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Electric properties of Titan's dusty ionosphere

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Recent studies have shown that negatively charged dust dramatically alters the electric properties of plasmas, in particular planetary ionospheres. Utilizing Titan flybys from the entire Cassini mission and full plasma content of the moon's ionosphere (electrons, positive ions and negative ions/dust grains) we derive the electric conductivities and currents, updating and extending previous results which did not include the charged dust and focused on a limited range of flybys.

Compared to the previous estimates, using the full plasma content increases the Pedersen conductivities by a factor ~ 2 and Hall conductivities by a factor ~ 1.2 . We identify dusty plasma as the reason for the sharp increase of Pedersen conductivity below 1000 km altitude reported previously. Using the full range of Titan flybys also reveals the conductivities on the dayside to be factor $\sim 7-9$ larger than on the nightside, owing to higher dayside plasma densities as well as generally heavier plasma species on the nightside.