CoMStOC: THE CORONAL MAGNETIC STRUCTURES OBSERVING CAMPAIGN

J.T. SCHMELZ
Applied Research Corp./Lockheed
SMM-XRP Code 602.6
NASA/GSFC
Greenbelt, MD 20715

ABSTRACT. The Coronal Magnetic Structures Observing Campaign (CoMStOC) was designed to measure the magnetic field strength and determine its structure in the solar corona. Simultaneous soft X-ray and microwave data separate the contributions of the two dominant microwave emission mechanisms – gyroresonance and thermal bremsstrahlung. Where gyroresonance dominates, the magnetic field can be determined.

The magnetic field strength and structure in the solar corona are fundamental properties in theories of the origin and evolution of coronal magnetic fields, the coronal heating process, and the origin of solar flares. Determining the solar magnetic field requires intensive, coordinated, multi-waveband observations of active region coronal loops such as those undertaken in CoMStOC. Simultaneous soft X-ray images from the Solar Maximum Mission's X-Ray Polychromator and microwave observations from the VLA can separate the gyroresonance and thermal bremsstrahlung contributions to the microwave emission. The temperature and emission measure determined from the X-ray observations reveal the importance of the bremsstrahlung radiation. Where gyroresonance dominates, the local magnetic field strength is simply H(Gauss) = 357 ν (GHz)/n, where ν is the microwave frequency and n is the harmonic.

Observations at different microwave frequencies sample various regions of the plasma with different field strengths allowing the determination of the three-dimensional field structure. This method provides the only direct means of determining the magnetic field strength and structure in the corona. Otherwise, the field must be extrapolated from photospheric magnetograms. The CoMStOC program allows a comparison of the coronal fields obtained from these two methods.

CoMStOC has provided an unprecedented set of observations of five new cycle active regions, offering a varied sample of intensity, activity, complexity, and projection angle. The data set includes a pair of regions on the southwest limb showing a clear connection in both the X-ray and microwave data; one of these regions was re-observed from a perspective differing by 90 degrees, at a later stage in its evolution. In addition, a weak region near central meridian was observed with structure that was surprisingly complex. The analysis of a single flaring region on the west limb is made especially interesting by the addition of the AS&E rocket results. Whatever the final scientific return from the detailed studies now in progress, CoMStOC has already provided a wealth of experience in obtaining coordinated, multi-waveband observations of solar active regions.

R. Beck et al. (eds.), Galactic and Intergalactic Magnetic Fields, 20.