

# A new deep view into the low frequency sky

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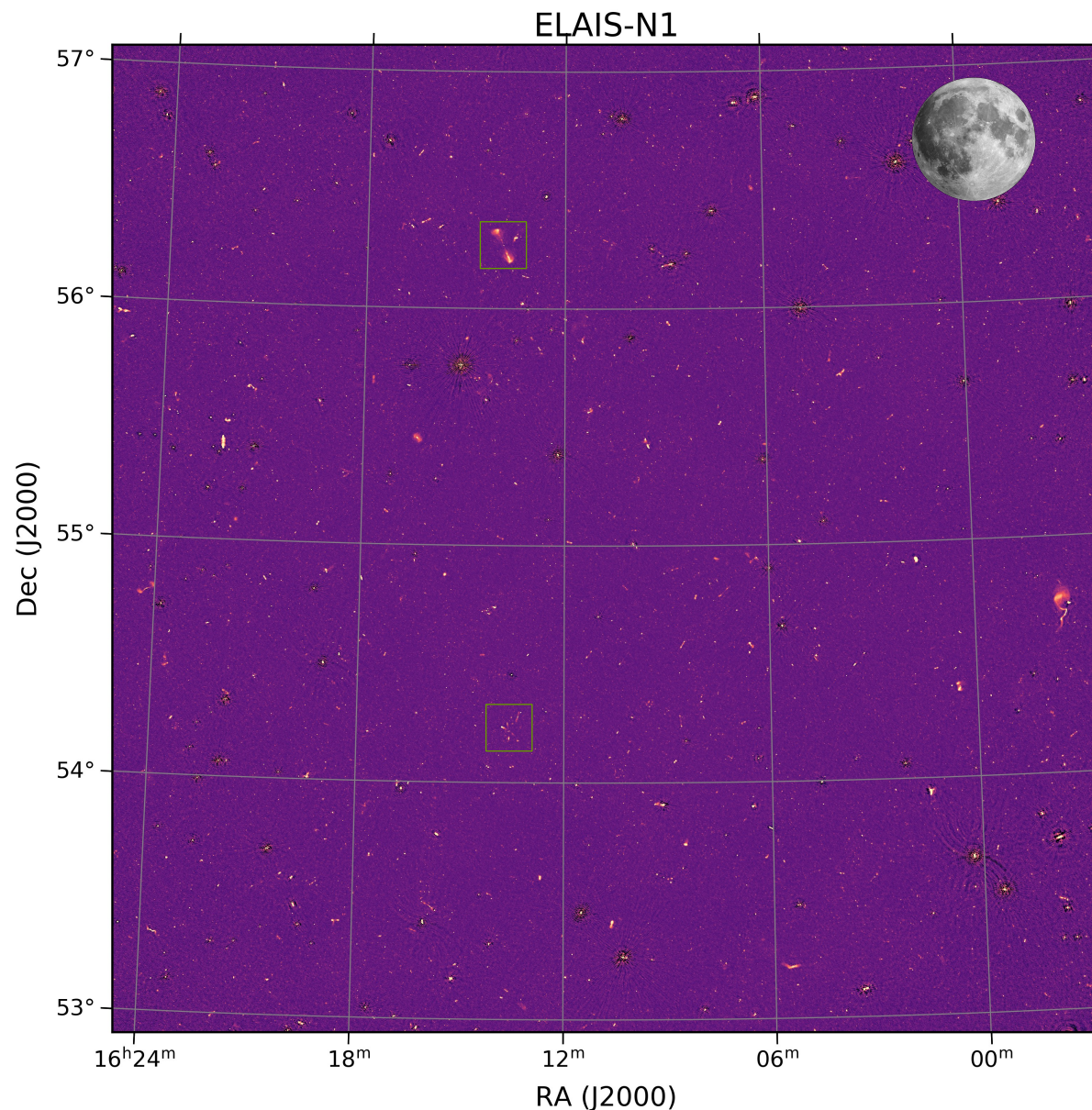
and the LOFAR Two-metre Sky Survey (LoTSS) Deep Fields team.

Abstract.- The LOFAR Two-metre Sky Survey (LoTSS) will cover the full northern sky and, additionally, aims to observe the LoTSS Deep Fields to a noise level of  $\lesssim 10 \mu\text{Jy beam}^{-1}$  over several tens of square degrees in areas that have the most extensive ancillary data. Here we present the ELAIS-N1 deep field, the deepest of the LoTSS Deep Fields to date.

(Sabater et al 2020 A&A submitted)

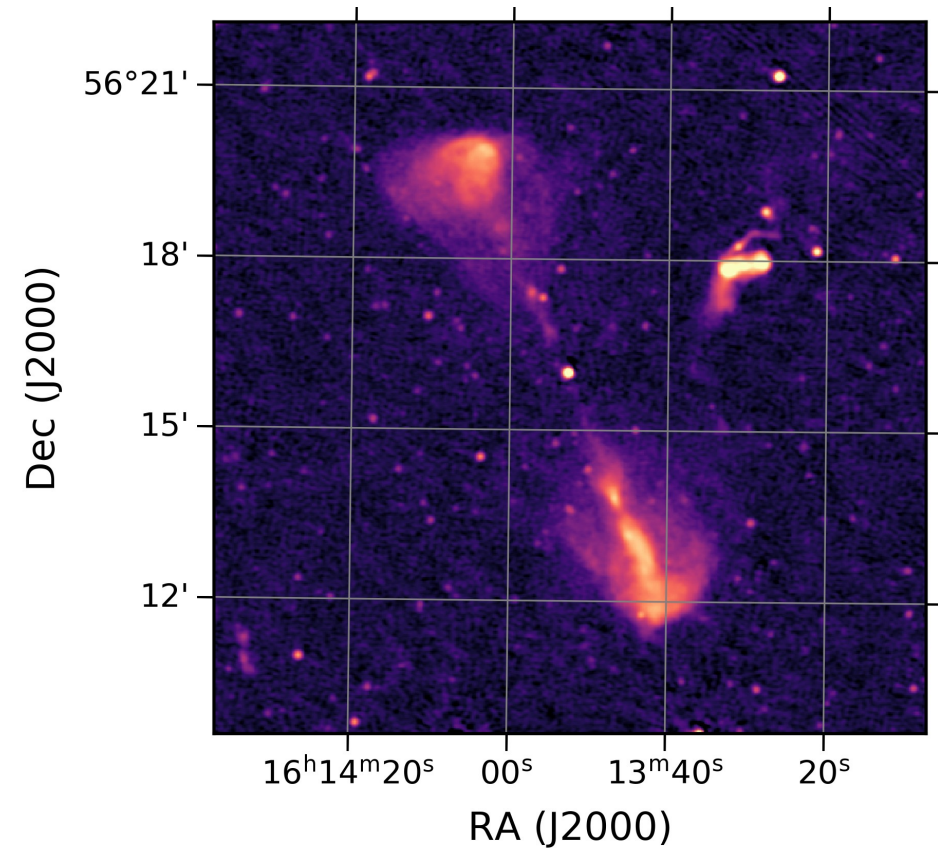
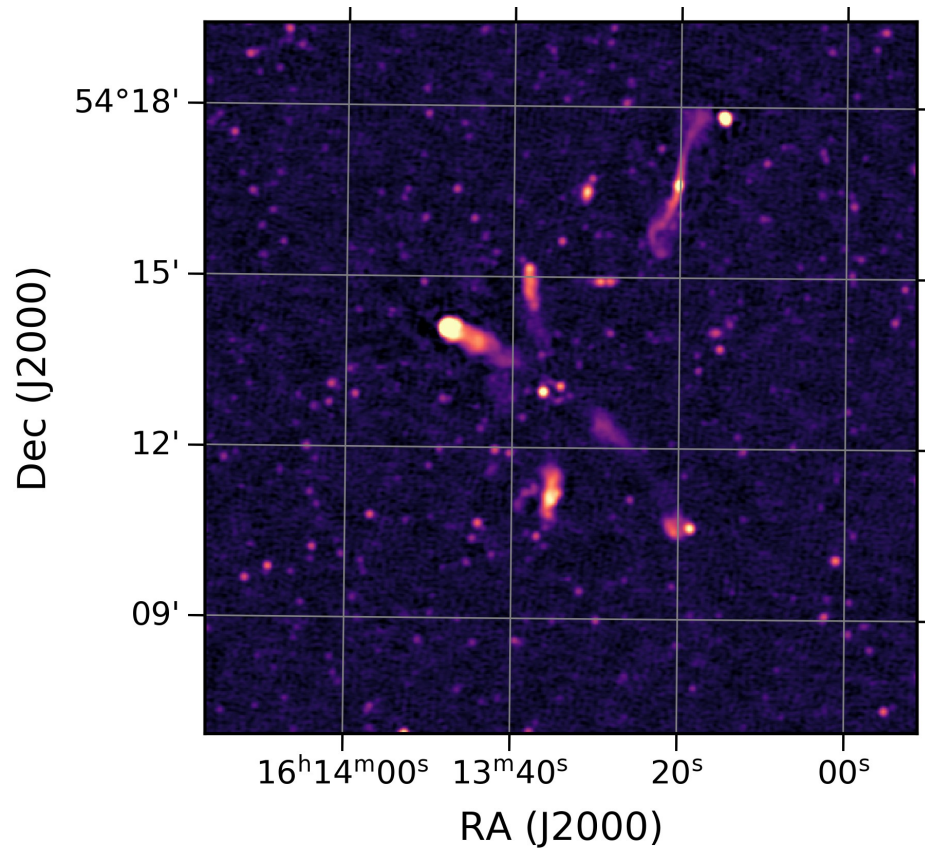
# LoTSS Deep: ELAIS-N1

- Deepest low frequency image to date.
- 167 hours
- 115-177 MHz
- **~85000 sources**
- resolution ~6 arcsec
- 30 deg<sup>2</sup> in image shown (68 deg<sup>2</sup> in total)
- RMS noise 20 μJy/beam



# Example cutouts

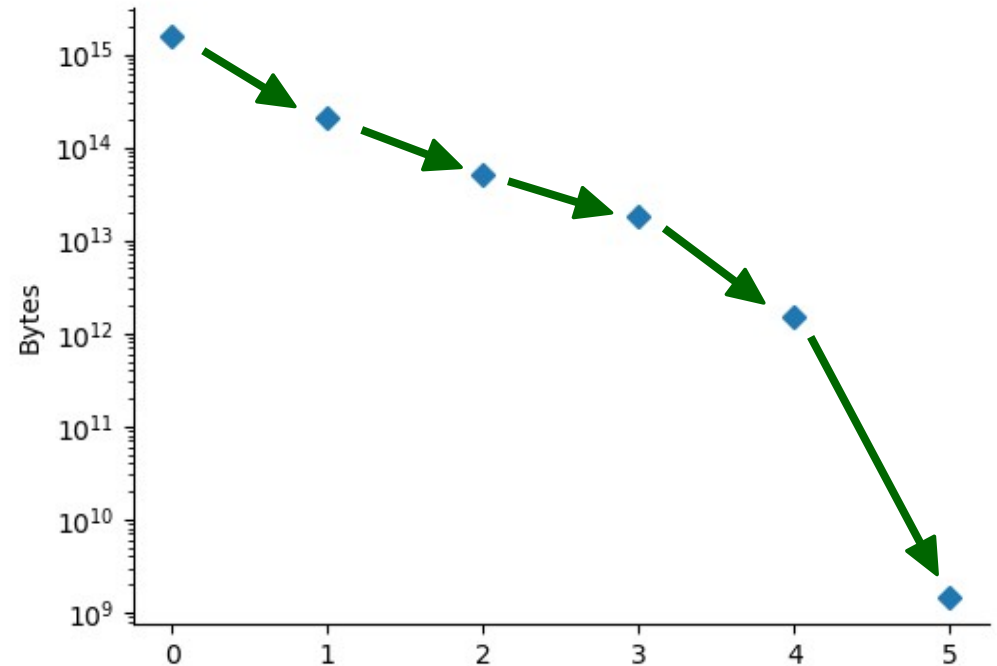
(each one ~0.1 % of the total area)



What looked like background “noise” are actually resolved sources

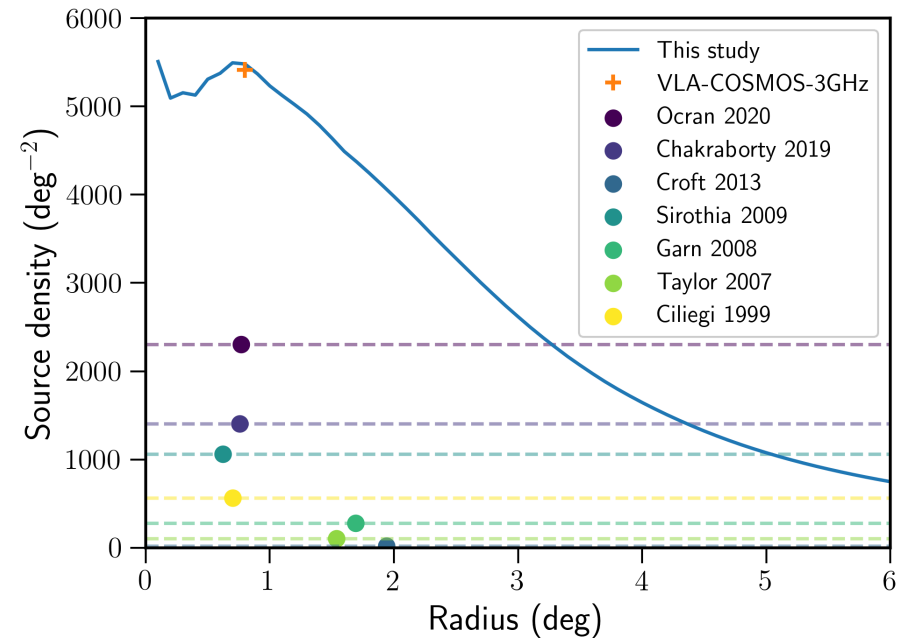
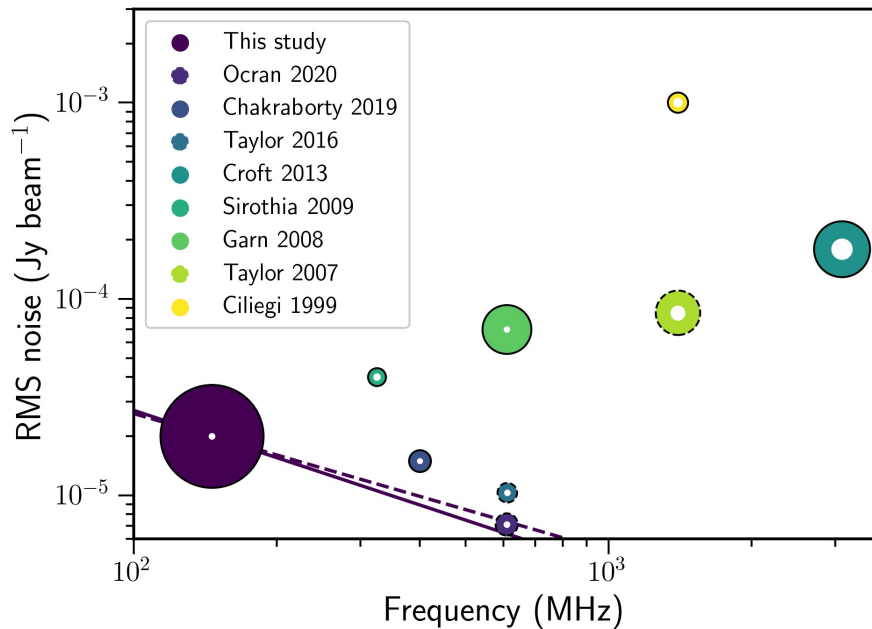
# Calibration and “data reduction” (literally)

- Correct Ionosphere
- **Data size: 2 PB → 1.5 GB**
- Steps:
  - Pre-procesing: 2 PB → 210 TB
  - Direction independent calibration: 210 TB → 52 TB
  - Direction dependent calibration: 52 TB → 18 TB
  - Compression: 18 TB → 1.5 TB
  - Imaging: 1.5 TB → 1.5 GB
- Infrastructure: Amazon Web Services, GRID, local cluster (Cuillin)



# Comparison with other surveys

- In theory, equivalent noise level (correcting for the spectral index) to the deepest survey of the field, but actually we get more than twice the sky density of sources (in a much bigger area).
- Sky density of more than **5000 sources per deg<sup>2</sup>** in the central 5 deg<sup>2</sup>. Same level as VLA-COSMOS that covers 2 deg<sup>2</sup> at 3 GHz.



# Impact and future

- Deepest low frequency survey to date.
- Special issue in *Astronomy and Astrophysics* in a few months with:
  - Optical/IR cross-IDs in the central 7 square degrees region with 97 % of radio sources matched.
  - Photometric redshifts and stellar mass estimates.
  - Evolution of SF and AGN.
  - Transients and variable sources.
  - More science.
- Data to be published in <https://lofar-surveys.org>