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Constraining the activity of waves on Titan's polar lakes and seas

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Saturn's moon Titan has an active hydrological cycle in which the primary working fluid, methane, is thought to transport between poles on seasonal timescales, driving much of the observed meteorology. Surface winds play a critical role in determining the evaporation rates of methane from Titan's polar lakes and seas. Observational constraints on these winds, however, are limited. Aeolian landforms, in particular sand dunes, characterize Titan's mid latitudes, providing evidence that winds at these latitudes have, at least in the geologically recent past, exceeded the threshold for saltation (which recent work has shown might be higher than previously predicted). The shoreline morphology of Titan's lone large southern lake, Ontario Lacus, has been interpreted as evidence for wave erosion. Evidence for wave activity on Titan's lakes and seas, however, has been notably absent in Cassini observations. Explanations that have been forwarded to explain the lack of waves include the possibility that the liquids that comprise Titan's lakes and seas are highly viscous or that seasonal winds have not exceeded the threshold for capillary wave formation (Hayes et al., 2012, Icarus 225). Only recently have Cassini Visual and Infrared Mapping Spectrometer (VIMS) observations provided the first evidence of wave activity on Titan, in the north as Titan progresses towards northern summer (Barnes et al., 2014, Planetary Science 3). Herein, we use Cassini VIMS observations of the specular reflection of sunlight from Titan's lakes to infer the presence or absence of waves on Titan. We investigate observations acquired between 2012 and 2014. We find evidence for the presence of waves on Kraken Mare during a number of flybys, while specular reflections from the smaller Jingpo Lacus are more consistent with a smooth lake surface.