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Constraints on the heating time-scale in active region cores

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Abstract. We present new measurements of the time variability of magnetic flux, intensity, Doppler and non-thermal velocities in moss in the core of an active region observed by Hinode in June 2007. The magnetic flux measurements were obtained by the Solar Optical Telescope (SOT) in the Na I 5896 Å line. The intensity and velocity measurements are derived from spectral profiles of the Fe XII 195 Å line obtained by the EUV Imaging Spectrometer (EIS). This is the first time it has been possible to make such velocity measurements in the moss, and the data presented are the highest cadence spatially resolved maps of moss Doppler and non-thermal velocities ever obtained in the corona. Our measurements of moss intensities show a variability of less than 15% over a period of 16 hr. Our new measurements of Doppler and non-thermal velocities reveal no strong flows or motions in the moss, nor any significant variability in these quantities. We find that the spatial distribution of the magnetic flux evolves slowly, and that the variation in individual pixels is $\sim 20\%$ on time-scales longer than the cooling times for hydrodynamic loops simulated from extrapolations of SOT Spectropolarimeter Fe I 6302 Å magnetograms of the moss regions. These results suggest that the heating in the cores of active regions is effectively steady. At sufficiently small spatial scales the heating may be impulsive, but if so it does not give rise to large nonthermal broadening or Doppler shifts at the spatial scales that we have observed. Since magnetic flux is known to relate directly to coronal soft X-ray emission, the SOT results could also be interpreted as indicating that the heating is effectively steady on spatial scales comparable to the cross-field scale of moss heating inferred from EIS filling factor measurements (~ 16 %).