A New Approach for Modelling Chromospheric Evaporation in Response to Enhanced Coronal Heating

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We present the results of 1D field-aligned simulations of the coronal plasma response to impulsive heating events. During these events, an increase in the coronal density occurs because the increased coronal temperature leads to an excess downward heat flux that the transition region (TR) is unable to radiate. This creates an enthalpy flux from the TR to the corona. The density increase is often called chromospheric evaporation. Sufficiently high resolution of the TR is essential in numerical simulations in order to obtain the correct coronal density (Bradshw & Cargill, ApJ, 2013). If the resolution is not adequate, then the downward heat flux jumps over the TR and deposits the heat in the chromosphere, where it is radiated away. Bradshaw & Cargill showed that major errors in simulating the coronal density evolution will occur. Therefore, to compensate for the jumping of the heat flux, when coarse resolutions are used, we propose that the TR should be treated as a discontinuity. We show that, by modelling the TR with an appropriate jump condition, we can (1) remove the influence of poor numerical resolution and obtain the correct coronal density, even when using resolutions that are compatible with 3D MHD simulations and (2) significantly reduce the computation time, by about a factor of 10, when compared to a fully resolved 1D code because we do not need to resolve the small length scales in the TR (Johnston et al, A&A, 2017a,b).