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Active region outflows as a source of the slow speed solar wind: elemental abundance measurements by Hinode/EIS.

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The solar wind impacts the terrestrial environment and influences the propagation of disturbances such as coronal mass ejections towards Earth. Hydrodynamic models of the solar wind are very sensitive to the boundary conditions at the formation site. Locating the source region of the slow speed wind, however, is still an outstanding problem in solar physics. Recently, Hinode X-ray Telescope (XRT) and EUV Imaging Spectrometer (EIS) observations have shown that there are areas of high speed outflow at the edges of many active regions. It has been suggested that these outflows may line on open field lines that extend out to the heliosphere, and that they therefore could be a significant source of the slow speed wind. We present new direct evidence of a connection between these outflows and the solar wind from EIS elemental abundance measurements of AR 10978. We show that the enhancement factor of low first ionization potential elements is always 3-4. This is consistent with measurements made in situ in the solar wind. Furthermore, when the outflows were favorably oriented towards the Earth, the EIS measurements made on the Sun were found to match those made a few days later by the ACE Solar Wind Ion Composition Spectrometer at Earth. The agreement between spectroscopic and ion composition measurements, from two different instruments on two different spacecraft, suggests that the plasma in the outflows really contributes to the solar wind.

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