

# Wide-field continuum observations with Apertif at 1.4GHz: new data release and combine view with LOFAR

Monday, 6 May 2024 15:05 (25 minutes)

We present new wide-field mosaic images of Boötes and Lockman Hole obtained with the Aperture Tile in Focus (Apertif) system of the Westerbork Synthesis Radio Telescope. The images were produced using direction-dependent calibration pipeline, showing a significant quality improvement compared to the ones of the first Apertif data release. The images represent a linear mosaic of hundreds of the individual compound beam images obtained with Apertif during 2019-2021. The mosaics have an angular resolution of  $27 \times 12$  arc-seconds and a median background noise of  $40 \mu\text{Jy}/\text{beam}$ . For both images, we extract the source catalogs and cross-matched the coordinates with the Low Frequency Array (LOFAR) catalog, resulting in one of the largest samples of spectral index estimates at 50-1500 MHz frequency range. We find a spectral flattening towards low flux density sources. Using the spectral index limits from Apertif non-detections we derive that up to 9 percent of the sources have ultra-steep spectra with a slope steeper than -1.2. Steepening of the spectral index with increasing redshift is also seen in the data showing a different dependency for the low-frequency spectral index and the high frequency one. This can be explained by a population of sources having concave radio spectra with a turnover frequency around the LOFAR band. Additionally, we discuss cases of individual extended sources with an interesting resolved spectral structure. With the improved pipeline, we aim to continue processing data from the Apertif wide-area surveys and release the improved 1.4 GHz images of several famous fields.

## keywords

Radio continuum surveys, catalogs, cross-matching, source finding, imaging, radio spectra

## In-person or online?

in-person

## Career level

Mid-Senior

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**Session Classification:** Surveys