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Variations of alpha particle parameters in the non-Alvénic wind

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Spacecraft observations made at 1 AU from the Sun showed that the solar wind parameters are highly variable. D'Amicis and Bruno (2015) suggested that two solar wind regimes can be distinguished according to the nature of the embedded turbulent fluctuations. If the velocity and magnetic field variations are strongly correlated, Alfvénicity of the fluctuations is high, thus the first solar wind regime is called Alfvénic. Its characteristics suggest that it probably originates from coronal holes. The alpha particle parameters correspond to those usually associated with the fast solar wind. The alpha relative abundance is high (about 4 %) and alpha particles are faster and hotter than protons. The second solar wind regime has embedded non-Alvénic fluctuations. It could come from coronal streamers, but its formation remains unclear. Observations at 1 AU show that the non-Alvénic wind typically has the small alpha-proton relative drift and nearly equal temperature of both ionic components. In our study, we focus on variations of the alpha particle parameters in the non-Alvénic wind and on changes during transition from the Alfvénic to non-Alfvénic winds. We found observations of alpha particles slower than protons, for example near the termination of the corotating rarefaction regions. Using the WIND measurements, we perform a statistical study and compare the plasma properties associated with different ranges of the alpha-proton relative drift. Furthermore, we use measurements from the WIND and Solar Orbiter missions to study changes of the non-Alfvénic wind with increasing distance from the Sun. We discuss their possible origin both in terms of formation near the Sun and during propagation through the interplanetary space.