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Force-free coronal magnetic field modeling using vector fields from Hinode and SDO

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Given the lack of routine direct measurements of the magnetic field in the solar corona, force-free reconstruction methods are a promising tool for the diagnostics of the magnetic structure there. Routine photospheric magnetic field measurements which monitor the temporal evolution of an active region and contain information on the non-potentiality of the field above are used as an input. Based on the assumption that magnetic forces dominate the solar atmosphere, these models allow estimates of the total and free magnetic energy content and the structure of the magnetic field above active regions. The outcome of force-free field modeling strongly depends on the vector magnetic field data used as boundary condition. We compare the model results based on simultaneously observed vector maps from the Helioseismic and Magnetic Imager (HMI) on board Solar Dynamics Observatory and from the Solar Optical Telescope Spectropolarimeter (SP) on board Hinode. We find substantial differences in the absolute estimates of the magnetic field energy but very similar relative estimates, e.g., the fraction of energy to be set free during an eruption or the fraction of flux linking distinct areas within an active region. Our study reveals that only relative estimates of coronal physical quantities from force-free models might be save and conclusions about the magnetic field topology might be drawn with caution.