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Magnetic field variability at Triton: Potential to characterise a subsurface ocean via electromagnetic induction

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Abstract

Triton is thought to have formed as an icy dwarf planet, before being gravitationally captured by the planet Neptune to become its largest moon. This history makes Triton a body of great scientific interest, and modelling of the moon's interior suggests that there is an ocean of liquid water beneath the icy crust. However, the Voyager 2 flyby remains the extent of our exploration of the Neptune system, and so the existence of a subsurface ocean has not yet been confirmed by observation. Here we model the variability of Neptune's magnetic field in the vicinity of Triton in order to assess the potential for electromagnetic induction in any subsurface ocean, and in support of ongoing planning of future missions to this ice giant planet. We model and analyse lower-frequency variability related to the period of Triton's orbit, as well as higher-frequency variability related to the period of planetary rotation. We discuss the potential for these inducing magnetic fields to generate induced magnetic fields in Triton's interior, which would shed light on a possible ocean if resolved by a magnetic field experiment on a future Neptune orbiter mission.