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Investigating the effects of the planetary rings on the azimuthal magnetic field at Saturn

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Magnetic field observations from the 22 Cassini Grand Finale orbits have shown a mean lagging azimuthal magnetic field configuration on magnetic field lines mapping from Saturn to its main rings in the equatorial plane, with some orbit to orbit variability. A prominent feature is observed in the southern hemisphere on field lines connecting to the B-ring on 70% of the orbits, which is spatially consistent with the location of in-falling dust indicated by the Cosmic Dust Analyser instrument. In our work, we examine the possible connection between the in-falling charged dust and the B-ring magnetic field feature. We also use a simple steady-state model to couple the planetary ionosphere to a weakly conducting ring ionosphere over the main rings, where the model output shows an expected leading field configuration associated with the rings. The discrepancy between the simple theoretical model and the data indicates the presence of additional processes (e.g. departure from Keplerian velocity of the charged ring particles), which will be discussed. We will further discuss the likely connection between the observed lagging field configuration in the middle magnetosphere and in the inner magnetosphere.