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Origins and Properties of Active Region Solar Wind

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A primary goal of both the recently-launched Parker Solar Probe (PSP) and upcoming Solar Orbiter (SolO) missions is to identify and explain the origins of the solar wind. Recent studies have suggested that active regions (ARs) are the source of a significant fraction of the solar wind. Of particular interest is the AR contribution to the slow solar wind; the origins of which are still largely unknown. We present a case study of a rare opportunity to explain how the solar wind may emerge from, or be otherwise altered by, an AR, and also to identify the properties resulting from such a process. A simple backmapping procedure is applied to combine EUV remote sensing (SDO-AIA and Hinode-EIS) and in situ (ACE and WIND) observations of the corona and solar wind for two consecutive Carrington rotations. Contrasting observations during the latter rotation, when an AR is present at a trailing coronal hole (CH) boundary, to those during the former, when the AR is yet to emerge, allows us to isolate the influence of the AR on the solar wind from the CH boundary in a unique way. This observational strategy is particularly timely, as the combination of in situ and remote sensing observations, often from multiple spacecraft, will be critical to the identification of solar wind origins with PSP and SolO. With this methodology we find that, as a result of the presence of the AR, there is significant alteration of solar wind features such as velocity, composition, structure, and magnetic field orientation. The changes observed when the AR is present are consistent with the occurrence of interchange reconnection between AR and CH magnetic fields, which we argue is the likely mechanism by which the AR solar wind is produced.