# ASTRON

LOFAR   *MSSS status update*

M*S*S*S MULTIFREQUENCY SNAPSHOT SKY SURVEY

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& George Heald (CASS)
20/7/16

* HBA v0.1 catalogue – average flux densities fairly reasonable, but artificially steep in-band spectral indices (severity of effect dependent on elevation and distance from flux calibrator).

* v0.2 – problem tackled directly using calibrator-to-calibrator gain transfers and beam adjustments. Goal: flux scale correct within 10% from 110-190 MHz, if calibrator < ~30 degrees from target field. Systematics go up beyond this radius.

Secondary calibrator (3C295), transferred calibration
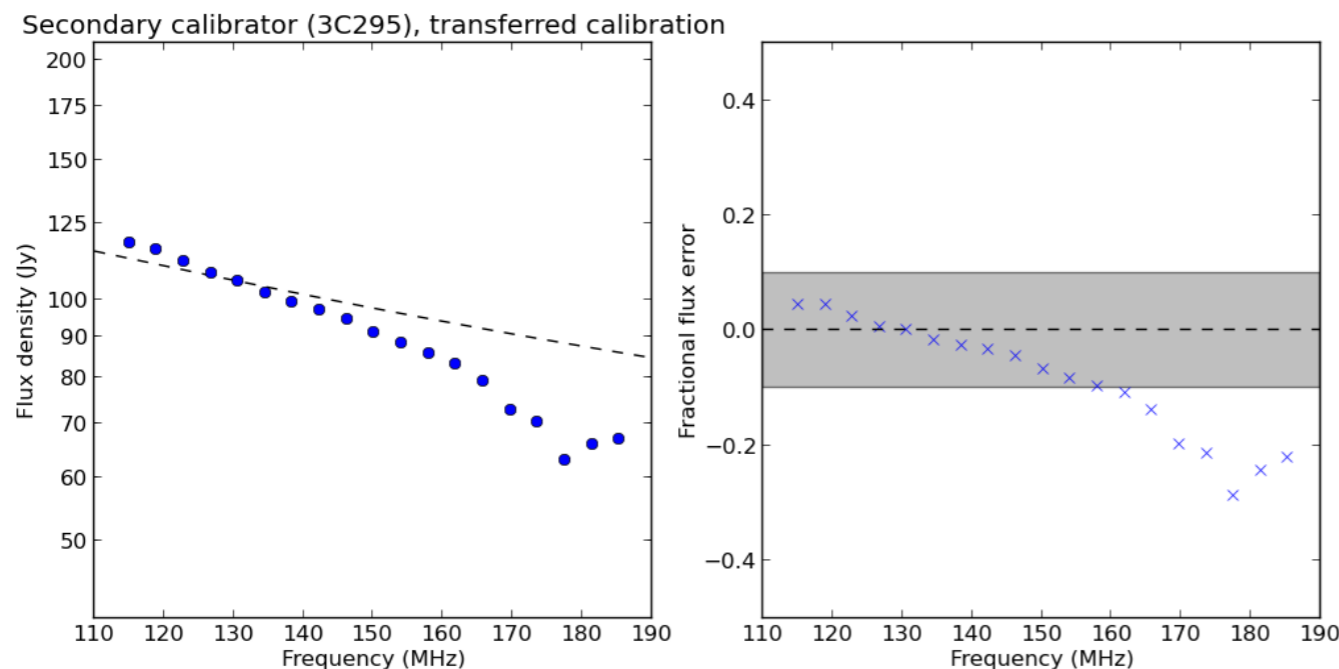
George Heald & Tammo Jan Dijkema

* Mosaicking and cataloguing (Alex Clarke, Rene Breton); quality control (Martin Hardcastle, Rene Breton, Alex Clarke, George Heald). Improvements but spectral index issue remains, esp. south of Dec. ~+35°.

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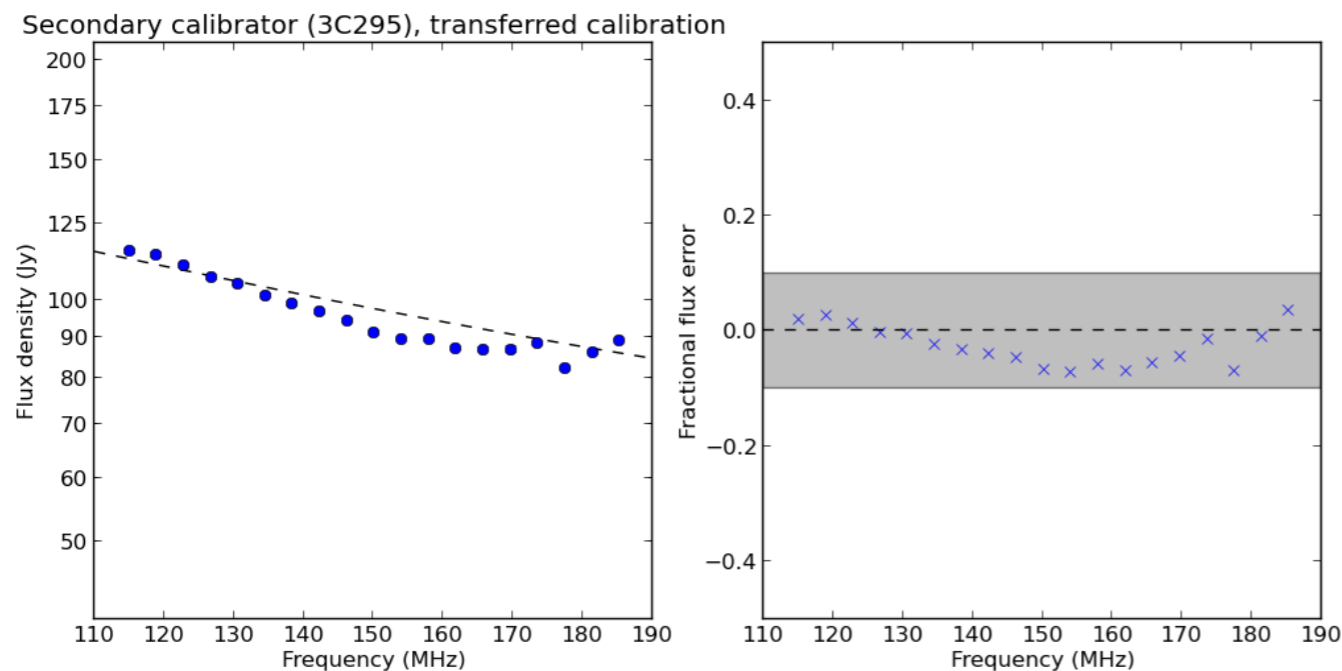
George Heald & Tammo Jan Dijkema (updated HBA beam model)

* Mosaicking and cataloguing (Alex Clarke, Rene Breton); quality control (Martin Hardcastle, Rene Breton, Alex Clarke, George Heald). Improvements but spectral index issue remains, esp. south of Dec. ~+35°.

* Catalogue v0.3: new empirical approach.

* Based on Hardcastle et al. 2016, arXiv:1606.09437: 'LOFAR/H-ATLAS: A deep low-frequency survey of the Herschel-ATLAS North Galactic Pole field'.

* Work led by Martin Hardcastle, with help from Rene Breton, George Heald and Alex Clarke:

- Concatenate beam-corrected LOFAR band images per field (convolved to same resolution) into a single data cube.

- Use PyBDSM spectral index mode to determine flux densities for each 'channel' in cube.

- Field-based analysis: cross-match sources > 0.1 Jy with VLSS and NVSS.

- Markov Chain Monte Carlo methods to determine correction factors to apply in image plane (assuming power law fits to radio spectra).

- Outlier rejection (e.g. from resolution effects, variability, spectral curvature etc.) and refitting implemented.

Results
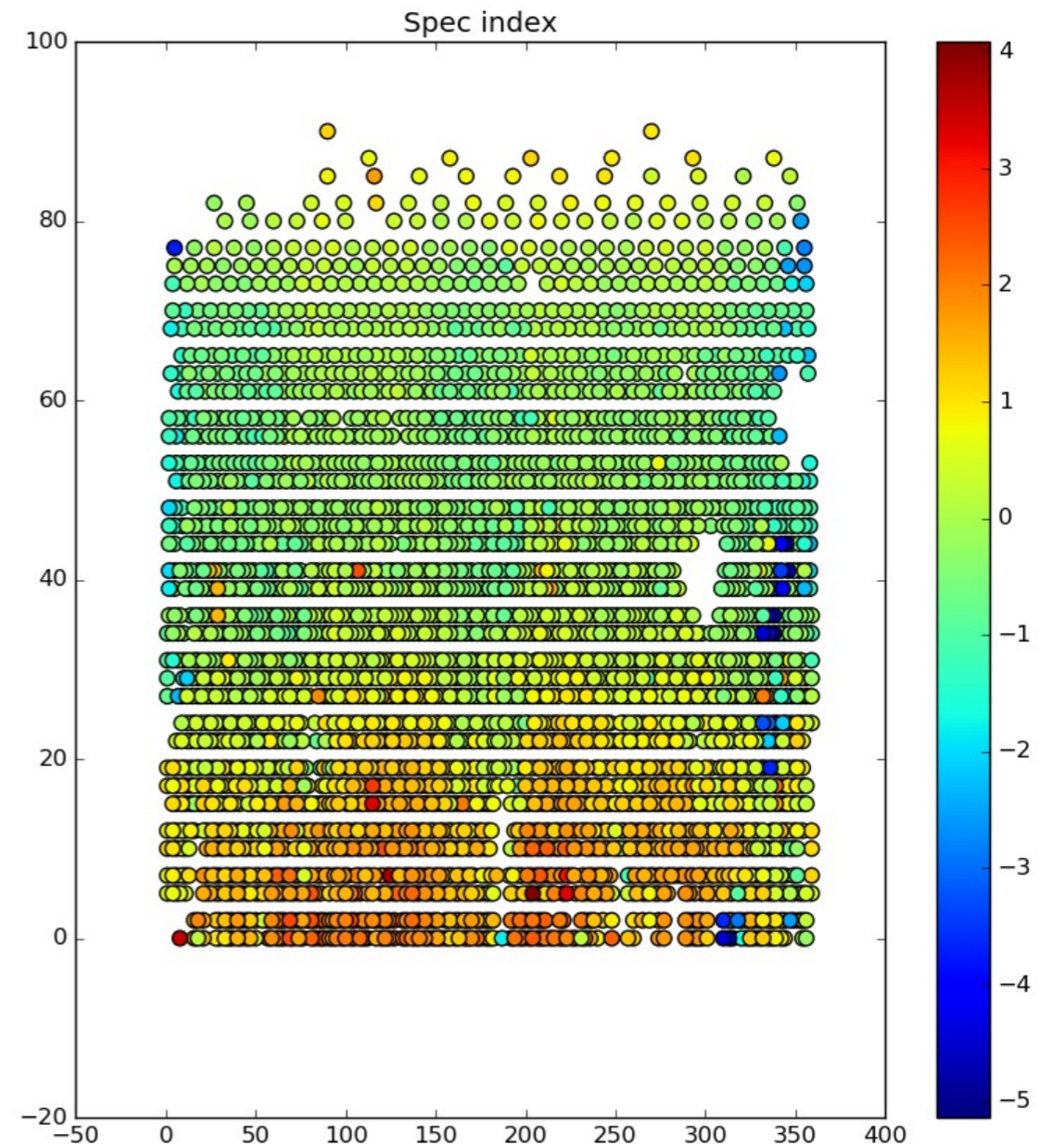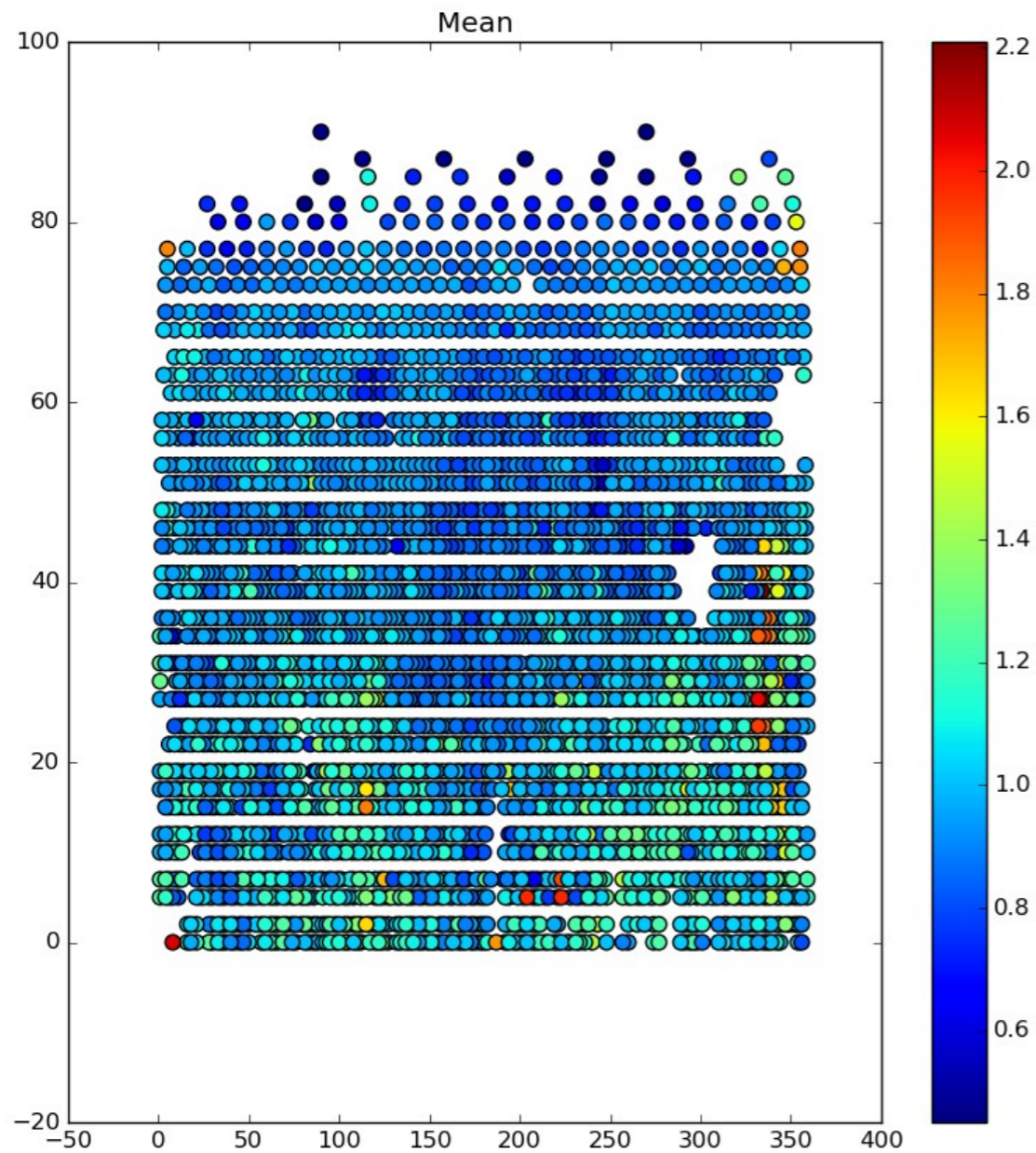
* After outlier rejection, 3372/214 fields with/without correction factors (but latter generally in problematic parts of the sky).
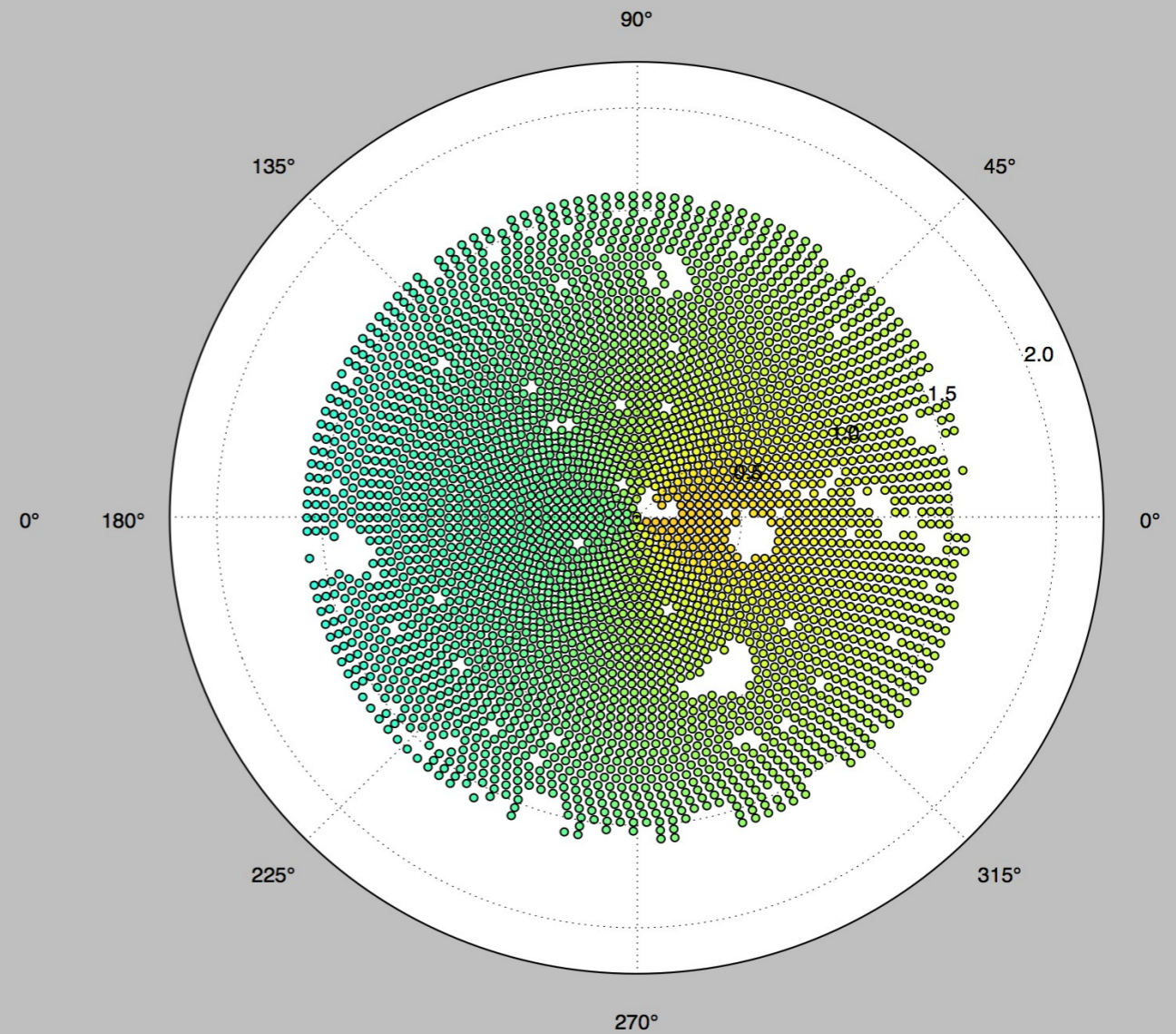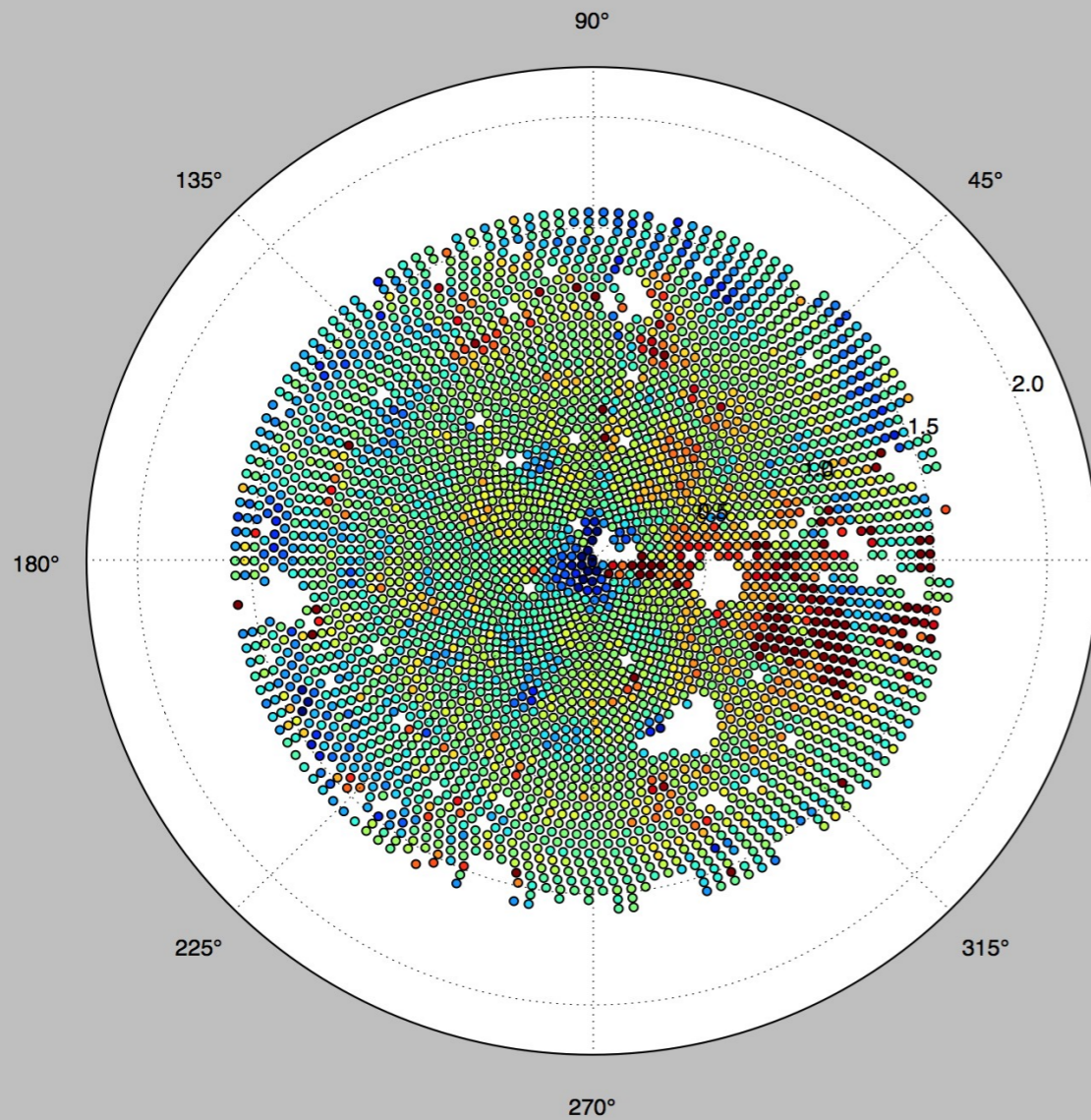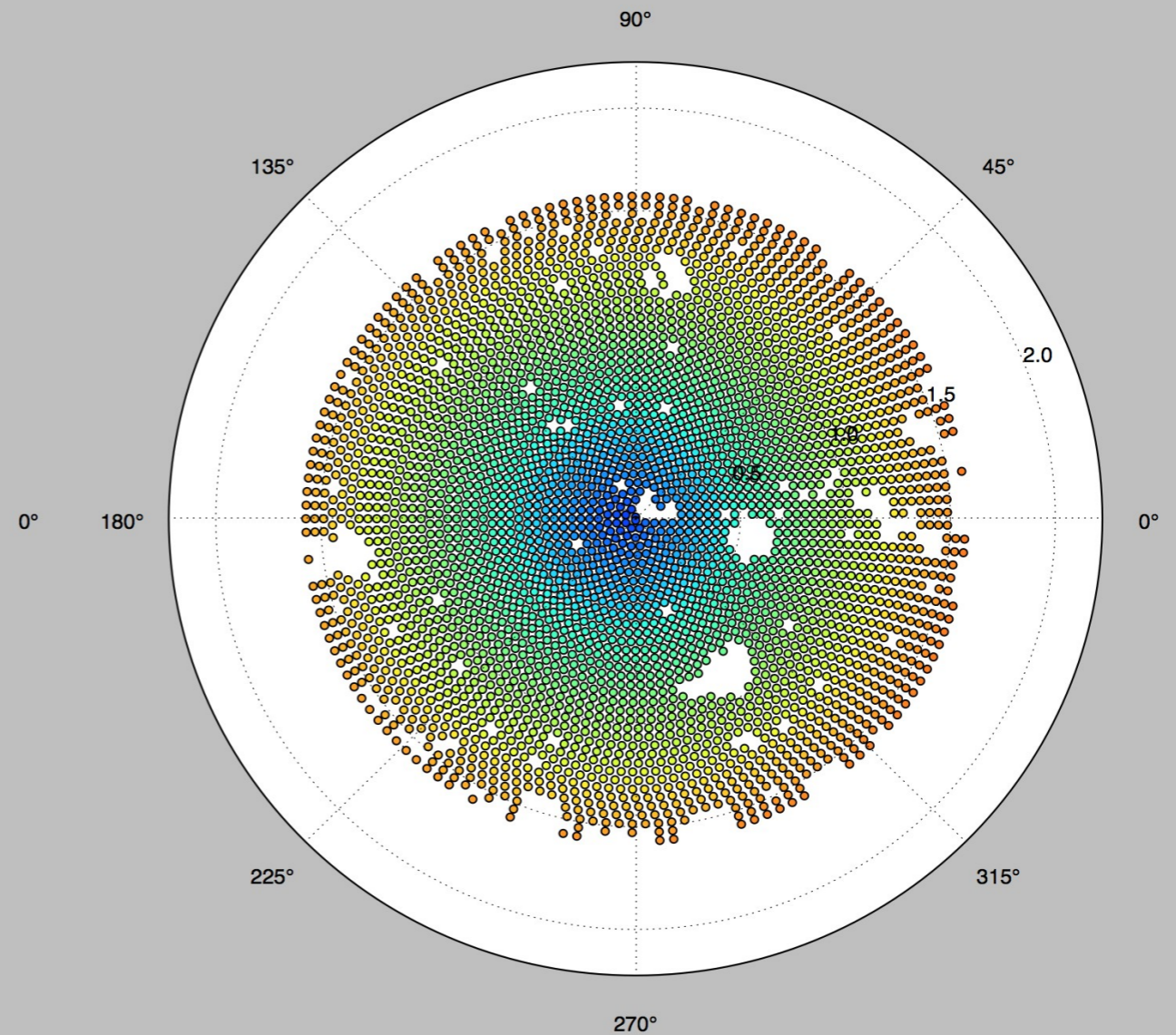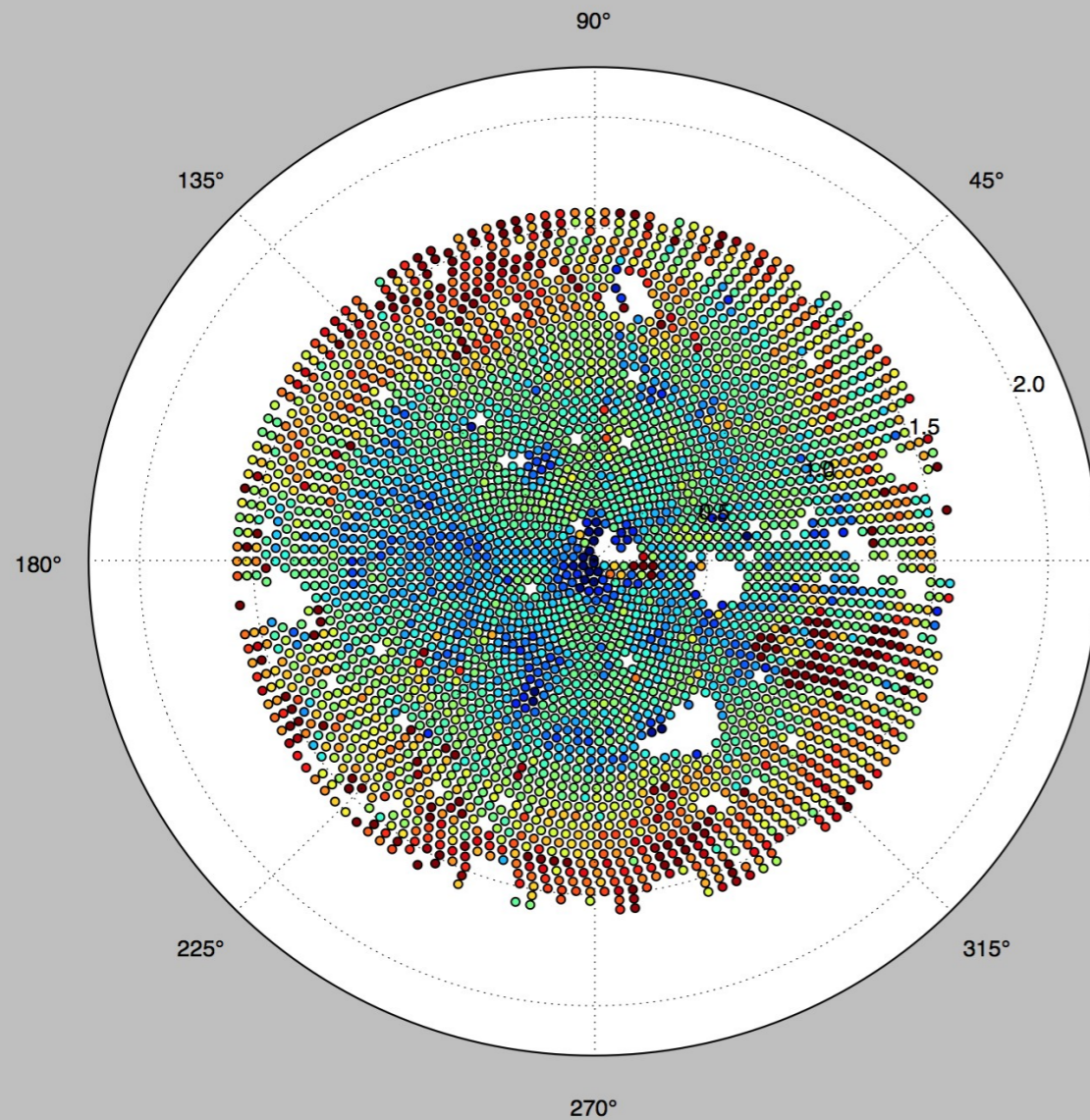
* Actual correction factors

* Fit of form CF = a + b*cos(RA) + c*DEC
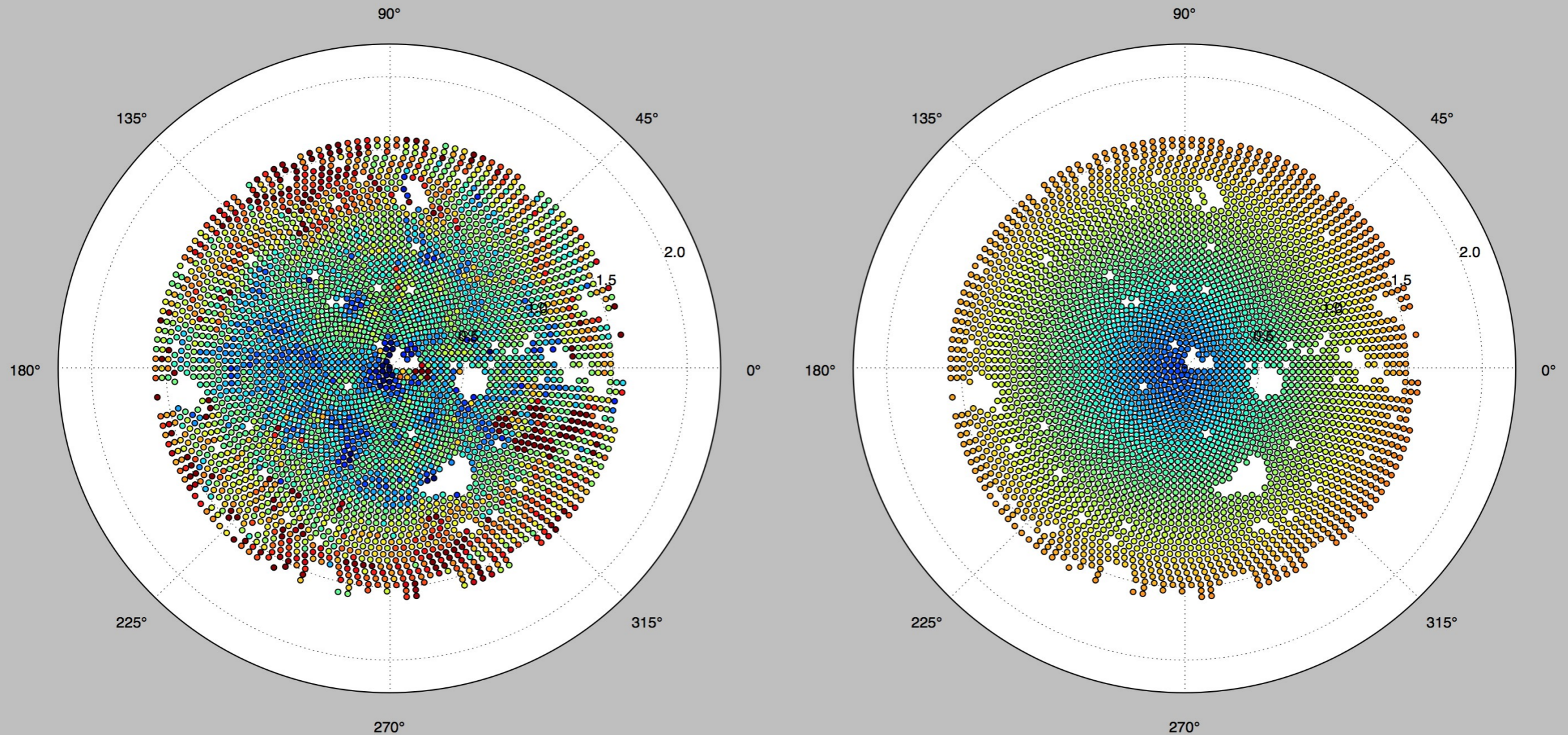
* Band 0 (120 MHz).

* Azimuthal coordinate RA; radial 90 – Dec.

* Actual correction factors

* Fit of form CF = a + b*cos(RA) + c*DEC

* Band 5 (147 MHz).

* Important sub-structure (key independent variables elevation and distance from calibrator, not RA/Dec).

Results

* Actual correction factors

* Fit of form CF = a + b*cos(RA) + c*DEC

* Decision: proceed with correction factors per field, rather than values from fit across sky. Remosaic, compare with TGSS-ADR1 and 7C, especially outliers.

* Estimated time-scale a ~few weeks to have v0.3 catalogue and associated mosaics available.

Higher-resolution reprocessing

* All Dutch station baselines included in MSSS-HBA observations.
* Imaging at 20-30 arcsec (i.e. TGSS-like) resolution feasible with modest computing.
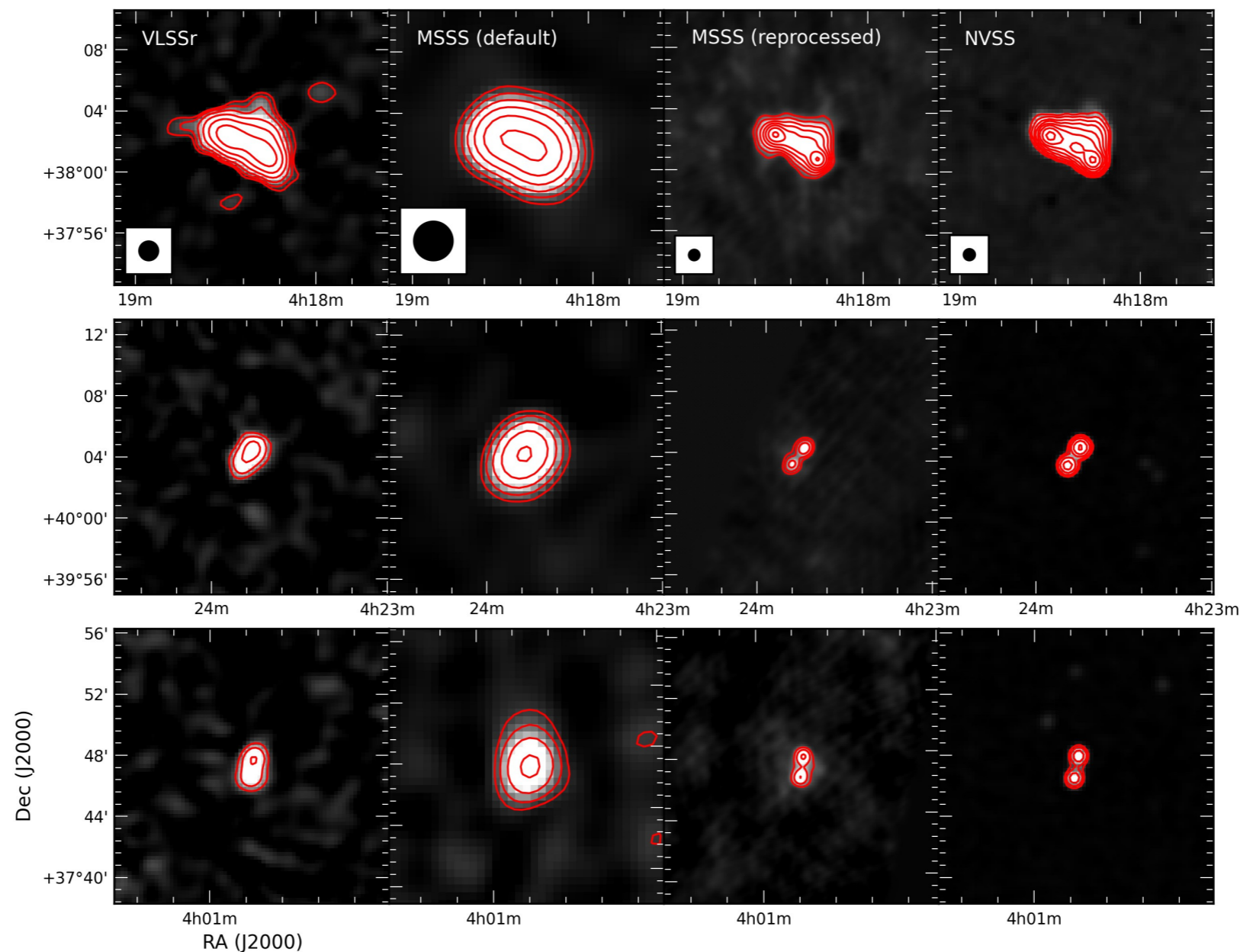
* Using v0.3 catalogue as initial sky model for self-calibration.

* ~Few more weeks to wrap up flux scale work, then we are ready to go.

* But where to do the reprocessing?

- CEP2

Request for up to six weeks processing time, but CIT Groningen switch-off deadline October 1st, and CEP4 commissioning still ongoing.

- CEP3

Observatory to make another node available, in addition to the two currently reserved for MSSS.

- External clusters

Discussions held; several facilities identified and plans being formulated.

* Andreas Horneffer developing and testing MSSS self-cal. pipeline (using generic pipeline framework on JURECA).

* HBA full polarisation reprocessing (Jamie Farnes & Cameron Van Eck; Nijmegen) - RM grids and depolarization properties.

* Resumption of early science programmes with v0.3 of HBA catalogue. Some projects still ongoing in recent months (e.g. transient searches in MSSS verification field data – Alexander van der Horst et al.; GWU).

* MSSS biweekly telecons rebooted in recent months. Regular updates on commissioning/testing and science progress.