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Upflows with different morphologies at active region boundaries observed by Hinode and Solar Orbiter

Plasma upflows with a Doppler shift exceeding 20 km/s at active region (AR) boundaries are considered potential sources of nascent slow solar wind. These upflows are often located at the footpoints of large-scale fan-like loops, showing temperature-dependent Doppler shifts from the transition region to the lower corona. In this study, we identified two upflow regions in the vicinity of an active region by analyzing the Doppler shift of the Fe XII 195 line observed by Hinode/EIS. Context images for the two regions are obtained by the High Resolution Imager (HRI) telescope of the Extreme Ultraviolet Imager (EUI) onboard Solar Orbiter. The region to the west of the AR appears as typical fan-like loops, while the eastern upflow region is near AR moss, revealing small-scale dynamic fibril structures. Carefully addressing the point spread function issue with the SPectral Imaging of the Coronal Environment (SPICE), we derive the Doppler shifts of Ne VIII, emitted by cooler plasma compared to Fe XII, in these two regions. The fan-like loops in the west show downflows (redshifts) of approximately 20 km/s, whereas the eastern region shows upflows (blueshifts) from 20 to 30 km/s. Further studies compare the density and thermal structures of the two regions. The different morphologies and plasma properties of the two upflow regions reveal the diversity in AR upflows, implying potentially different driving mechanisms.

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