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Study global electromagnetic induction using terrestrial and satellite observations

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Satellites have the potential to sample the whole Earth (unlike observatories), but because there are few satellites at any one time they sample spatially complex sources poorly. Observatories provide relatively better spatial coverage and might thus be used to help constrain external sources for interpretation of the satellite data. However, for observatories it is not possible to separate ionospheric and magnetospheric sources (both are external to the observatory), and this separation is necessary for proper interpretation of the satellite data. Ultimately one should model both external source regions explicitly, together with the magnetic fields induced in the Earth, fitting all data (satellite and observatory) with a physically consistent model. This is a challenging problem that will require improved understanding of sources, together with advances in 3D modeling and inversion of induction data. As a small step toward this goal we are analyzing night side observatory data (under the assumption that this data has with little ionospheric contribution) to better understand spatial complexity in the magnetospheric sources. Improved models of nightside magnetospheric spatial structure will allow us to improve estimates of satellite induction transfer functions, and thence conductivity of the Earth. Progress on this effort will be reported.