A study of preflare and postflare evolution in active region using Metsähovi and RATAN-600 data

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The set of mutual observations made with Metsähovi and RATAN-600 shows their effectivity for the study of flare energy release on the scales of several days before and after the flare itself. These phenomena embrace the vast space region on the all levels of solar atmosphere. Many solar phenomena (filaments eruption, coronal mass ejections, proton events and others) are including in flare process. Up to now these phenomena are not clear completely for researches. What scenario of the preflare situation is more typical? Are there some prediction pecularities at radio waves? Which magnetic topology (strong magnetic shear, emergence of new magnetic flux, magnetic flux dissipation, strong electric current near neutral line and others) determines the flare activity? Where the preflare region is situated in chromosphere or in corona? What are the radio signatures of flare eruption?

The mutual Metsähovi and RATAN-600 observations are covered more then 6 octaves from 87 GHz to 0.9 GHz both in intensity and circular polarization. Some results of such observations are discussed here. In mutual observations during May 1997 the temporal parameters for plasma flow rise from the deep levels of the chromosphere to corona was detected. The temporal characteristic of plasma cooling was determined too. These intervals are of about 10 minutes. This information is very useful in order to solve the energy transport problem and the problem of energy balance in deep chromosphere. Also the comparison of Metsähovi and RATAN-600 data show that the origin of emission enhancement is quite different in deep chromosphere and in upper chromosphere and low corona levels.

Second quite interesting phenomenon which was found in the mutual program is the temporal dynamic of the microwave spectrum. We found that the spectrum is decreased before flare on the scale of two days and increased after the flare on the same scale. Such behavior of the spectra is not usual and can be driven by cold plasma flowing up from the deep levels. Also we need the statistic data of such kind events.

The third kind of phenomenon determined from the observations is the reaction of multiwave spectra on moving plasma flow from the upper chromosphere to the corona. It was found that the evolution of fine spectral structure of microwave emission is sensitive enough to the long-term flare processes. Our observations shown that the wide range spectral structures of AR emission in the course of three days before a flare and three days after the flare are identical. But within this time interval the spectral fine structure was smoothed. Such disappearance and appearance of fine spectral structure suggest the complicated multi-loop structure of AR. At the same time, no changes in the magnetic structure on the photosphere level were observed before, during and after the flare.

Thus, the mutual Metsähovi – RATAN-600 observations revealed the plasma mass flows in all stages of flaring active region. The study of emergence of new magnetic flux, flare prediction in wide spectral range looks very promising for future collaboration.

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References

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