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Quiet Sun Chromospheric Network Magnetic Field

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Abstract. The 3-D structure of quiet Sun chromospheric network magnetic field is studied by comparing the observed and computed chromospheric magnetograms. The comparison shows that the best correlation occurs at ≈1800 km above the photosphere at which the Fe I 8688 line forms.

Keywords : Sun, Network, Magnetic field

1. Introduction

Deeper in the solar atmosphere, the external gas pressure exceeds the magnetic pressure with a weaker internal gas pressure ensuring the pressure balance. Higher in the atmosphere, the flux tube comprising the magnetic element is believed to be open out, a process which continues with height until interaction occurs with fields originating in nearby elements. This forms a canopy over a non-magnetic region. From the energy balance calculation Gabriel (1976) has given 1500 km as the typical height at which the canopy occurs.

2. Data Analysis and Results

We collected 103 pairs of photospheric (Fe I λ8688) and chromospheric (Ca II λ8542) line-of-sight magnetograms from NSO/KP (Jones et al., 1992) spanning the period from 1996 to 2000. We multiplied the photospheric and chromospheric magnetic images by 1.46 and 2.15 respectively, in order to convert them in to units of gauss (Wang et al., 1997). After derotating and registering the two, we extracted a 128×128 pixel area near the disk center and used it for the potential extrapolation and comparison. Figure 1(a) shows an example for photospheric and chromospheric magnetogram pairs. The comparison of these two magnetograms show that in

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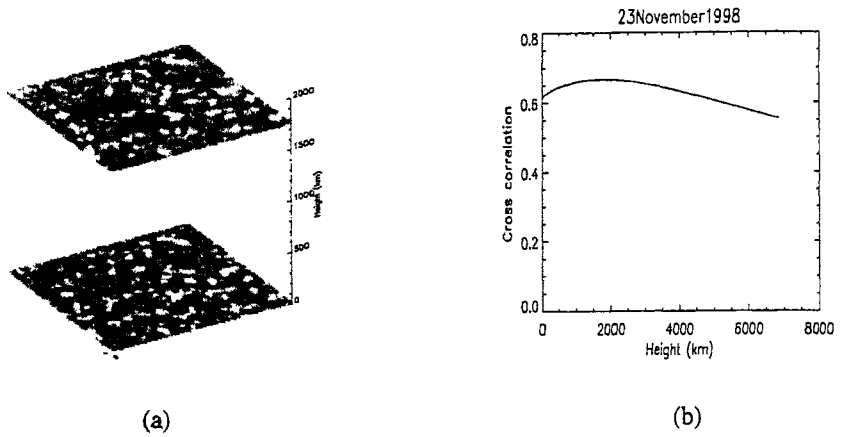

Figure 1. (a) Photospheric (bottom) and Chromospheric (top) magnetograms taken with a time difference of ≈1.5 hour. (b) A plot of cross correlation between the extrapolated magnetic field and the chromospheric magnetic field vs height (km).

most of the regions magnetic structures are similar. Mismatch in some of the regions may be due to the possible disappearance of the features in the magnetograms recorded with large time difference between them or due to the sensitivity of the magnetograph in detecting the magnetic field. The potential extrapolation of the photospheric magnetograms to different heights shows that the cross correlation (CC) becomes maximum at ≈1800 km (Fig. 1(b)). Out of selected 103 magnetogram pairs, 88 pairs showed a maximum CC at 1800 km above the photosphere. In summary, chromospheric magnetic features are very similar to the photospheric features and the probable height of formation of network elements observed in Ca II λ8542 is at or around 1800 km above the photosphere.

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