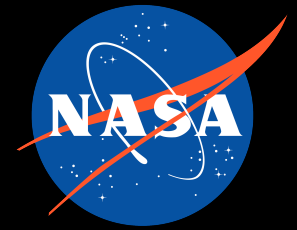


?ETI

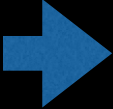
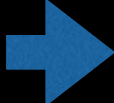


Crystallinity mapping of the Saturn Satellites Dione and Rhea

C.M. Dalle Ore, F. Scipioni, K. Stephan, D.P. Cruikshank, E.G.
Rivera-Valentin, M. Kirchoff, Chris Long, and Fiona Nichols-Fleming

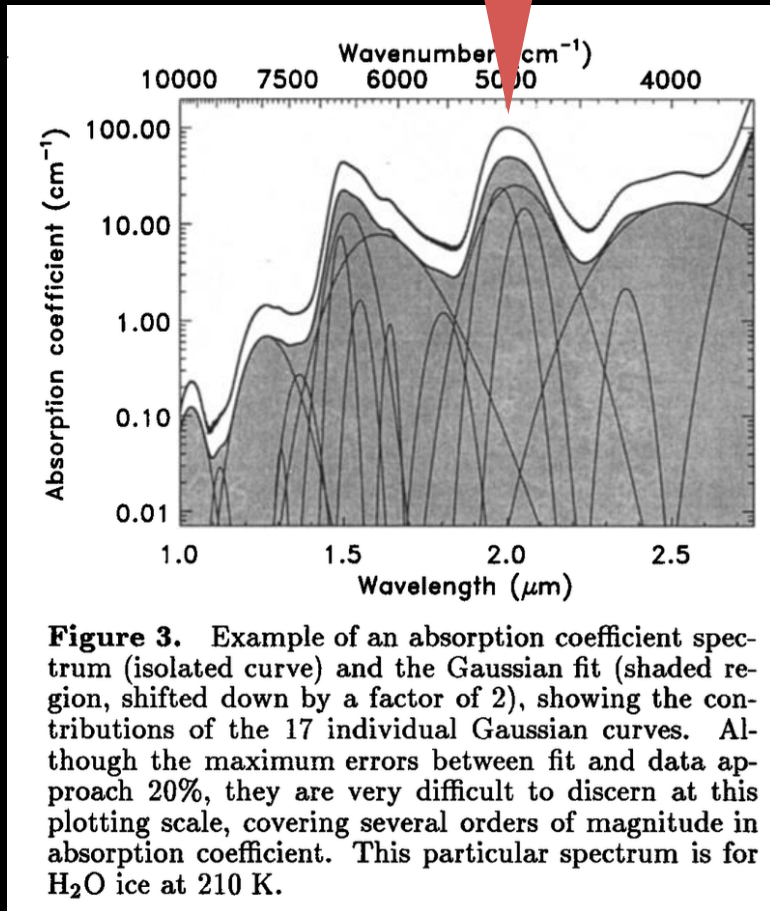


Ice phase lab facts

- Mastrapa et al. 2013: H₂O ice at 80K<T<120 typical of icy satellites is amorphous or disordered for the age of the Solar System
- Baragiola et al. (2003): irradiated crystalline ice (at sufficiently high energy) yields disordered (amorphous) ice
- Stewart et al. (2008): localized heating (meteoroid impact) can change amorphous into crystalline.
- Ice phase budget  trace of recent history
-  need a precise measurement of crystalline / amorphous

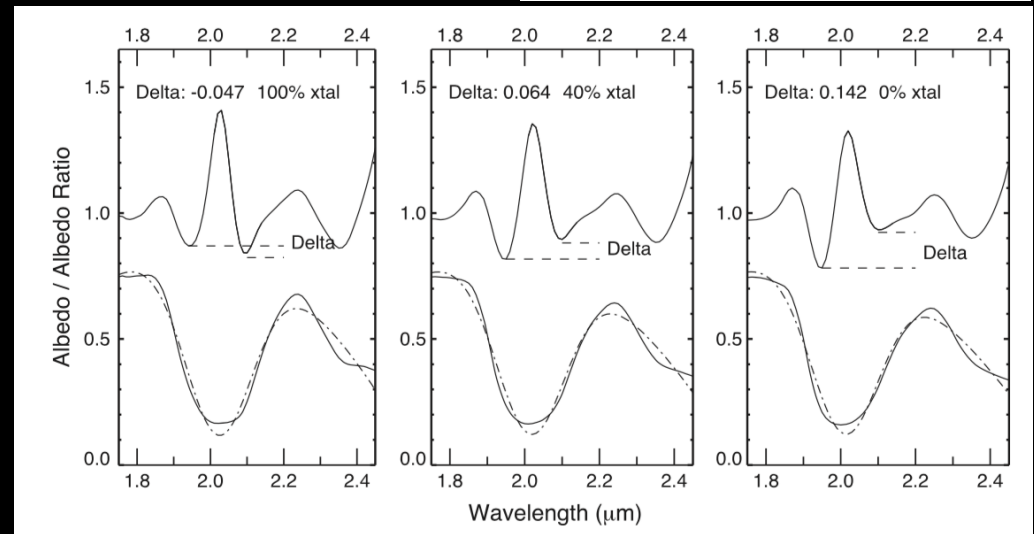
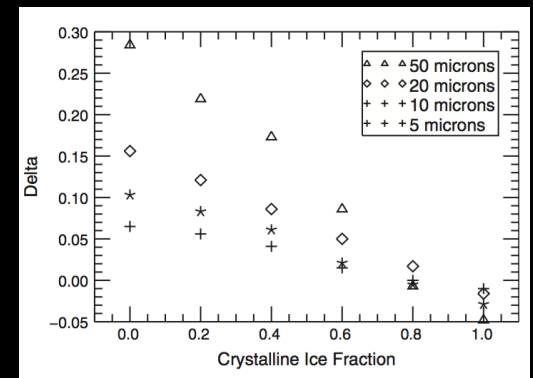
Crystalline/amorphous measurement

- If only 20% of H₂O is crystalline the 1.65 μm band will indicate full crystallinity (Mastrapa et al. 2006)
- VIMS data have a filter junction at 1.65 μm
-> we adopt the 2.0 μm band



Grundy and Schmitt
1998

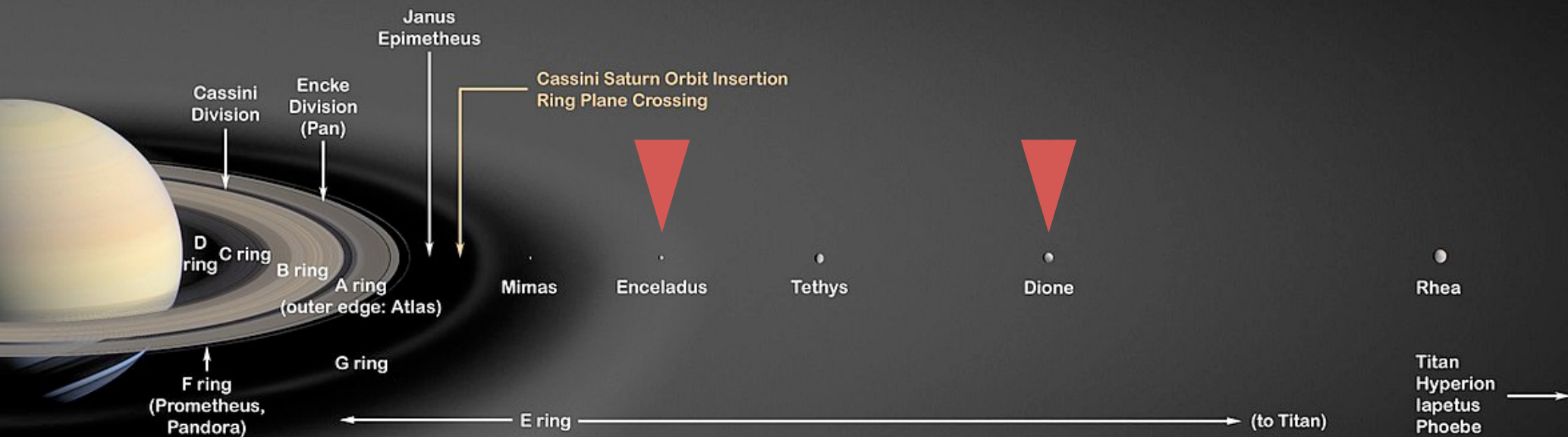
Calibration example



Gaussian residuals -> Delta

Ice phase maps cheat sheet

- more crystalline = warmer
- more amorphous = higher flux of infalling particles
- Amorphous features might indicate areas of fast freezing
- Known initial ice phase and infalling particle flux = age estimate



Icy Saturn satellites

Dione and Enceladus are they 'siblings' in activity?
 Enceladus is locked in orbital resonance with Dione

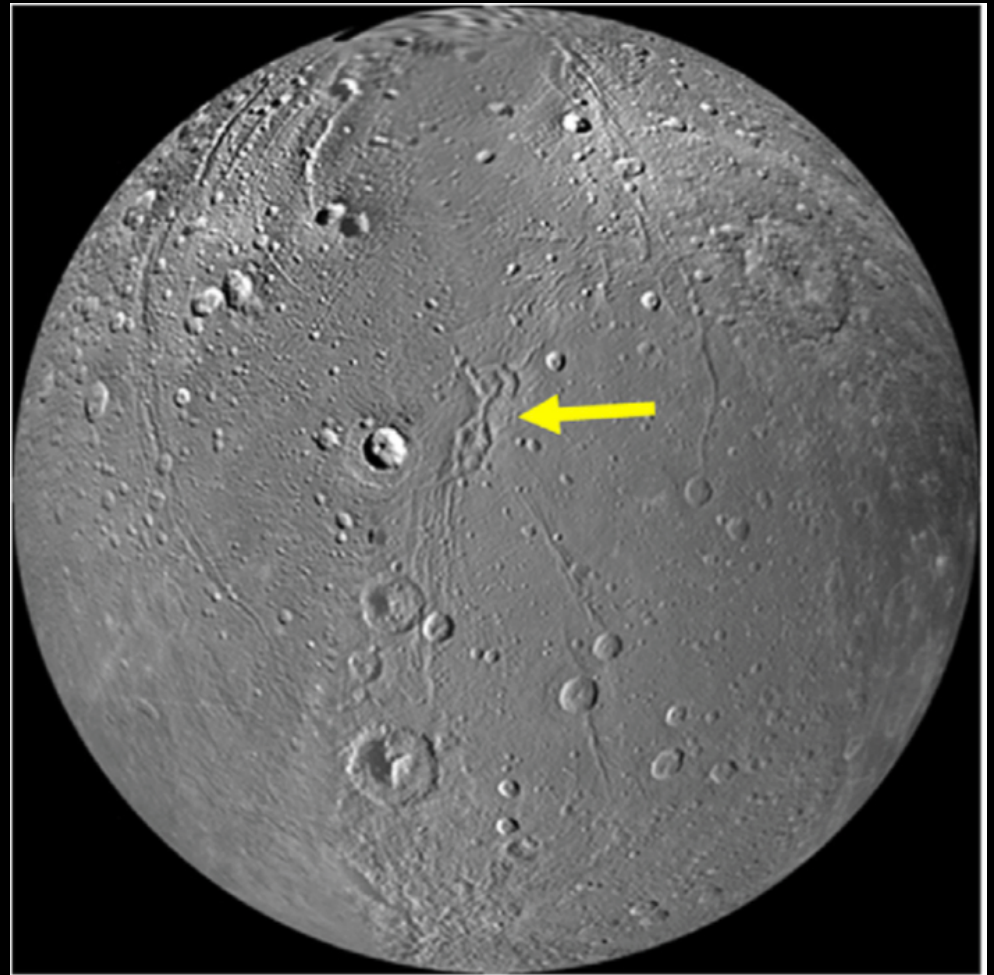
Is Dione active?

Enceladus is locked in orbital resonance with Dione

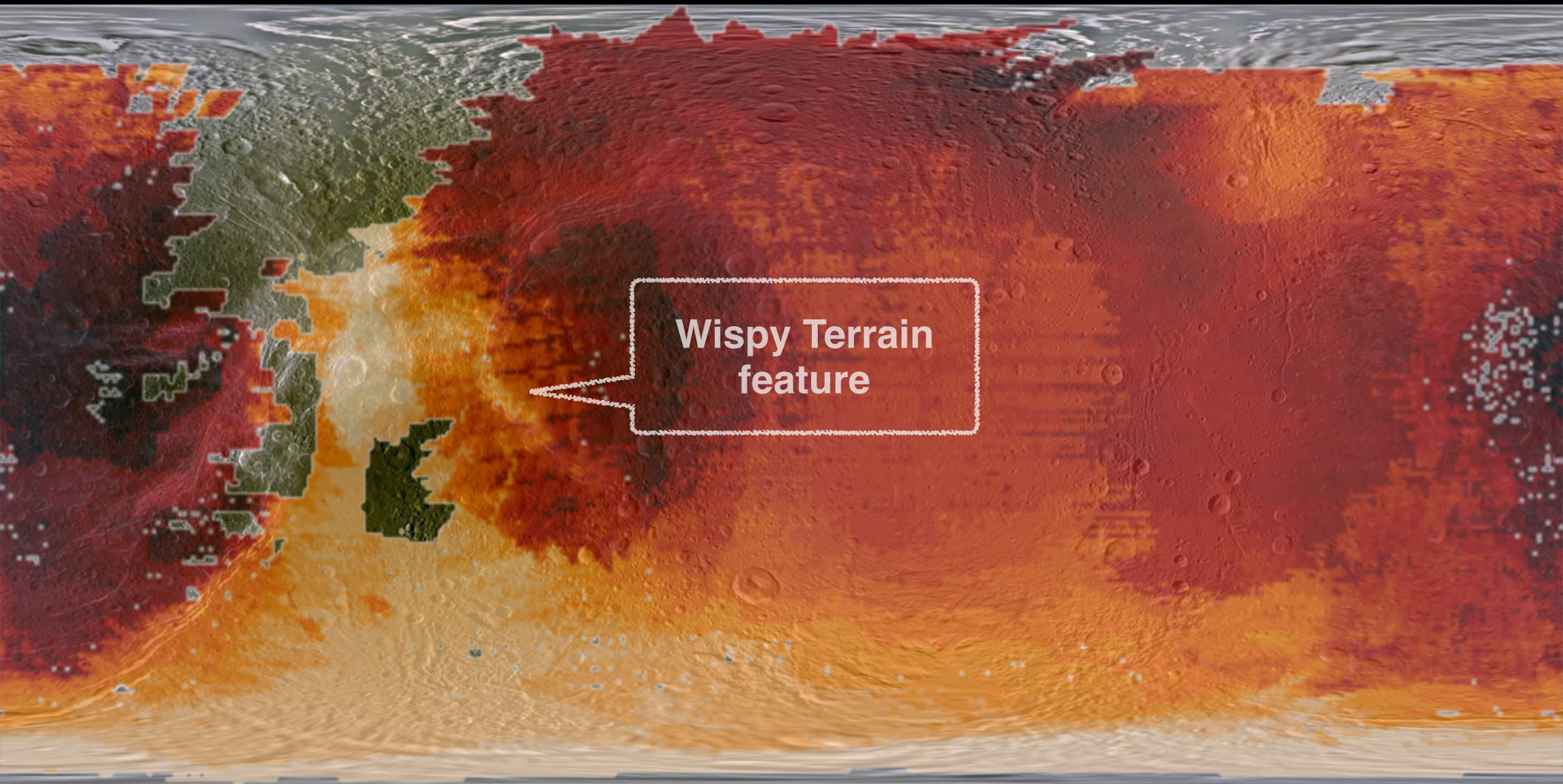
Evidence of possible cryovolcanic structures

Evidence for a tenuous atmosphere in 2004

No plumes detection 🤔



From Buratti et al 2018



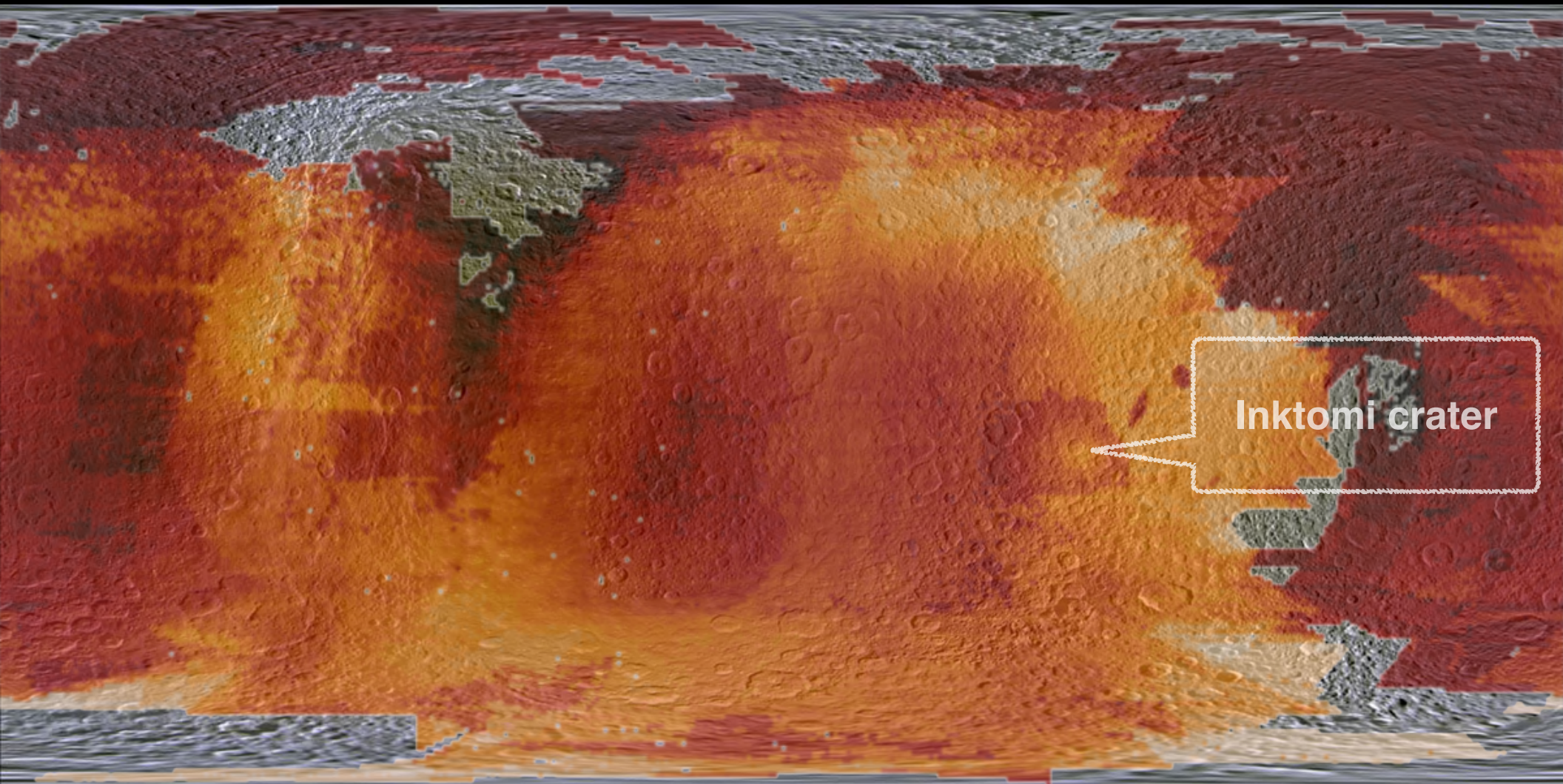
Wispy Terrain
feature

Amorphous H₂O fraction on Dione

overlaid on a base map

More amorphous

More crystalline



Inktomi crater

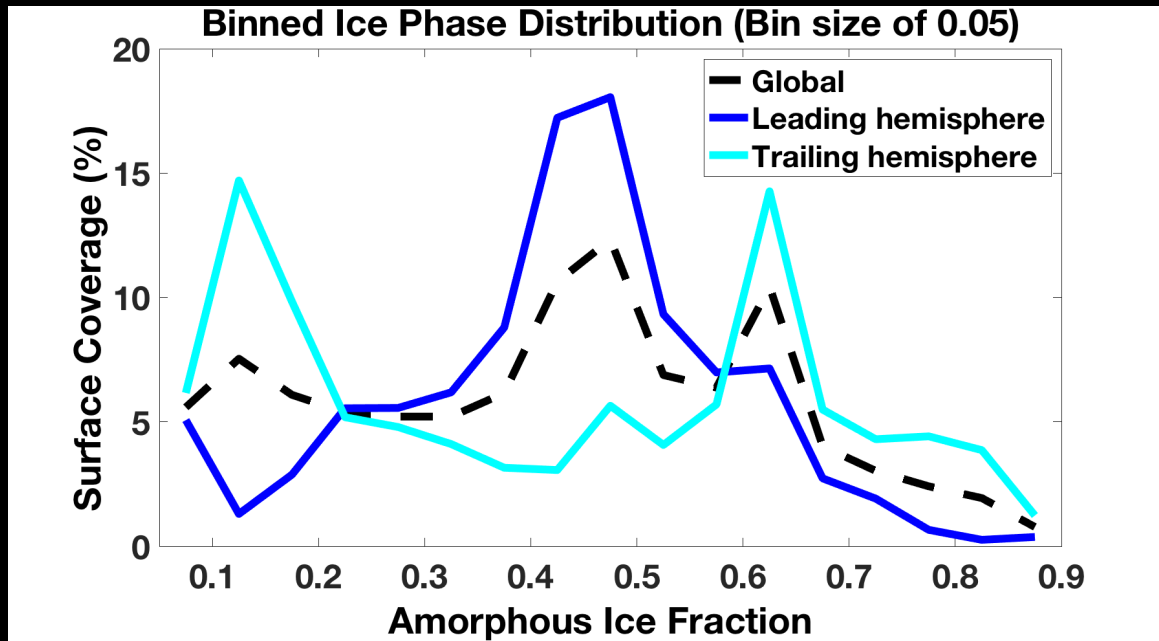
Amorphous H₂O fraction on Rhea

overlaid on a base map

More amorphous

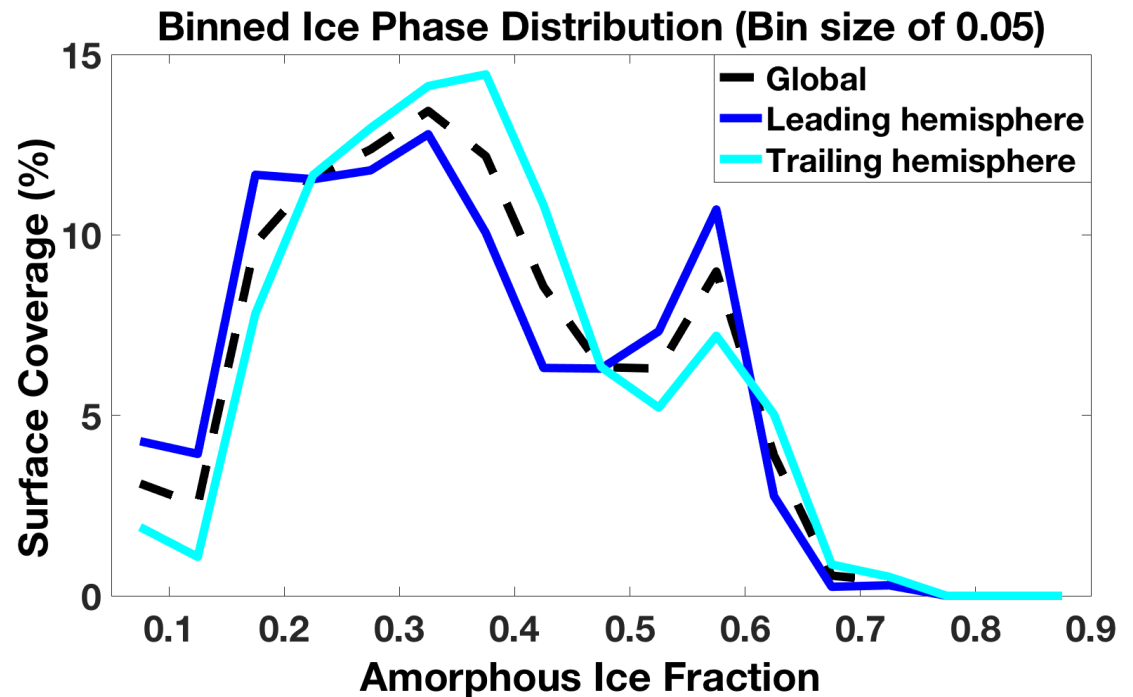
More crystalline

Amorphous population



<- Dione

Rhea ->



Summary

- Dione amorphous ice map shows a distribution consistent with amorphous ice predominantly on the trailing hemisphere as expected
- The amorphous ice distribution is **interrupted** by crystalline ice corresponding approximately with the Wispy Terrains.
- Analogous analysis on Rhea shows just the expected pattern
- The phase distribution graphs also show a very different behavior between Dione and Rhea

Preliminary Interpretation

- The Wispy Terrains stand out as more crystalline
-> very localized increase in temperature either currently or in a fairly close past
- Another indication of activity?