

Ducts and Super-Refracting Layers in Planetary Radio Occultation with Implications for Atmospheric Profile Recovery

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The presence of atmospheric ducts and super-refracting layers presents a challenge to atmospheric profile recovery in radio occultation experiments. In particular, these atmospheric structures can potentially trap or guide occultation signals, obscuring them from a receiver. Under these circumstances, inversion of occultation data to recover atmospheric profiles produces misleading results.

This research uses propagation simulations to characterize the effects of ducts and super-refracting layers in radio occultation experiments. This work demonstrates how these atmospheric phenomena may present themselves in occultation data and illustrates the results of applying Abel inversion for profile recovery when ducts and super-refracting layers are present during occultation. Further, this research also explores models for understanding radio wave propagation in atmospheres with ducts and super-refracting layers as well as implications for inversion and potential methods of overcoming the difficulties of profile reconstruction in the presence of strongly refracting atmospheric structures.