

THE SUN AT THE VLA's METRIC AND DECIMETRIC WAVELENGTHS

S. M. White, M. R. Kundu, N. Gopalswamy and E. J. Schmahl
Astronomy Program
University of Maryland, College Park, MD 20742

During September 1988 (International Solar Month) we observed the Sun with the Very Large Array on 4 days in the period Sep. 11-17. The VLA was in its most compact configuration, which is ideal for studying large-scale coronal structures. Here we summarize some preliminary results of the observations at 0.333 and 1.5 GHz. Despite the presence of numerous active regions the Sun was actually very quiet, with no flares during our observing, and this allowed us to make high-dynamic-range maps.

There is exceptionally good correspondence between the 1.5 GHz radio sources and regions which are dark in the He10830 images and bright in the Ca images. This extends to very small weak features in the 1.5 GHz radio maps, which nonetheless are found to have associated dark regions on the He images. Several filaments show up as depressions in active regions or as empty lanes. The 1.5 GHz sources are generally very extended, appearing as a canopy straddling several nearby regions in one hemisphere. None of the active regions was particularly bright at 1.5 GHz. The peak brightness temperatures of the active region sources on the four days are 1.7, 1.6, 1.5 and 1.8 x 10⁶ on Sep. 11, 12, 13 and 17 respectively. However, on all days the range of peak brightness temperatures in different active regions was remarkably small. Typically there were about eight active region peaks present, each in the range 1.0 - 1.6 x 10⁶ K, and with a low degree of circular polarization.

Generally there are remarkably few structural changes in the active region sources from one day to the next, suggesting that structural evolution is relatively slow. We present contour maps at 1.5 GHz for each of the four days in the Figure. However one sharp change from the 11th to the 12th can be seen in the region at about S20W10 on the 11th. This region shows a highly polarized feature trailing the primary peak over the active region on the 11th. By the 12th this location has developed into a strong eastward-pointing extension, in conjunction with the rapid emergence of new positive magnetic flux in a region of predominantly negative flux. Another interesting change occurs on the 13th, when an ephemeral region appears as a strong compact source close to disk centre.

Two noise storms were present at 0.33 GHz all week and were all highly polarized: the R-polarized storm in the north on all days is a single source, which however shows individual bursts shifting in position within the envelope of the storm. The noise storms in the south are more interesting. The maps from the 17th show them to be of opposite polarizations but well separated spatially, corresponding rather well to the simple underlying bipolar magnetic structure evident in the magnetogram. Clear evidence for the degree of divergence of magnetic field lines in the corona can be seen in the structure of this region. There is definite limb brightening present in the .33 GHz maps on all days.

This research was performed with support from NSF grant ATM-87-17157, NASA grant NAGW-1541 and NASA contract NAG 5-969. The very Large Array is a facility of the National Radio Astronomy Observatory, which is operated by Associated Universities, Inc., under contract with the National Science Foundation.

