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Poster

3. Magnetic coupling and mass flux through the atmosphere

# Doppler shifts, line widths and the orientation of the magnetic field

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Observations show a clear center-to-limb variation of the Doppler shifts of transition region emission lines with the cosine of the heliocentric angle. As argued since more than a decade, this would be consistent with the flows causing the shifts being predominantly vertical. This would fit into the picture of the transition region emission originating mostly from the footpoints of coronal loops, where the magnetic field would be predominantly vertical at the low heights where the transition region is located. The line width observations show no (or at least no clear) center-to-limb variation. If field-aligned flows would cause non-thermal broadening, then the width should drop to the limb. If motions across the (guide) field would dominate the broadening, like for Alfvénic waves, then the line width should increase toward the limb. The observation of a missing center-to-limb variation thus implies that the two effects would have to balance, which sounds unlikely but could be possible in principle.

To test the hypothesis if the flows in the transition region are indeed predominantly vertical, we investigate the results from 3D MHD models. Here we concentrate on one model for an active region and another one for quiet Sun or enhanced network. To our surprise, both these models show that the bulk part of the transition region emission originates from regions where the magnetic field is not vertical, but has an inclination of very roughly 45° or even more horizontal. While this result helps in understanding the missing center-to-limb variation of the line width, it challenges the traditional interpretation of the center-to-limb variation of the Doppler shifts.