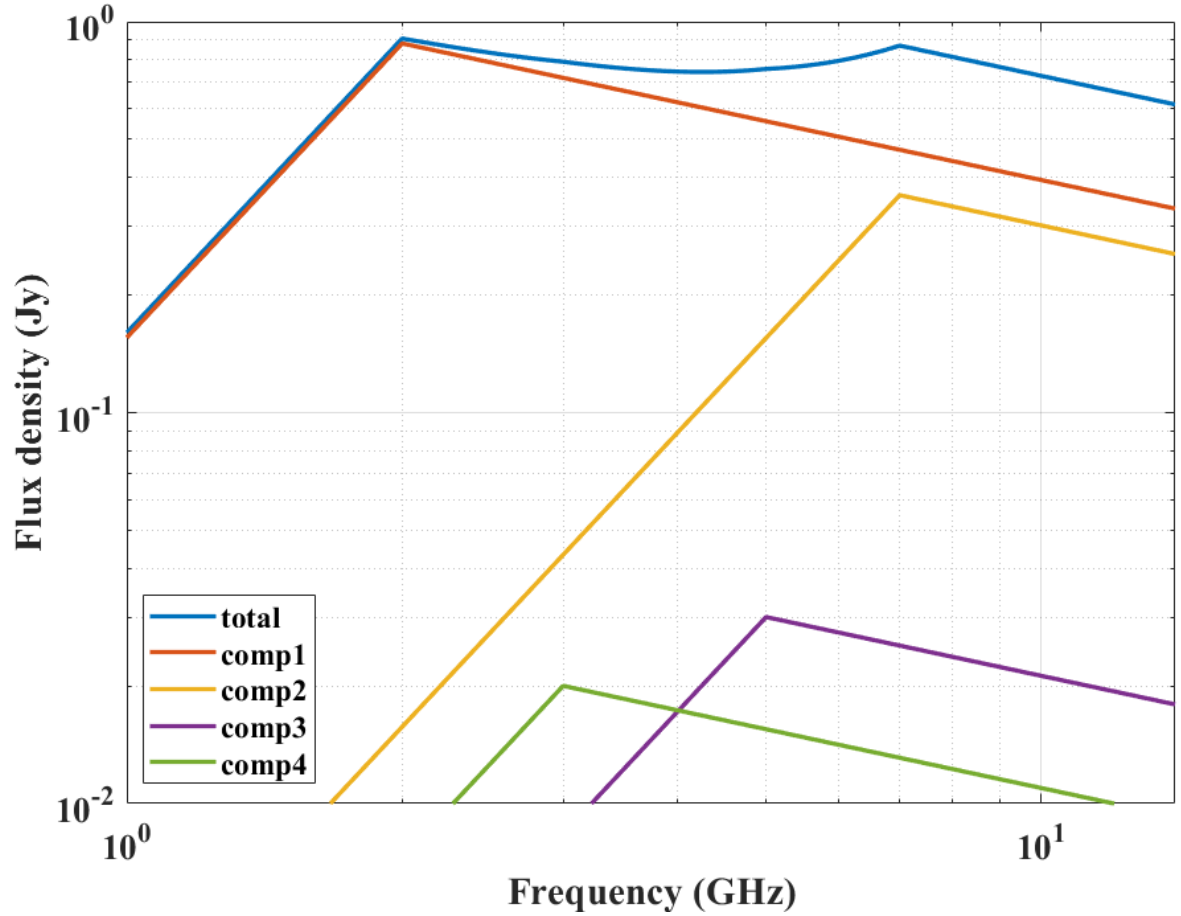
SI calculation

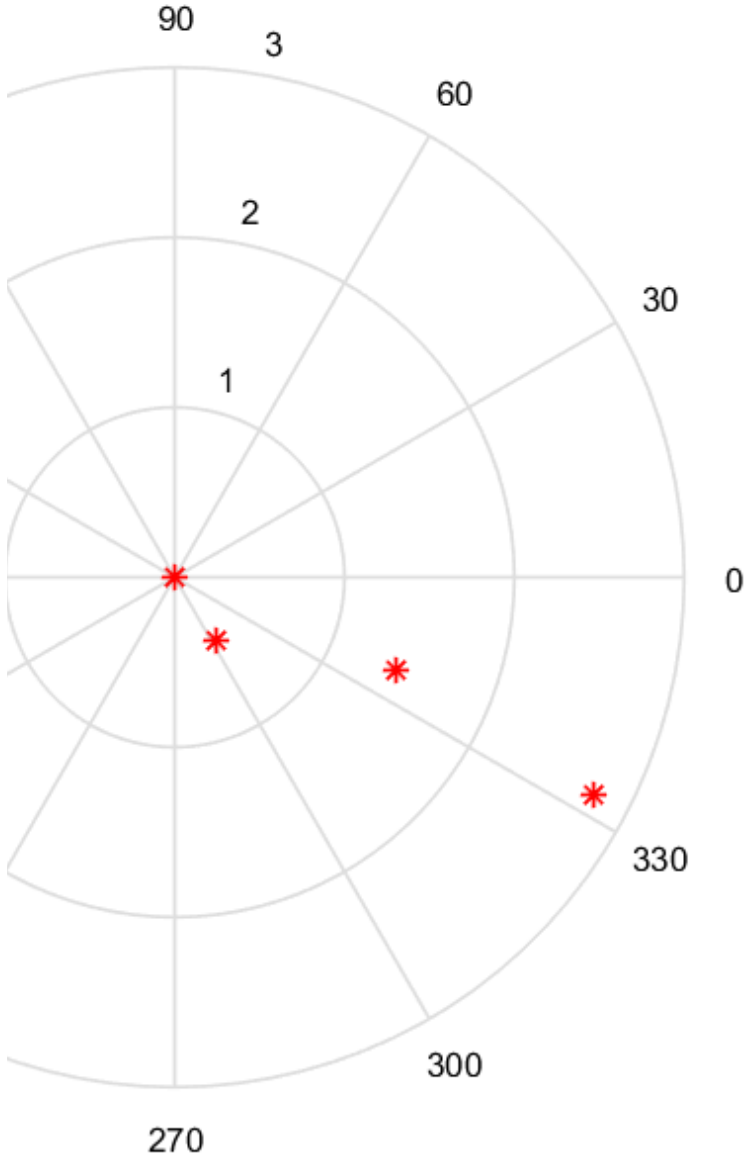
Time Variability

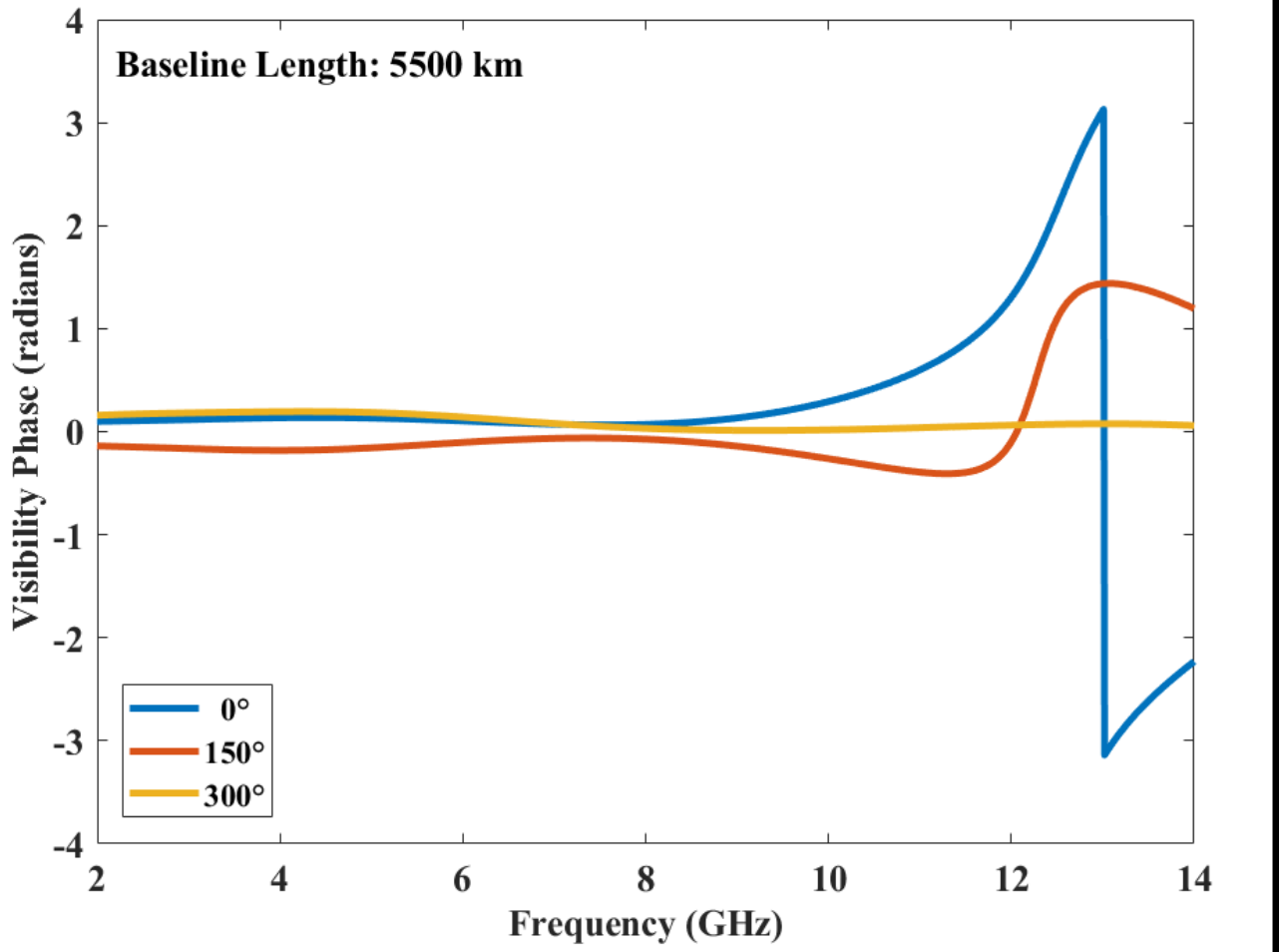


Time series of total flux density and structure index in 8.6
Source: 0133+476

Source Model

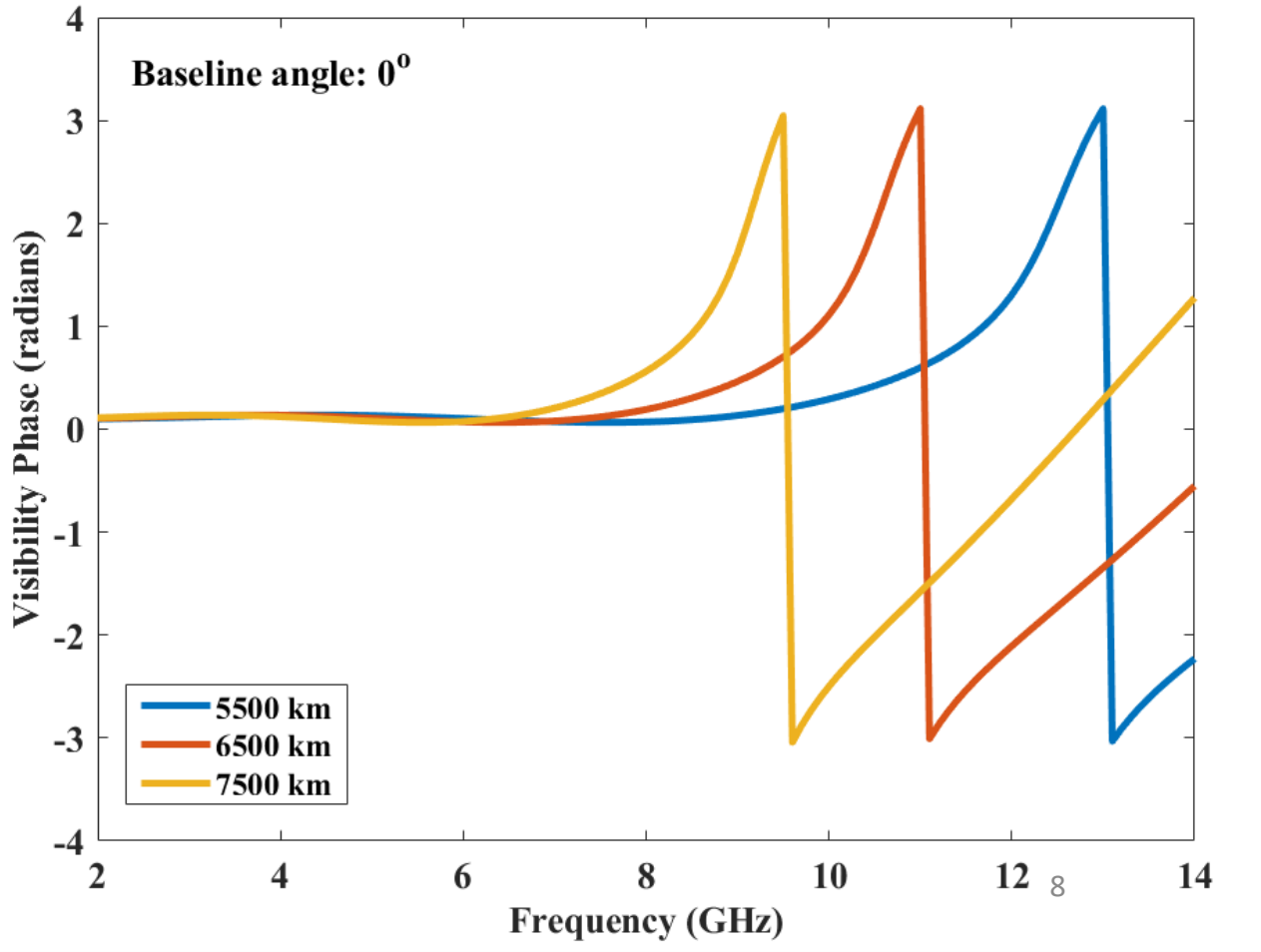






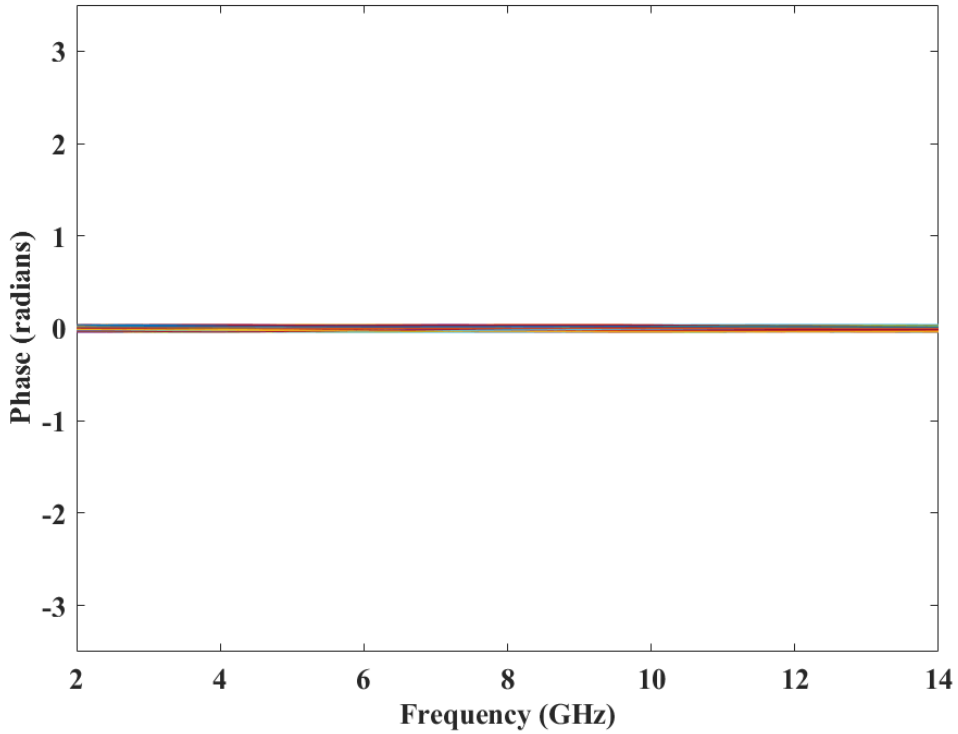
- Fixed baseline length
- Different baseline angles

- Fixed baseline angle
- Different baseline lengths

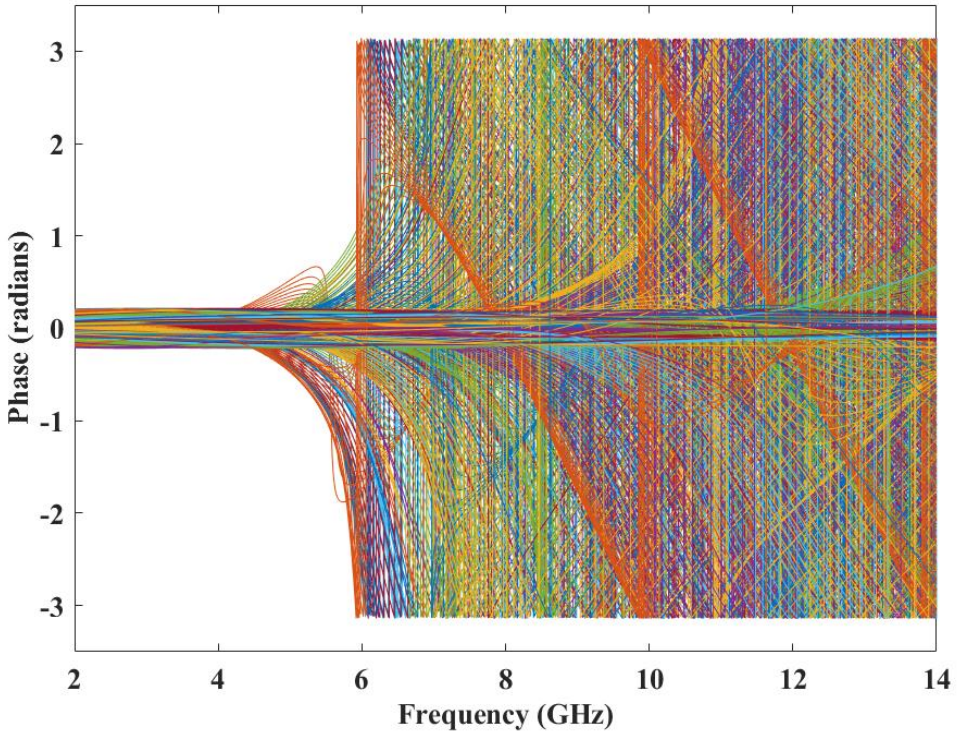


- ✓Scheduling with VieSched++
  - 1 source
  - 11 stations
  - 30 seconds source scan
  - 10 minutes between scans
  - 24 hours session
- ✓Source model from automated scripts (Gaussian fitting)
- ✓Source structure module of VieVS (Shabala et al. 2015)

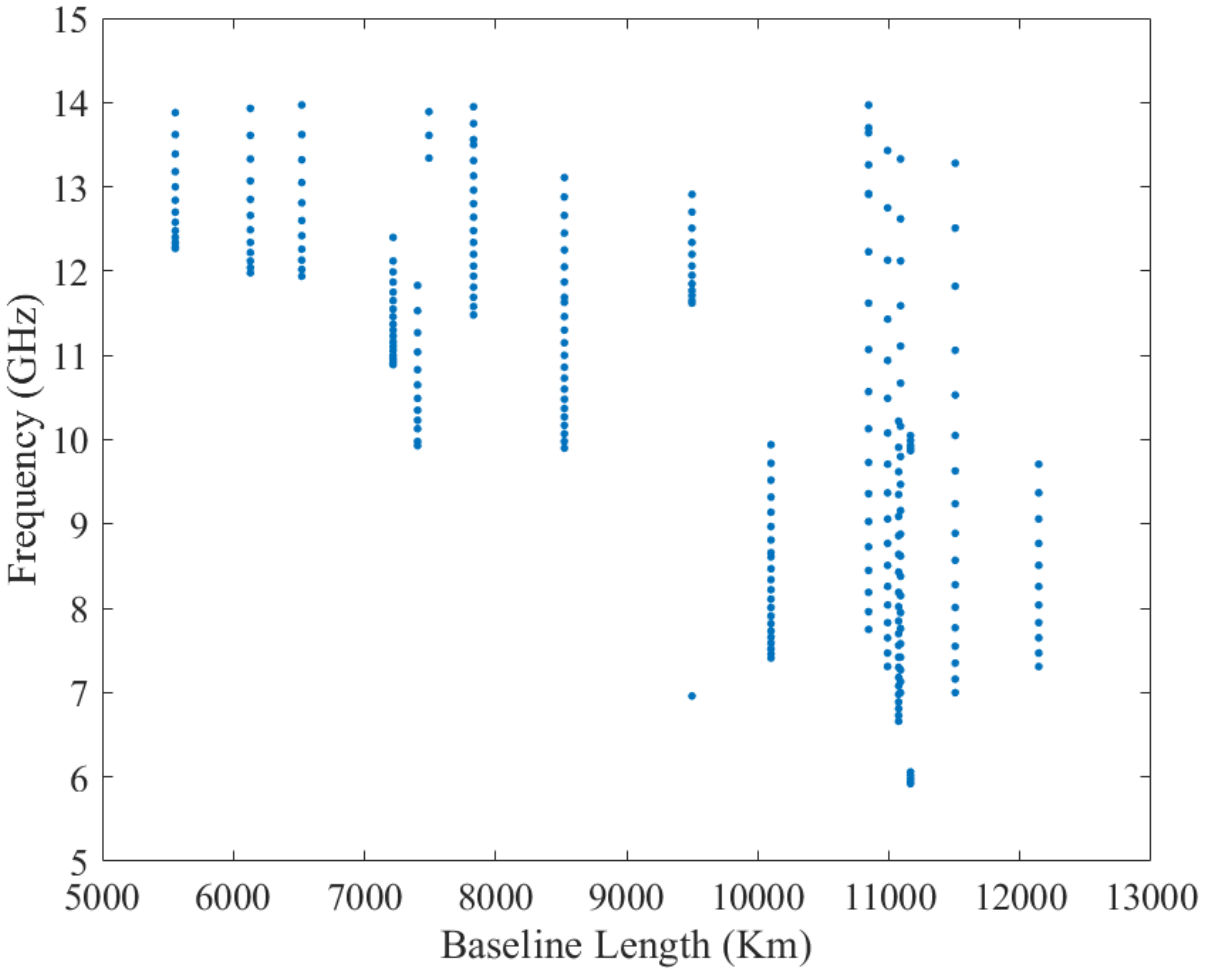
SI = 0.6 (2000)

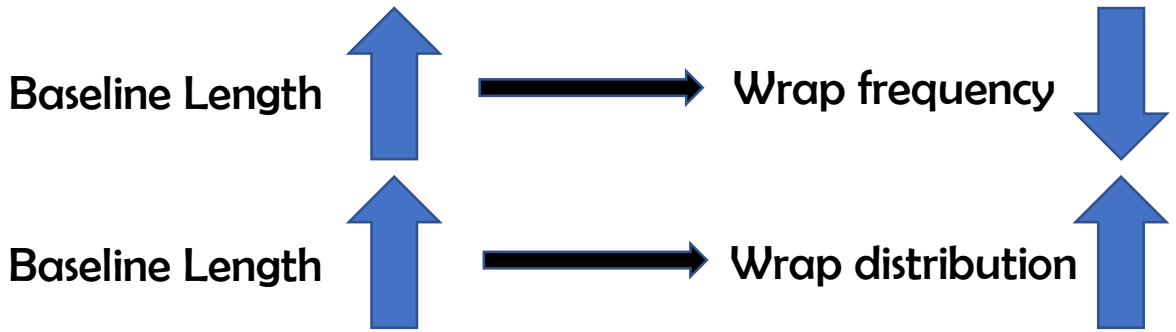


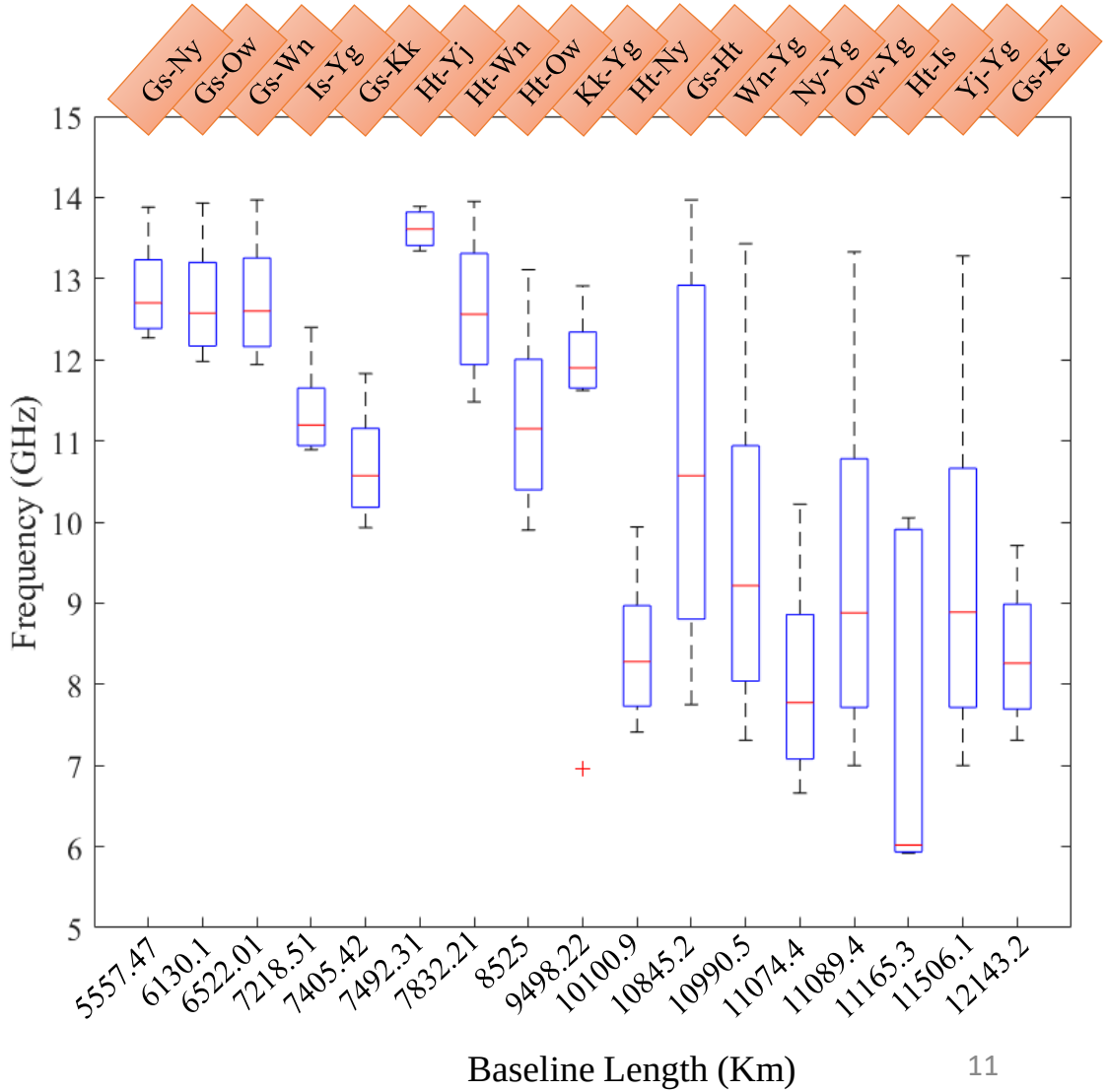
SI = 2.5 (2011)

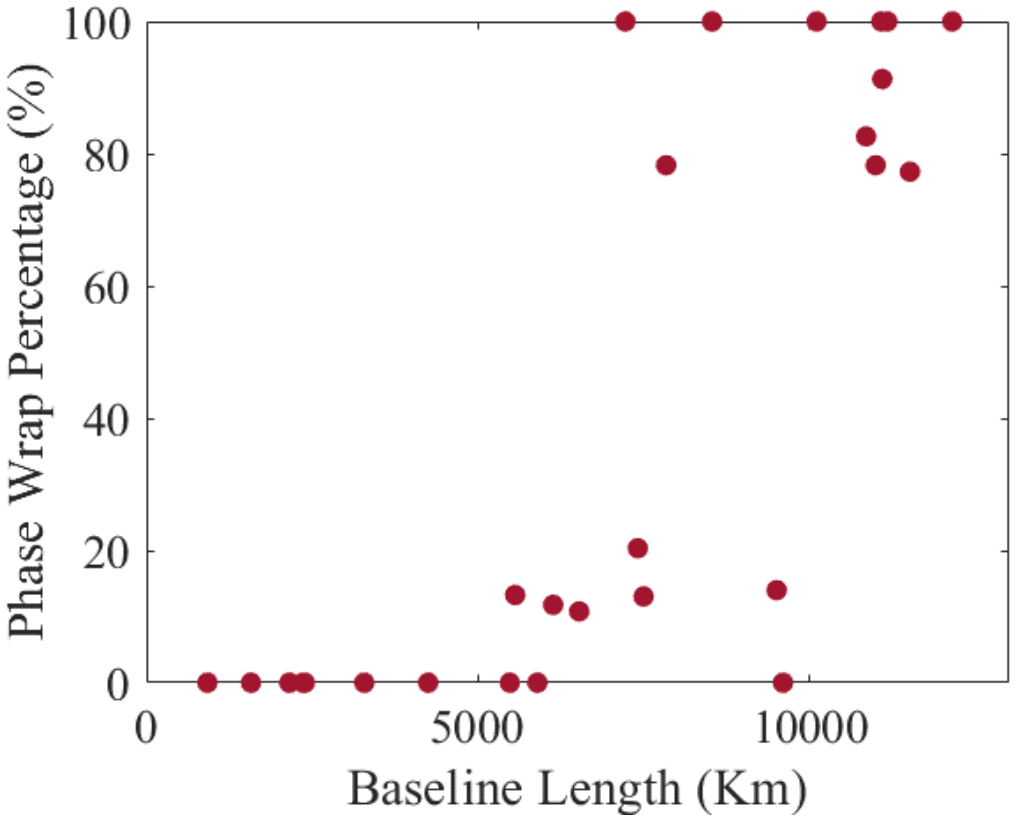


Phase wrap changes









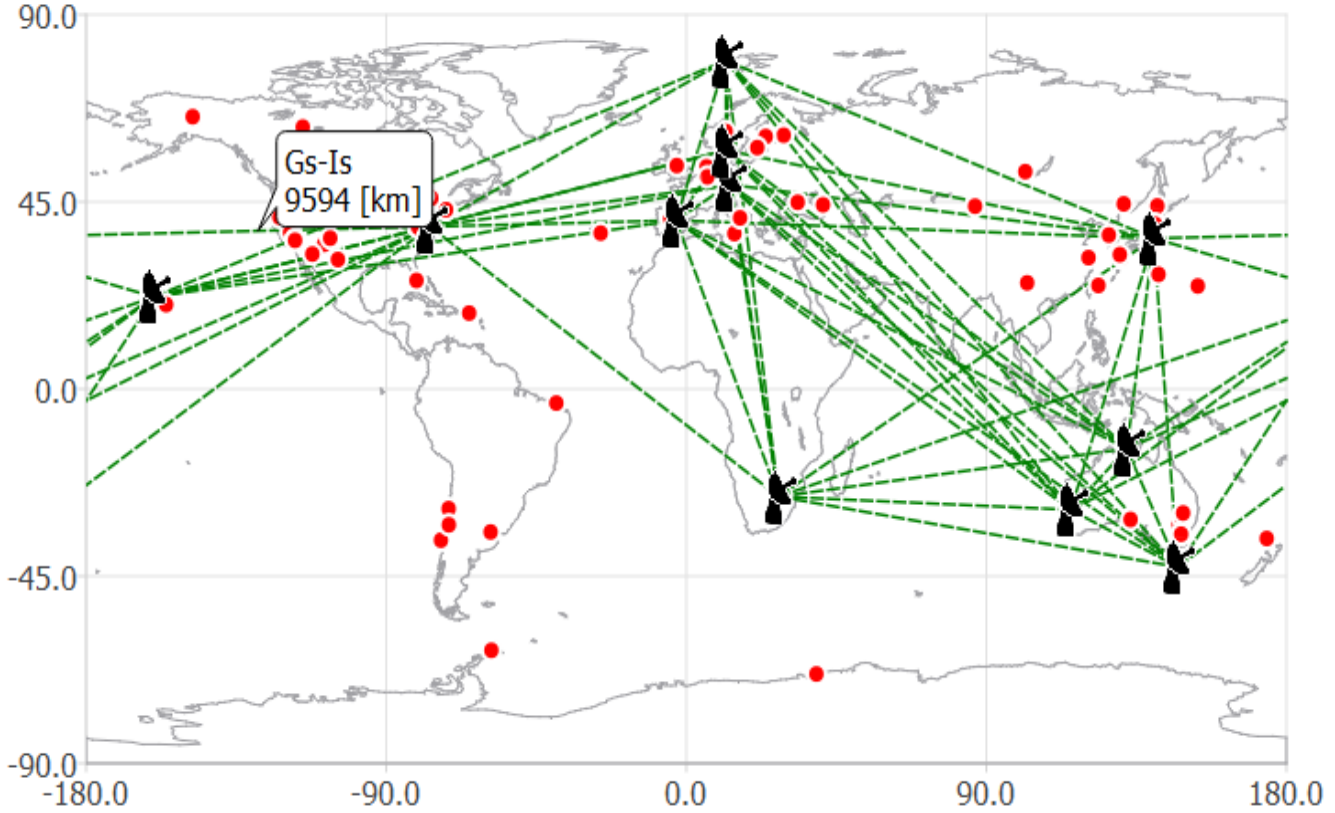
Phase wrap percentage as a function of baseline length

Caveats:

- One source
- One epoch
- Only X-band structure
- Image quality (FITS files)
- Automated routine (Fitting model)
- Baseline geometry

Next Steps

- Study more well observed sources
- Improving the routines for automatically deriving the source models
- Connect these theoretical investigations with real observations



Thank you…