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Coronal heating above active regions – 3D MHD model versus multi-spacecraft observations

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The plasma heating mechanism in the Solar corona is a puzzle since decades. Today high-performance computing together with multi-spacecraft observations offer new insights. We conducted a high-resolution simulation of the corona above an active region and compare synthetic emission deduced from the model with co-temporal observations. Photospheric observations act as a boundary condition for our model that drives magnetic-field braiding by advection and generates a net upwards Poynting flux. In particular, we do not only get a sufficient energy input to the base of the corona, but we also reproduce the observed coronal loops: the 3D structure of the hot AR loops system in the model compares well to joint STEREO-A/-B and Hinode observations. The plasma flows along these loops are similar to observed Doppler maps. Draining and siphon flows along magnetic structures at different temperatures offer a new alternative explanation for the average Doppler red-shifts in the transition region and coronal blue-shifts. This match between model and observations indicates a realistic distribution of the coronal heating in time and space and shows that our 3D MHD model of the corona captures the relevant processes involved.