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Microwave brightness temperature from a rough liquid surface on Titan : implications for Cassini's radar measurements

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Cassini's radar instrument[1], in a passive radiometric mode, will be used to map the microwave emission from Titan's surface. Passive radiometry combined with the Sun as a source can be used to provide bistatic reflection measurements of liquid surfaces, such a measurements can provide constrains on the roughness and possible composition of lakes or seas that might exist on Titan's surface. Campbell[2] has recently shown evidence of the possible existence of liquid surfaces on Titan. Liquid methane and ethane are the most likely candidates to be the main source for replenishing such a liquid environment. The presence of a liquid surface can be detected from specular reflection of the Sun. For a calm, rough–less surface, Fresnel relations are directly applicable. However, if substantial areas of liquid surface do exists on Titan, then wind–driven surface waves are expected and Fresnel equations are not longer directly applicable. As in Earth, gravity plays a dominating role on the development of wind–driven surface waves, other factors such as surface tension and viscosity only influencing the capillary–wave range and being only significative at wavelengths lower than few centimetres. Herein, we present numerical simulations of the microwave reflectivity of the sun-glint from a rough liquid surface. The roughness of the surface is modeled by adapting current models for wind–induced effects on Earth's oceans to Titan's conditions. Furthermore, the vertical and horizontal polarized brightness temperature of the possible liquid surface can be used constrain its dielectric constant.

References

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