

Time and space evolution of the H₂O-ice clouds seen by the **OMEGA / MEx instrument**

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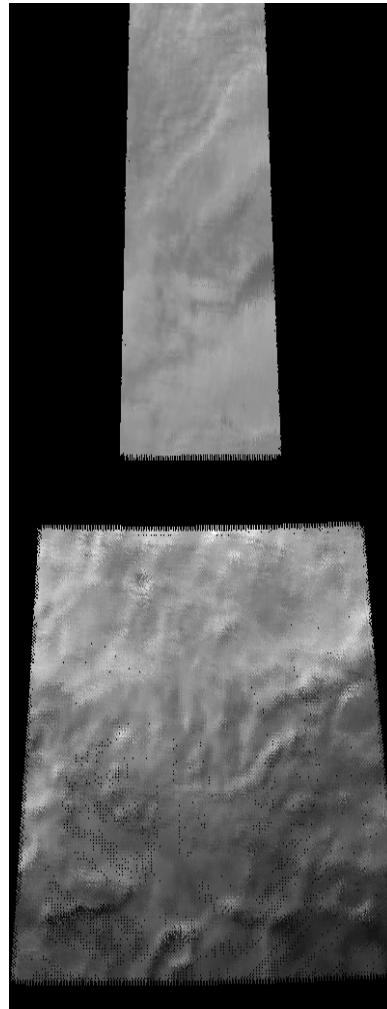
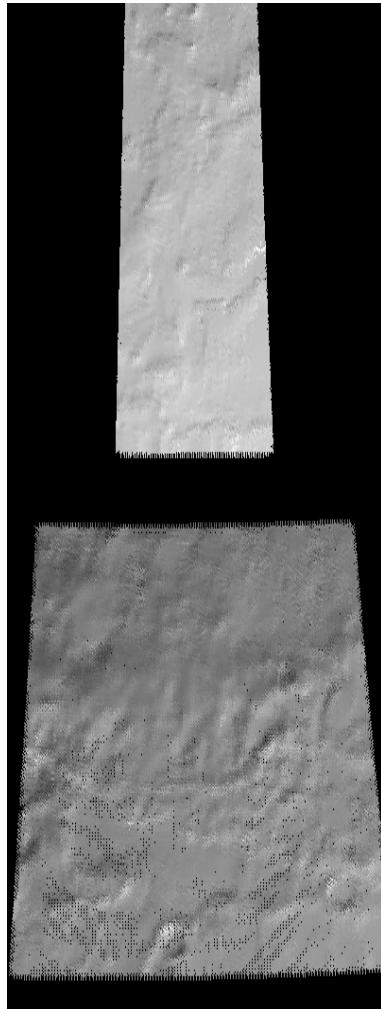
gondet@ias.fr

Time and space evolution of the H₂O-ice clouds seen by the **OMEGA / MEx instrument**

Goals

1. Clean surface features from atmospheric ones
2. Contribute to the monitoring of H₂O and CO₂ cycles
3. Contribute to the understanding of the cloud formation / precipitation processes
4. Contribute to an integrated, cooperative and coordinated MEx atmospheric sounding

H_2O -ice feature

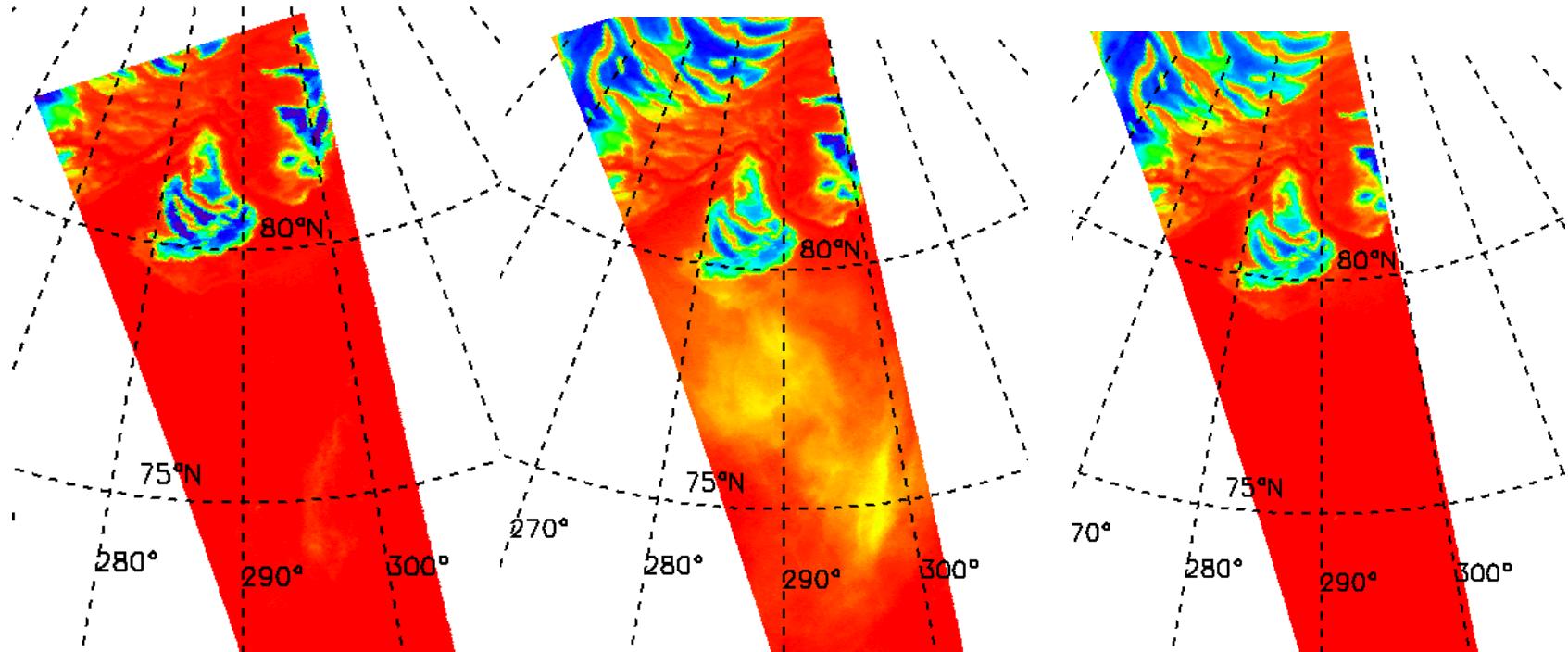


cloud: surface structures fade



frost : surface structures clear

Example of OMEGA monitoring of cloud evolution

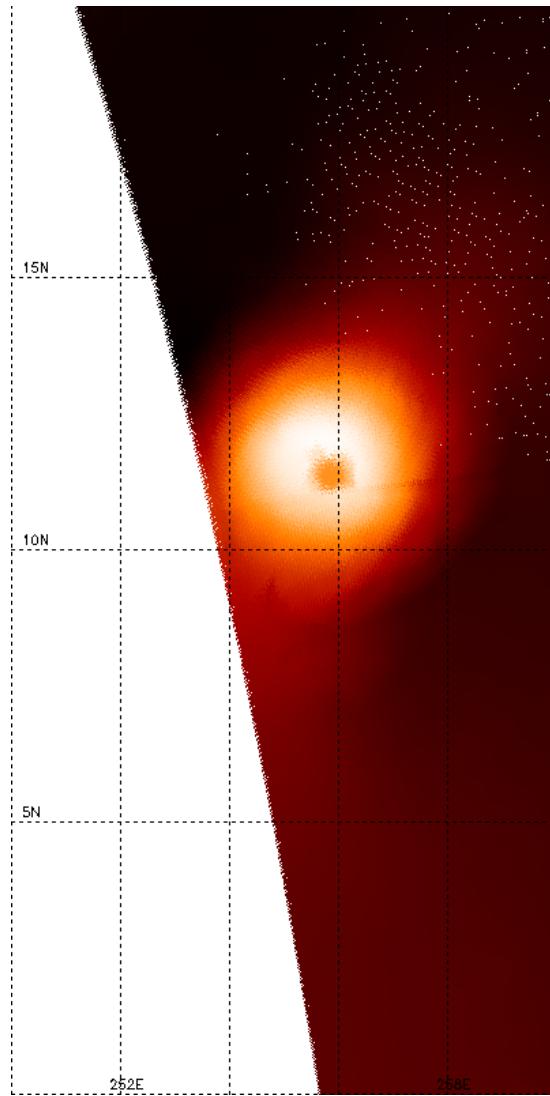


09/11/04
 $L_s = 113$

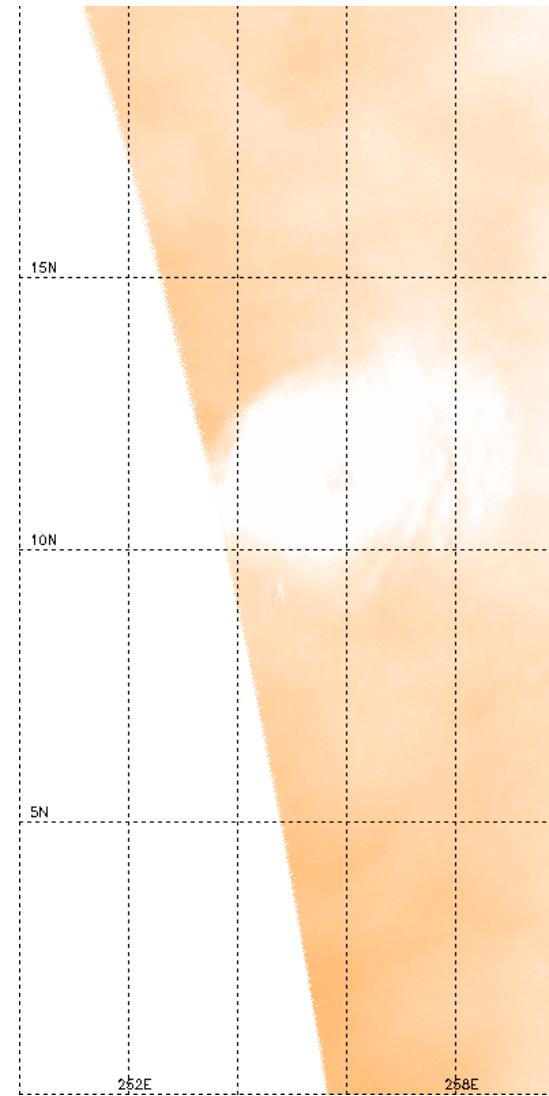
12/11/04
 $L_s = 114$

15/11/04
 $L_s = 115$

cloud around Arsia Mons $L_s=48$, orbit 519

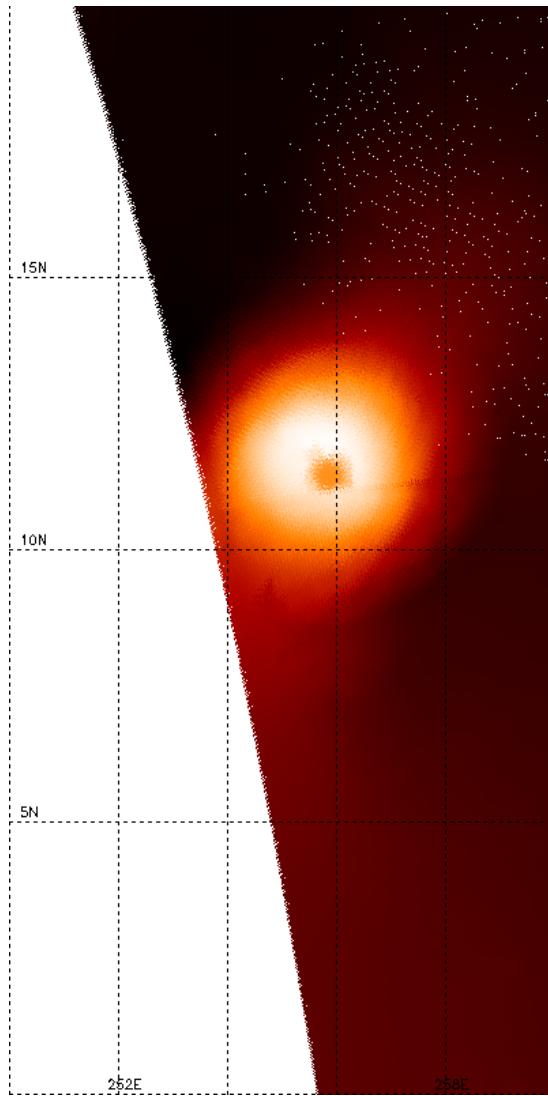


MOLA altimetry

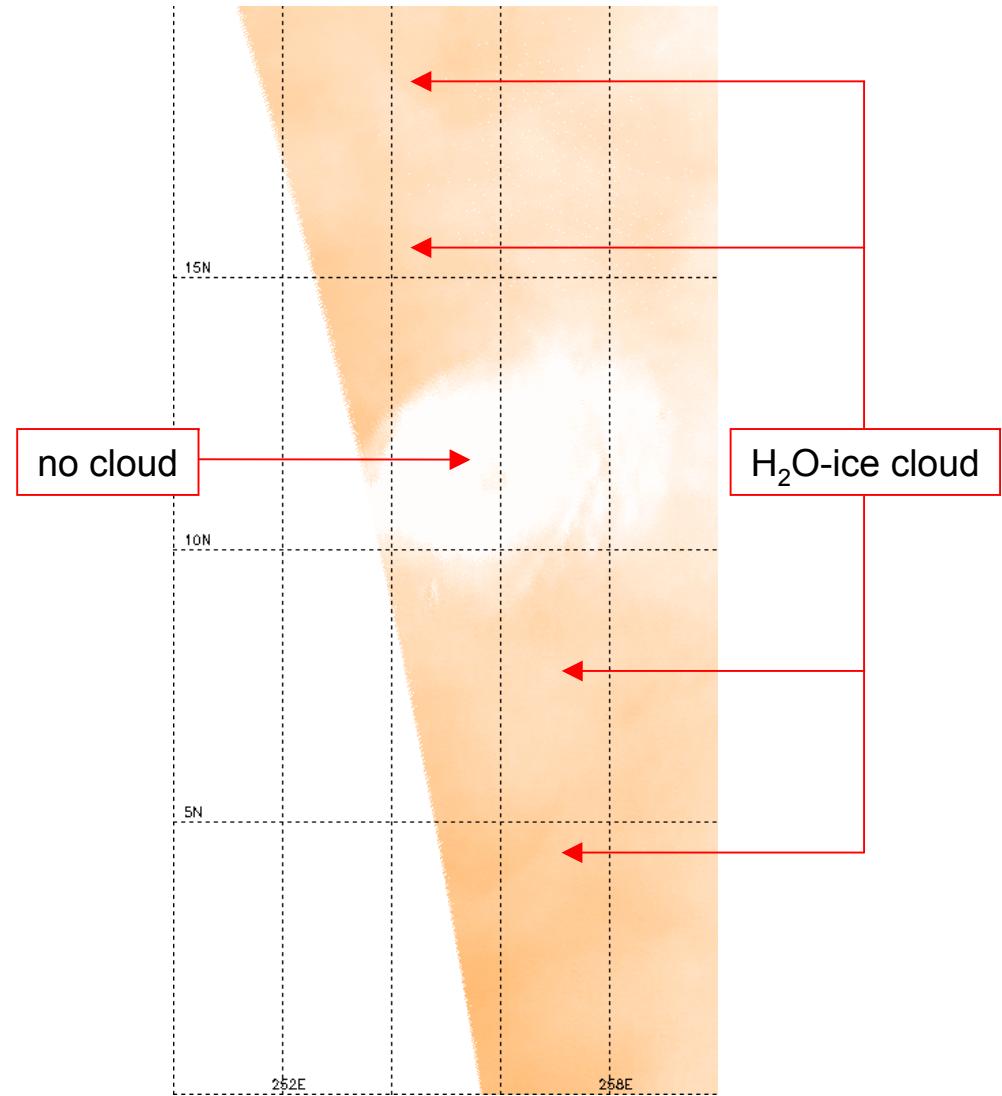


OMEGA 1.5 μ m map

cloud around Arsia Mons $L_s=48$, orbit 519



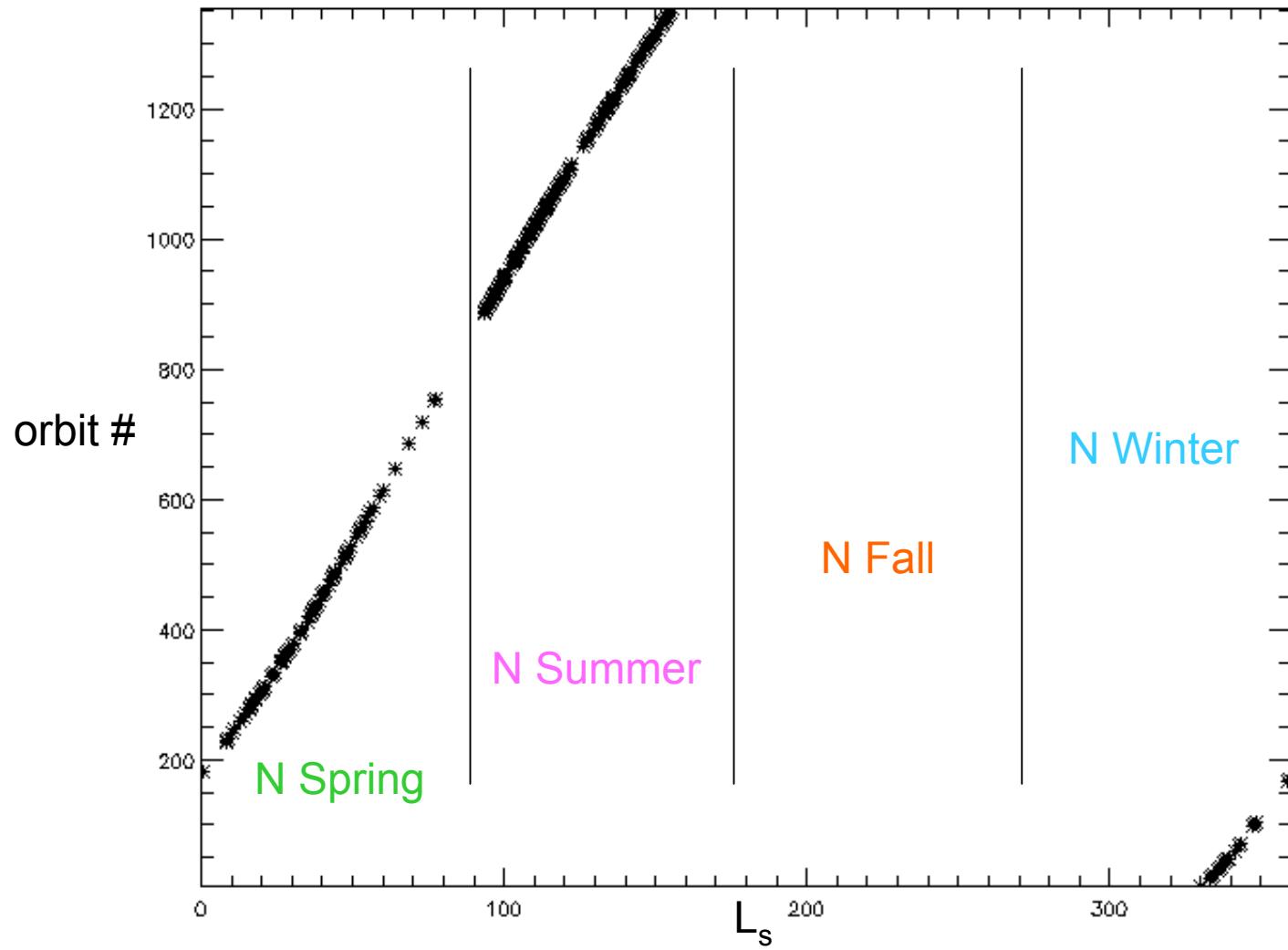
MOLA altimetry



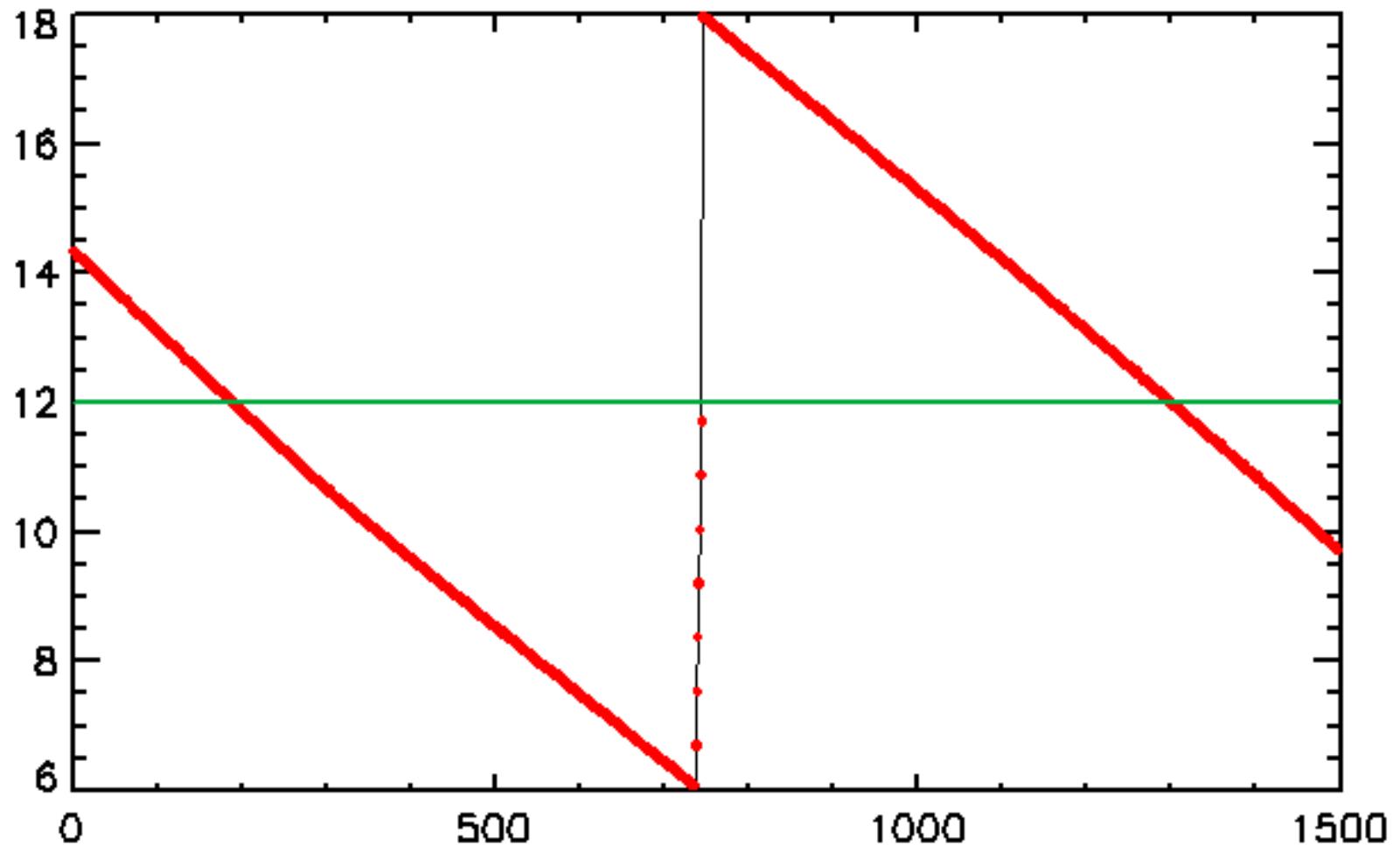
OMEGA 1.5 μm map

OMEGA dataset:

observations along 294 orbits
ranging from N mid-winter ($L_s=330$) N summer ($L_s=160$)

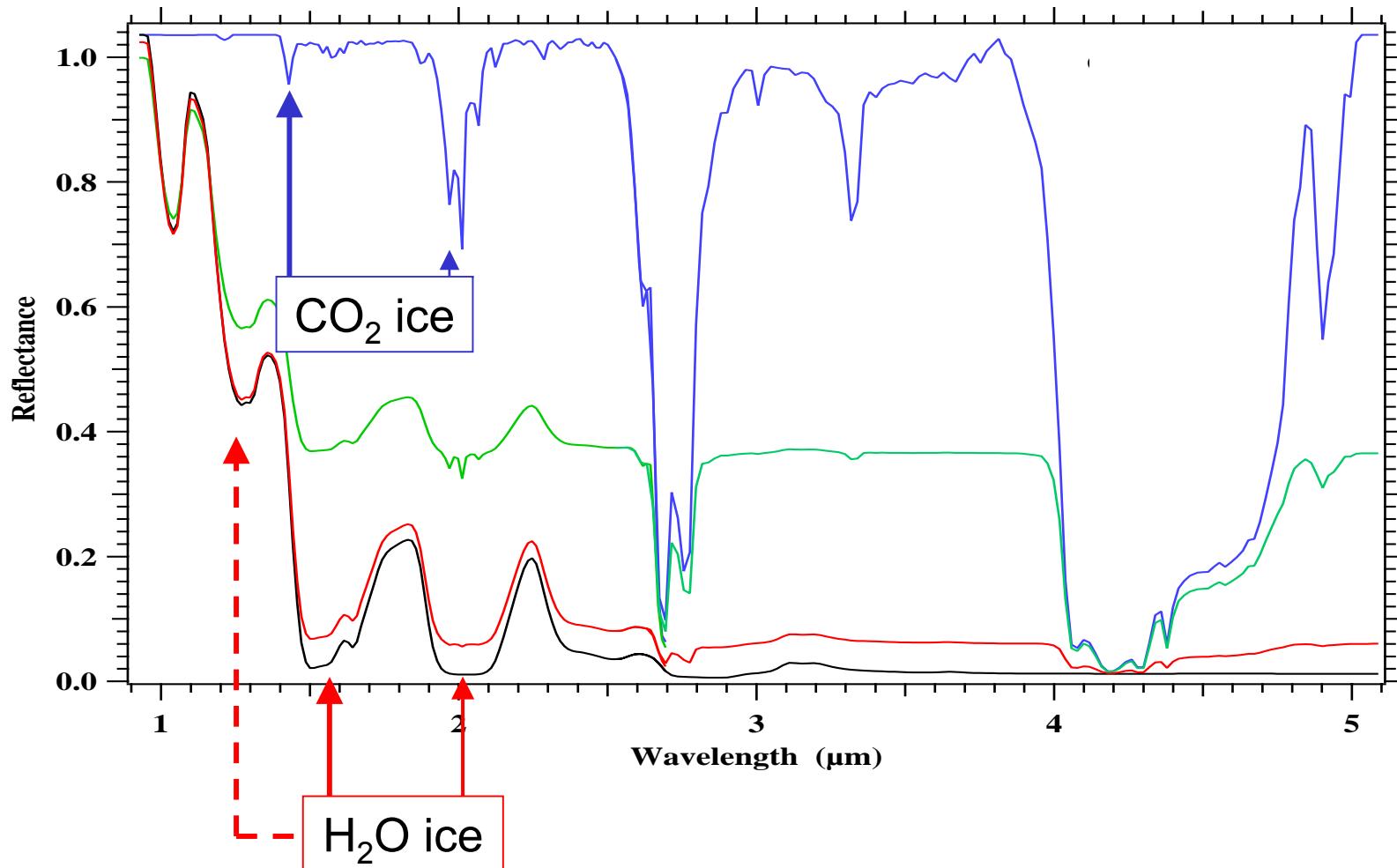


local time @ equator = f(orbit number)

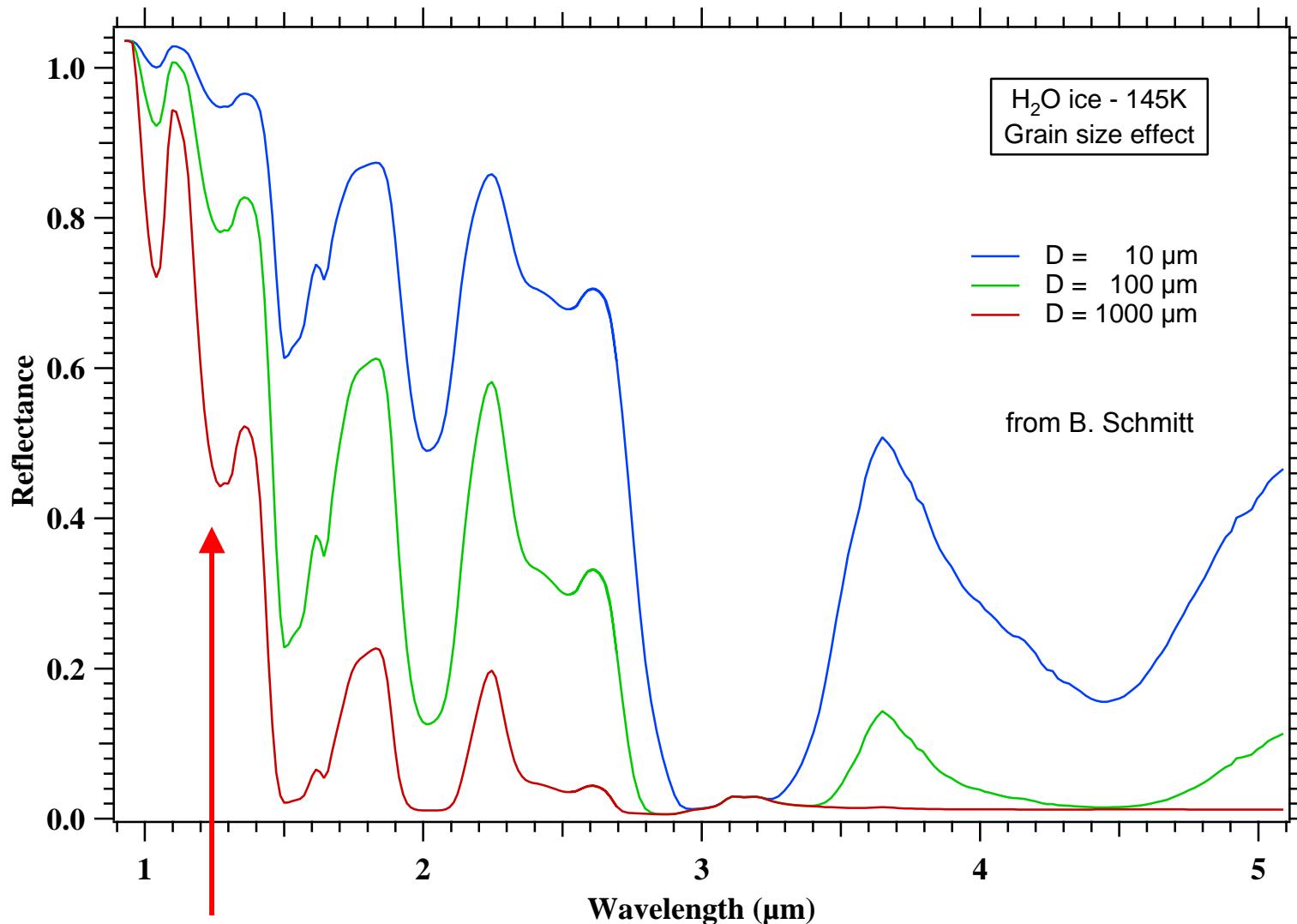


NIR features used in this study:

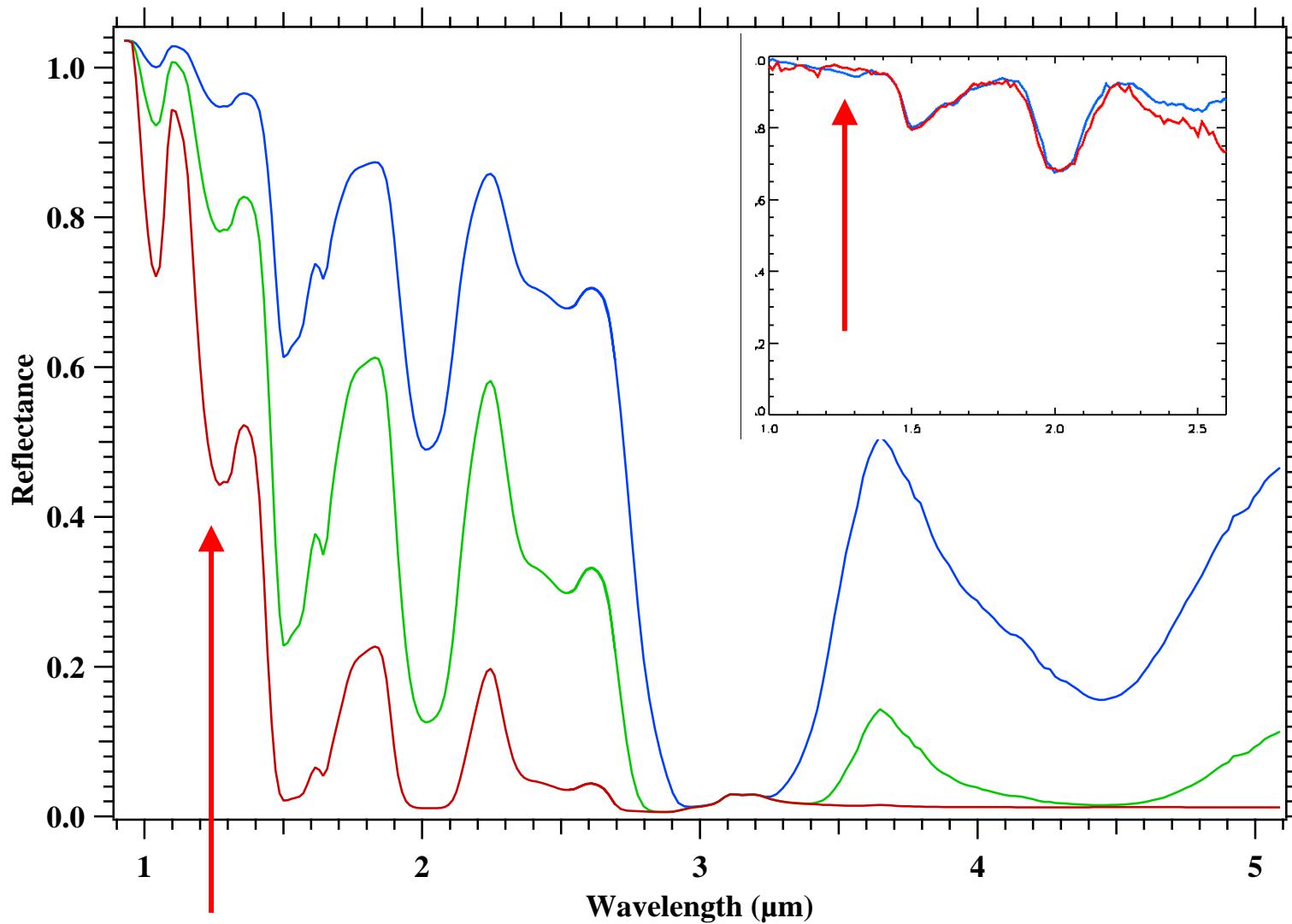
1.5 μm (and 2.0 μm) H_2O -ice absorption
1.4 μm (and 2.0 μm) CO_2 -ice absorption



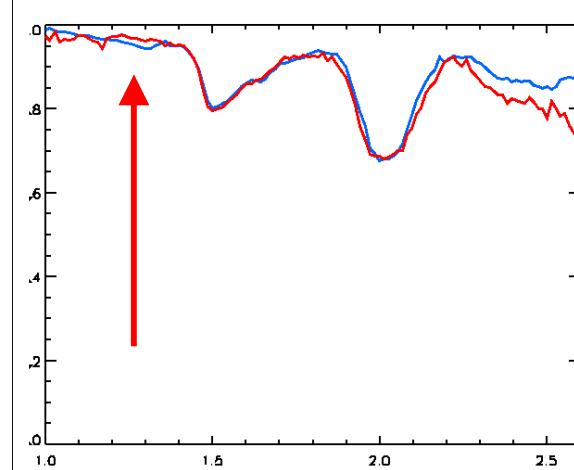
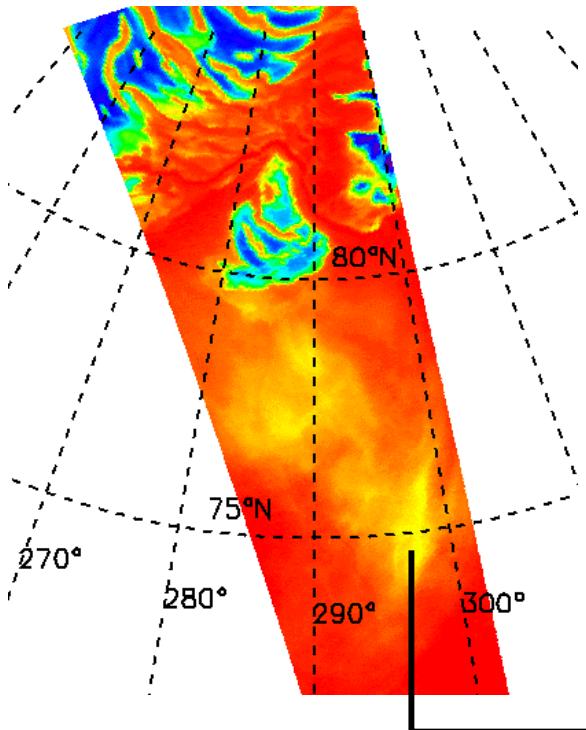
$1.25 \mu\text{m}$ H₂O-ice absorption: grain size sensitive thus: cloud sensitive



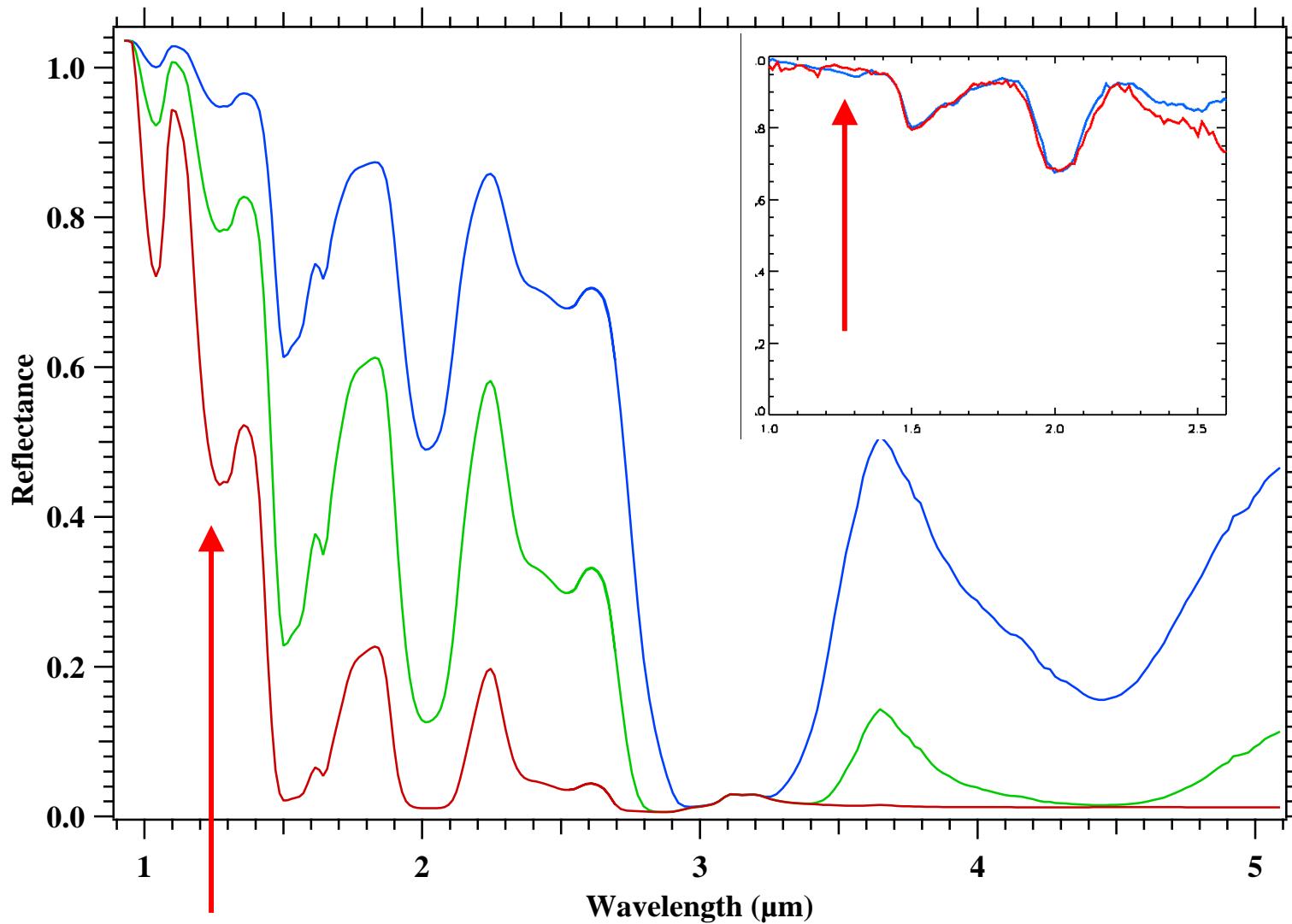
$1.25 \mu\text{m}$ H₂O-ice absorption: grain size sensitive thus: cloud sensitive



1.25 μm H₂O-ice absorption: grain size sensitive thus: cloud sensitive

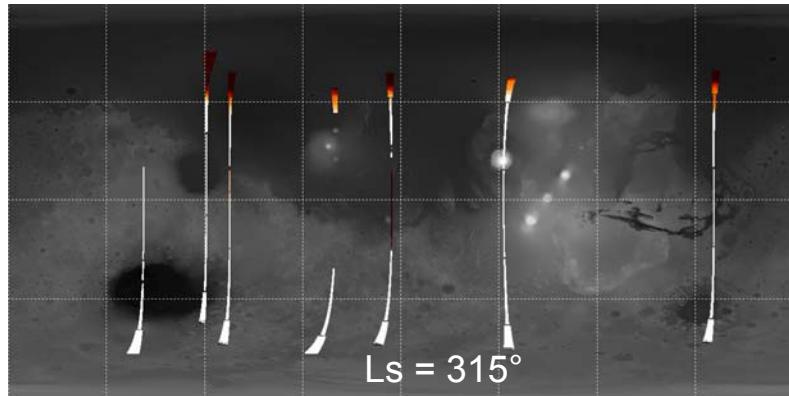


$1.25 \mu\text{m}$ H₂O-ice absorption: grain size sensitive thus: cloud sensitive

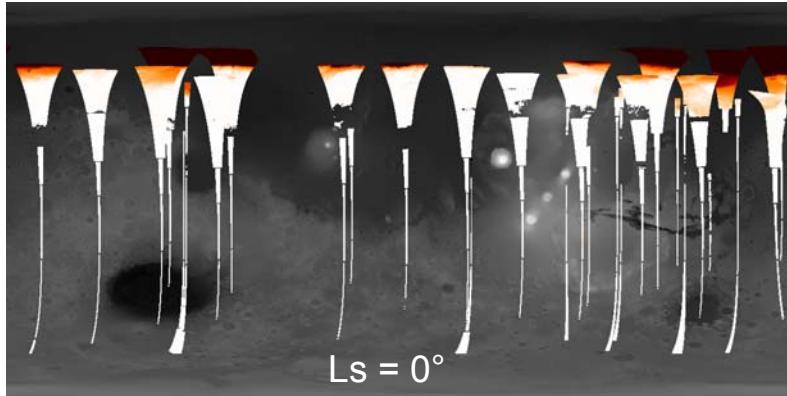
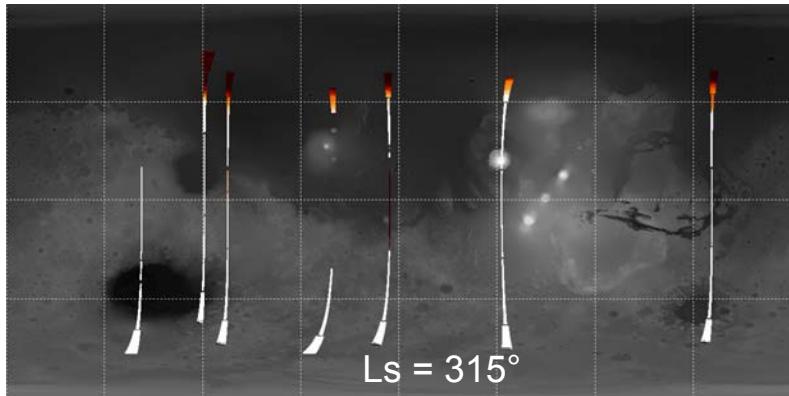


H₂O-ice clouds and frosts (mapping of 1.5 μm feature strength)

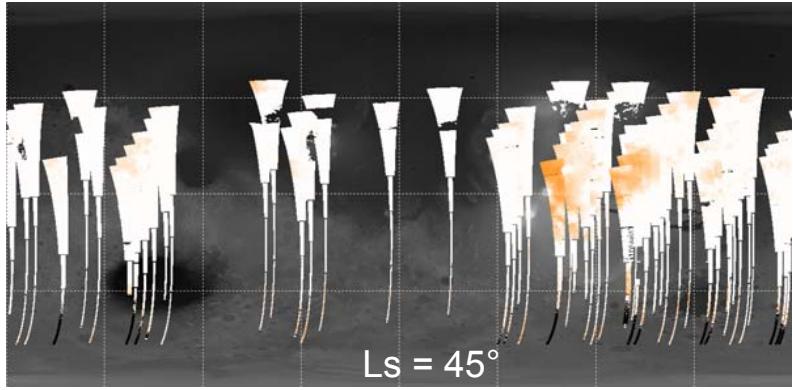
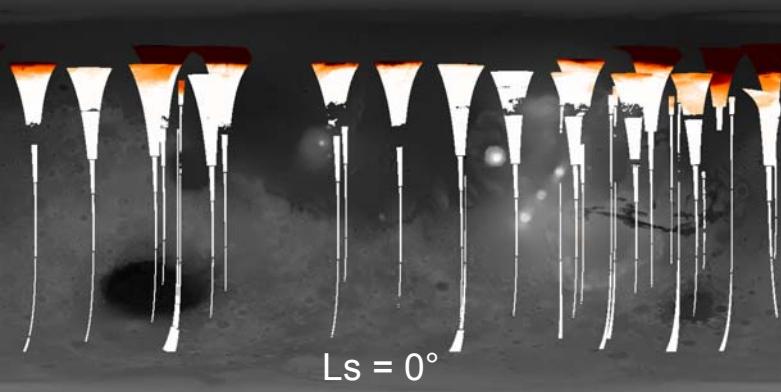
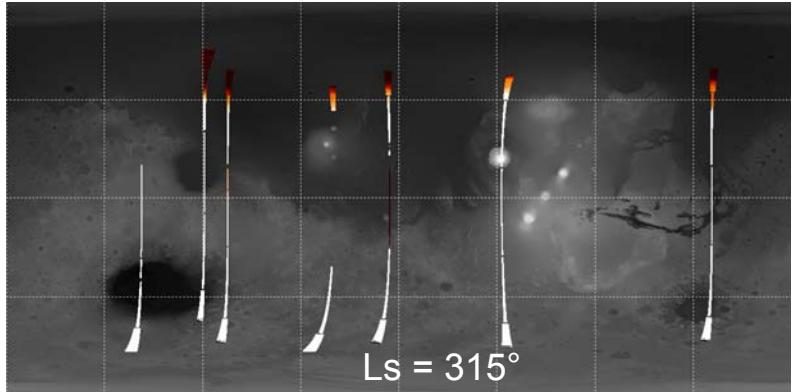
H₂O-ice clouds and frosts (mapping of 1.5 μm feature strength)



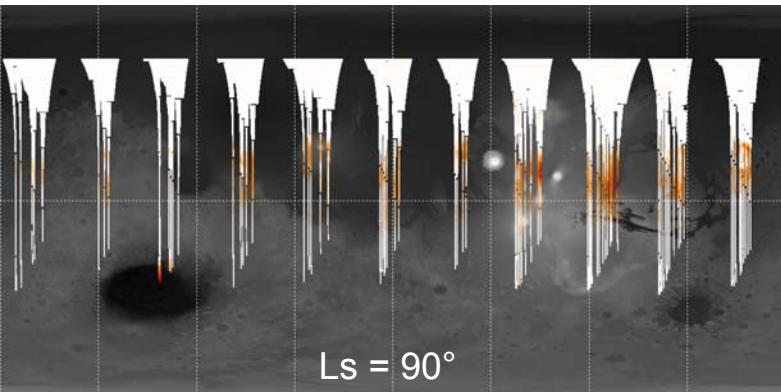
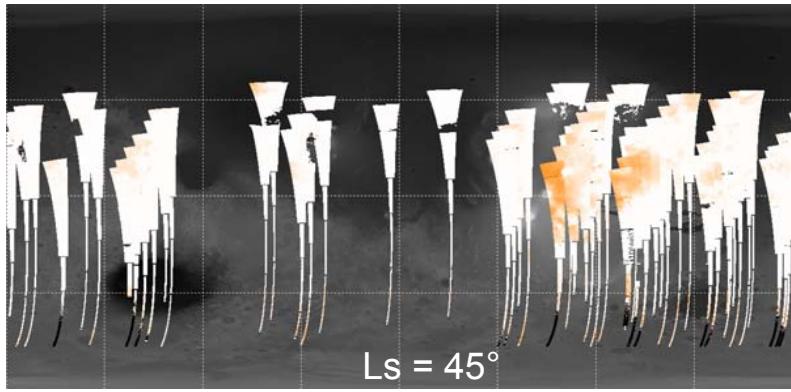
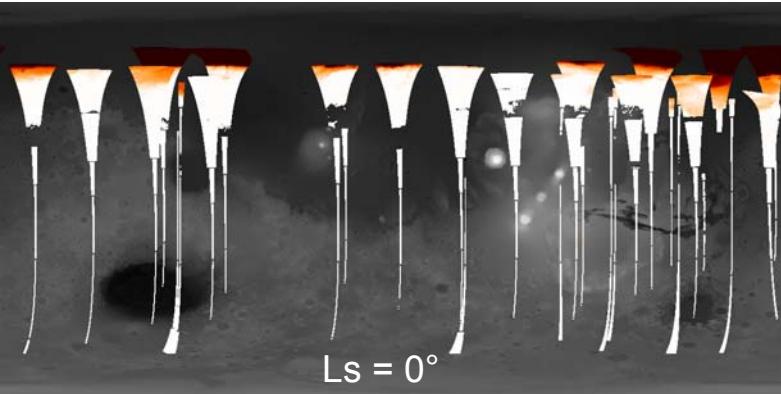
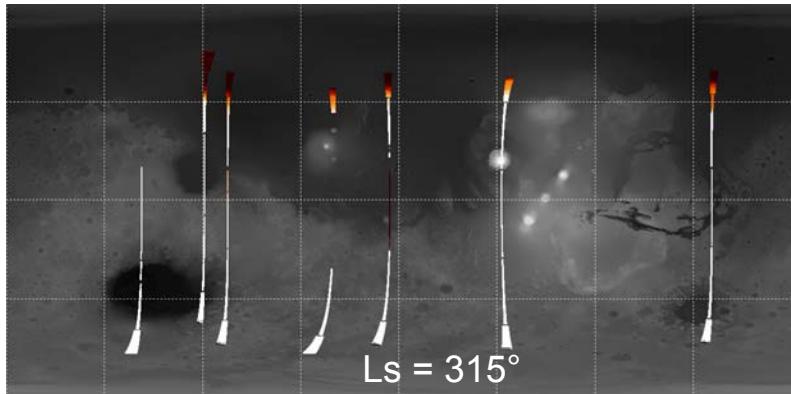
H₂O-ice clouds and frosts (mapping of 1.5 μm feature strength)



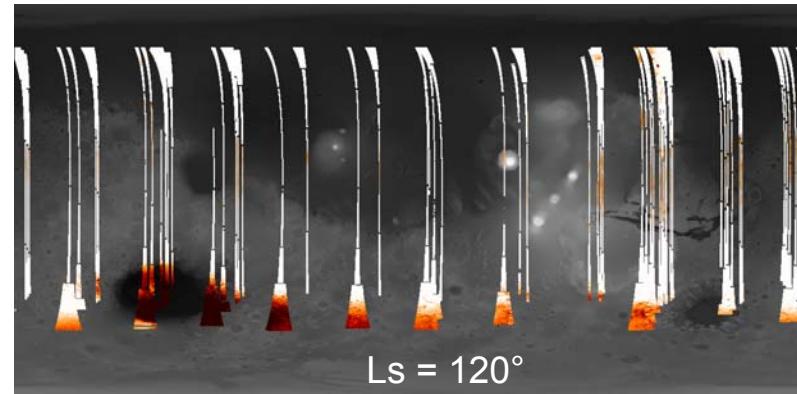
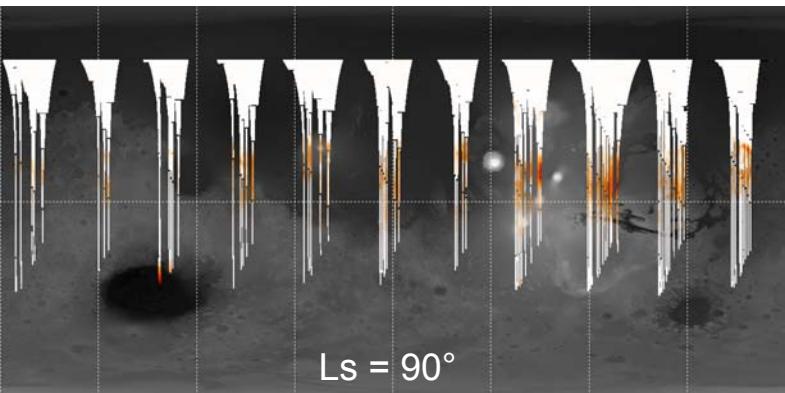
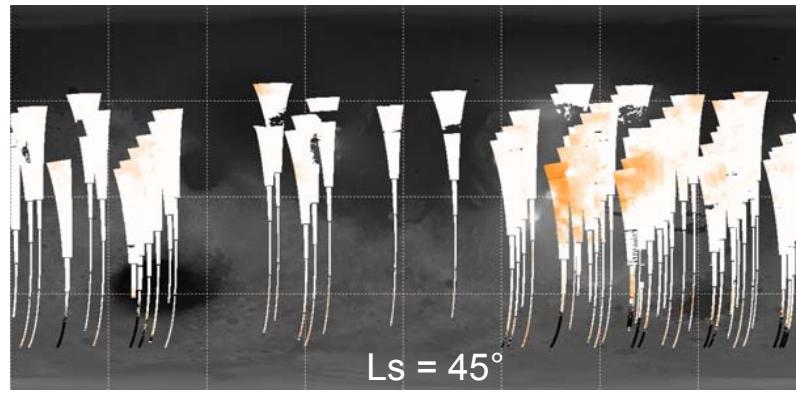
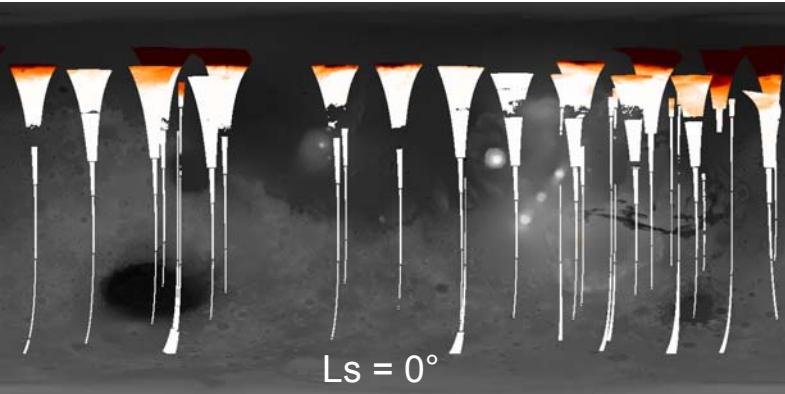
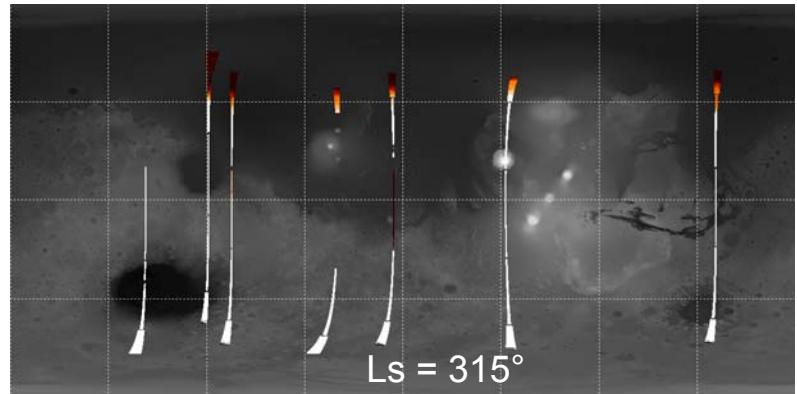
H_2O -ice clouds and frosts (mapping of 1.5 μm feature strength)



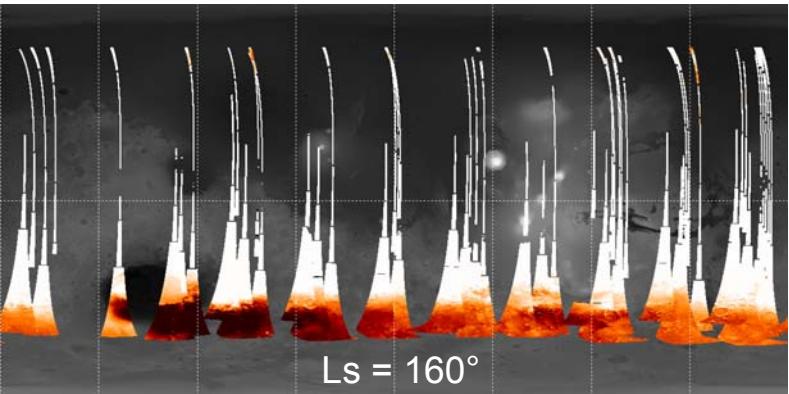
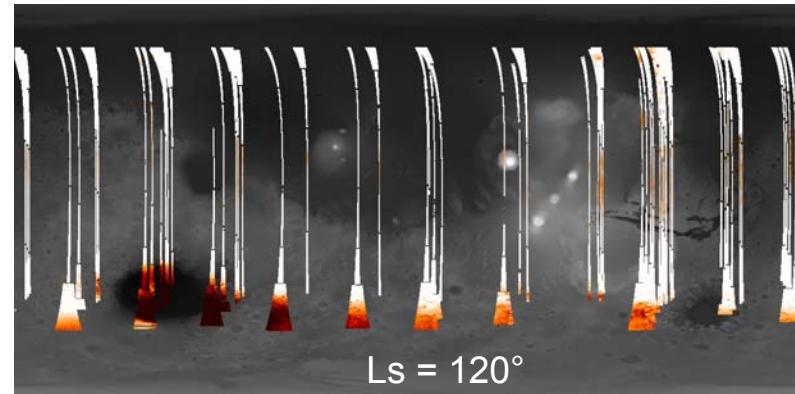
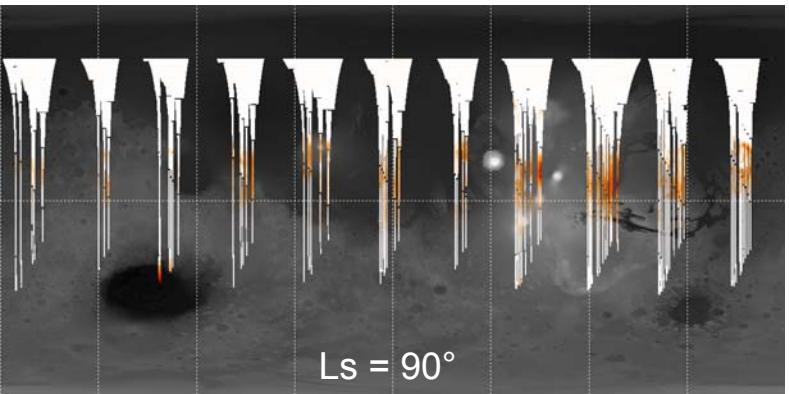
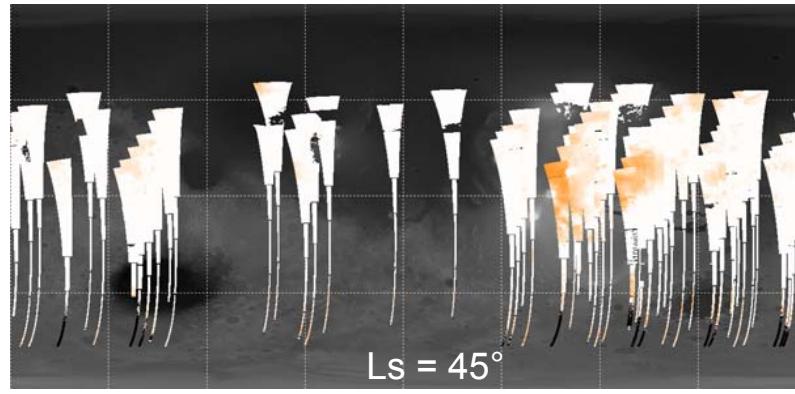
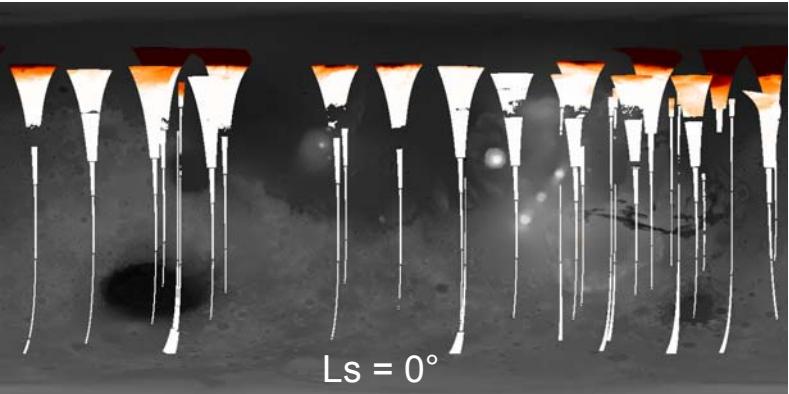
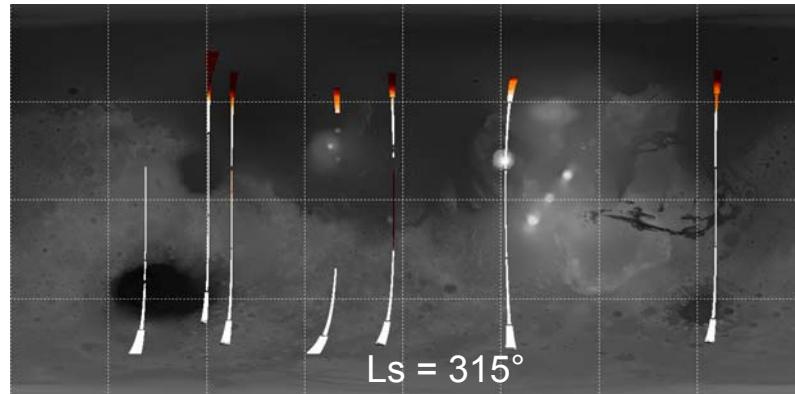
H_2O -ice clouds and frosts (mapping of 1.5 μm feature strength)



H₂O-ice clouds and frosts (mapping of 1.5 μm feature strength)



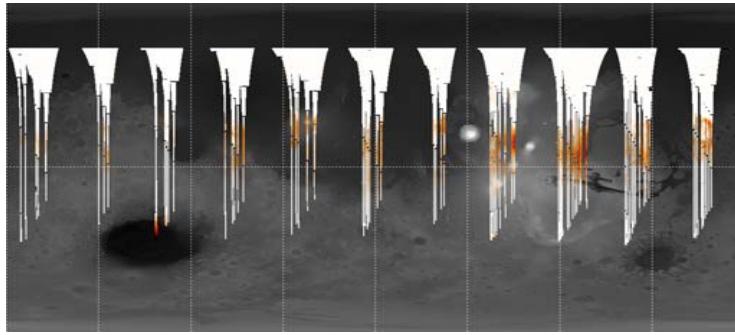
H₂O-ice clouds and frosts (mapping of 1.5 μm feature strength)



H₂O-ice clouds



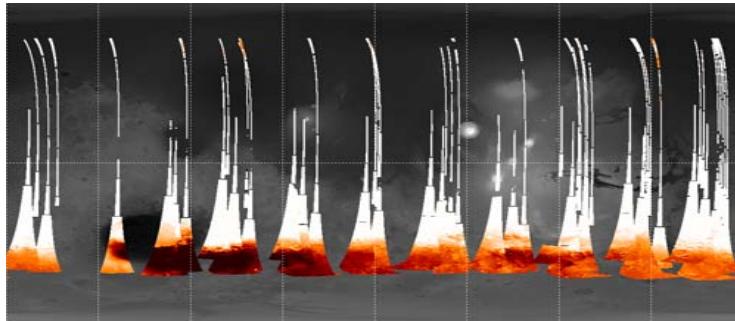
$$L_s = 0^\circ$$



$$L_s = 90^\circ$$

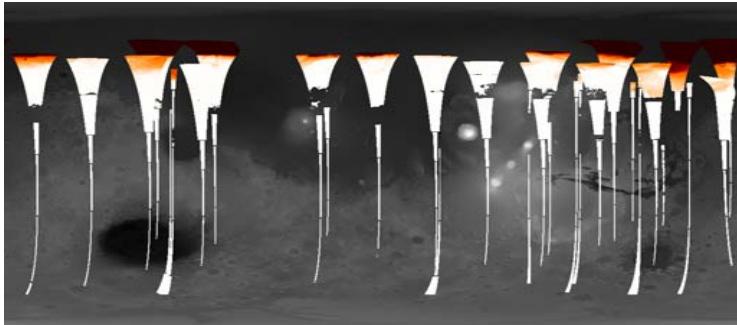


$$L_s = 120^\circ$$

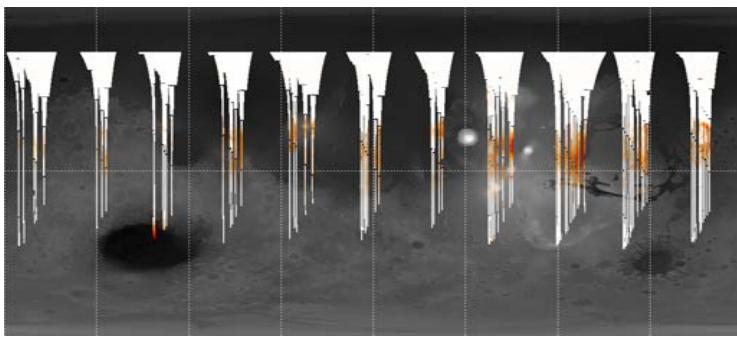


$$L_s = 160^\circ$$

H_2O -ice clouds and frosts



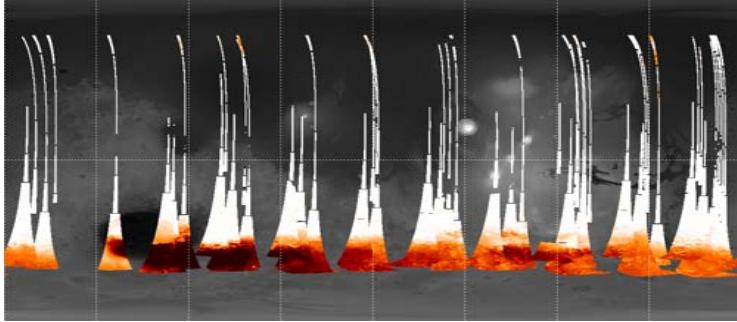
$$L_s = 0^\circ$$



$$L_s = 90^\circ$$

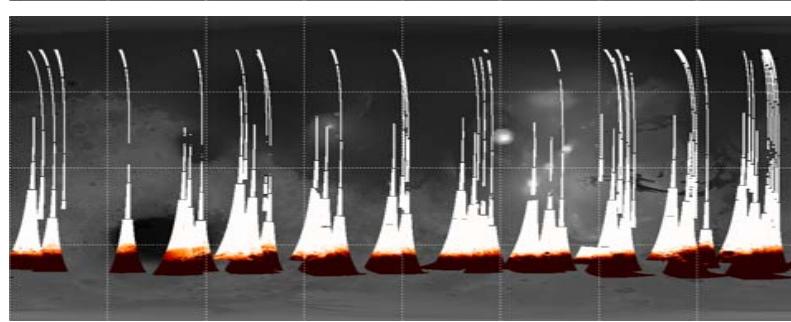
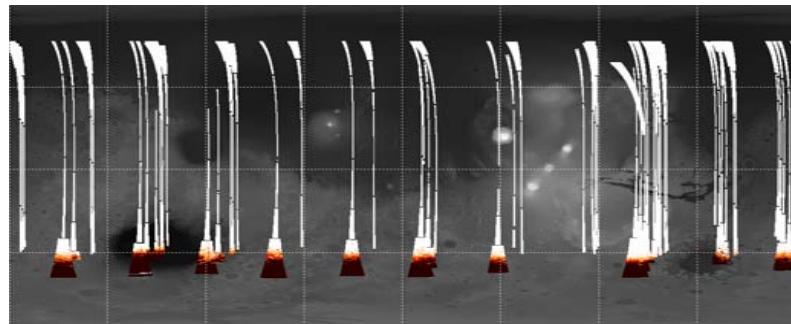
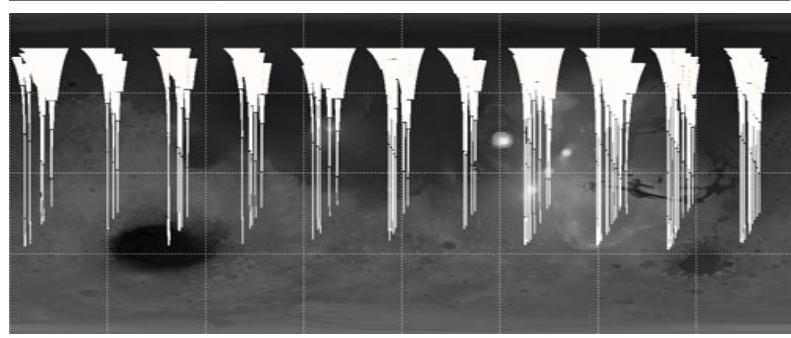


$$L_s = 120^\circ$$

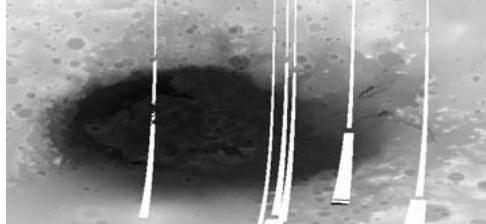


$$L_s = 160^\circ$$

CO_2 frosts

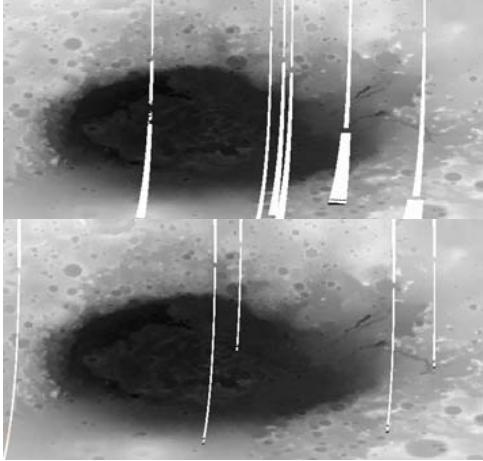


H₂O ice clouds and frosts in Hellas

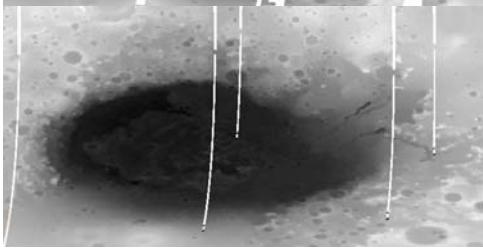


$L_s = 335^\circ$

H₂O



$L_s = 335^\circ$



$L_s = 15^\circ$

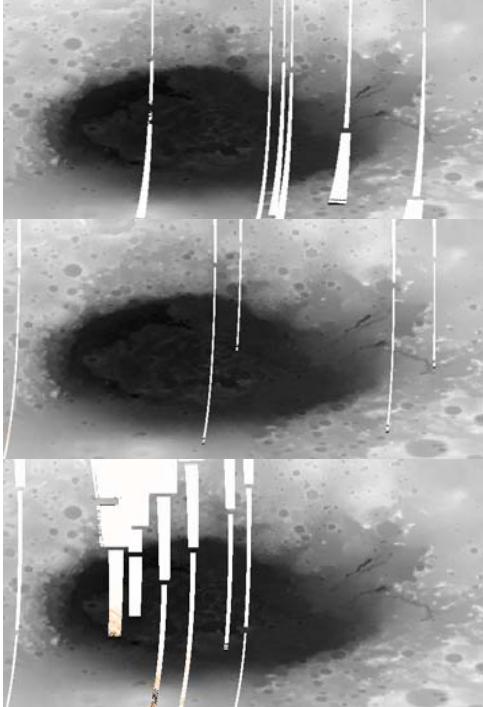
H_2O

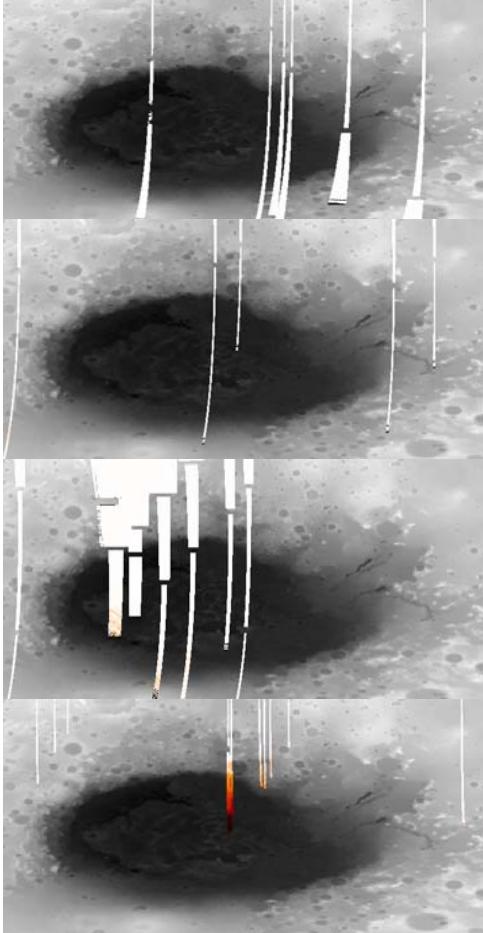
$L_s = 335^\circ$

$L_s = 15^\circ$

$L_s = 45^\circ$

H_2O





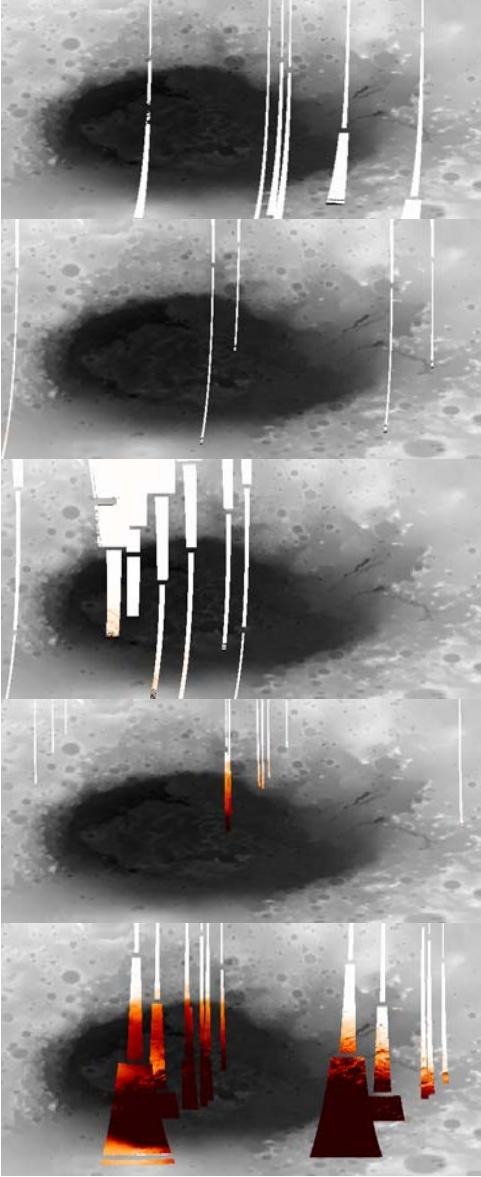
$L_s = 335^\circ$

$L_s = 15^\circ$

$L_s = 45^\circ$

$L_s = 105^\circ$

$L_s = 335^\circ$



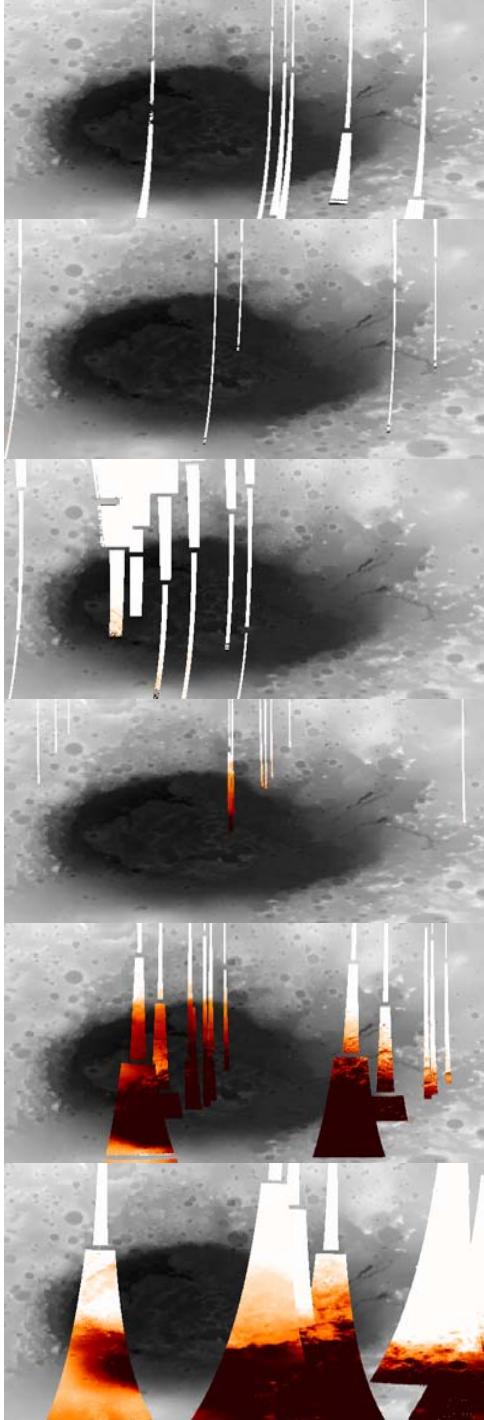
$L_s = 15^\circ$

$L_s = 45^\circ$

$L_s = 105^\circ$

$L_s = 120^\circ$

$L_s = 335^\circ$



$L_s = 15^\circ$

$L_s = 45^\circ$

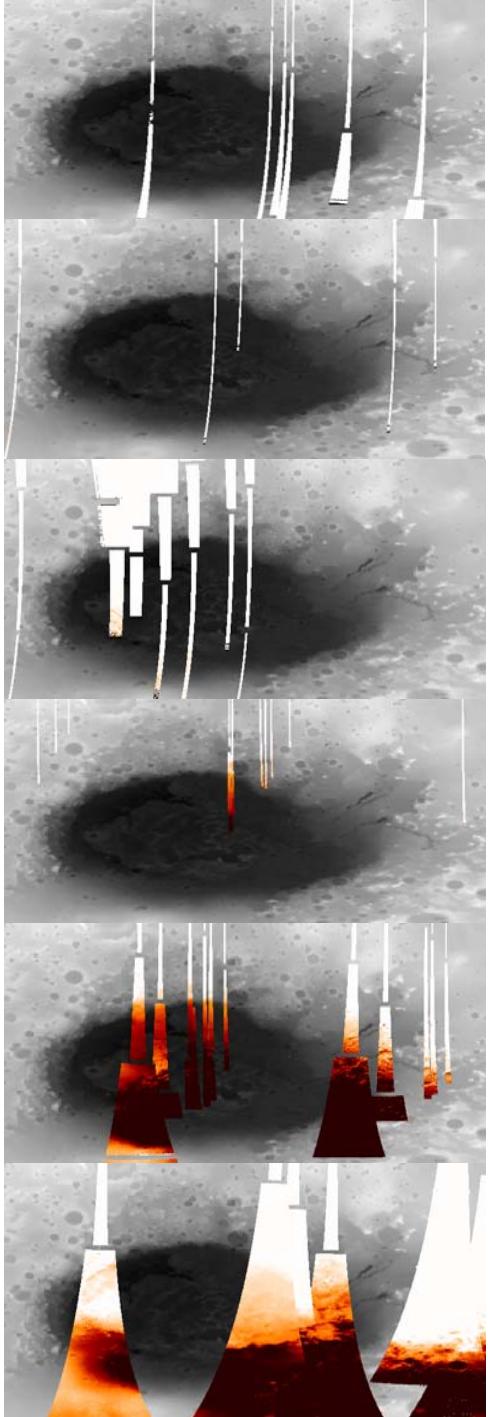
$L_s = 105^\circ$

$L_s = 120^\circ$

$L_s = 145^\circ$

H_2O

H_2O



$L_s = 335^\circ$

$L_s = 15^\circ$

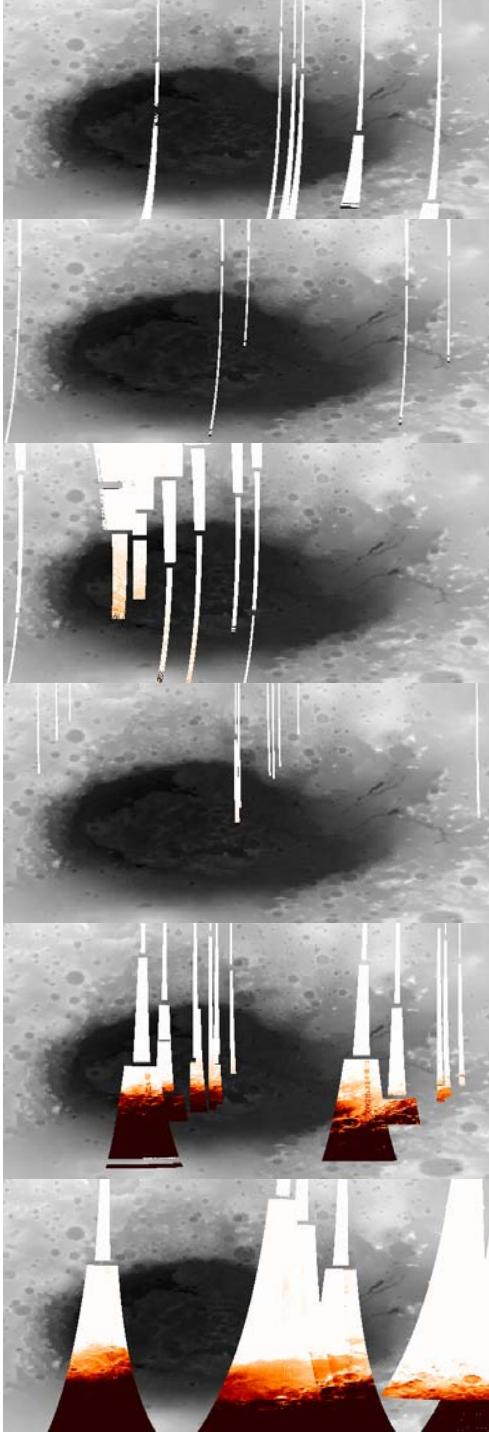
$L_s = 45^\circ$

$L_s = 105^\circ$

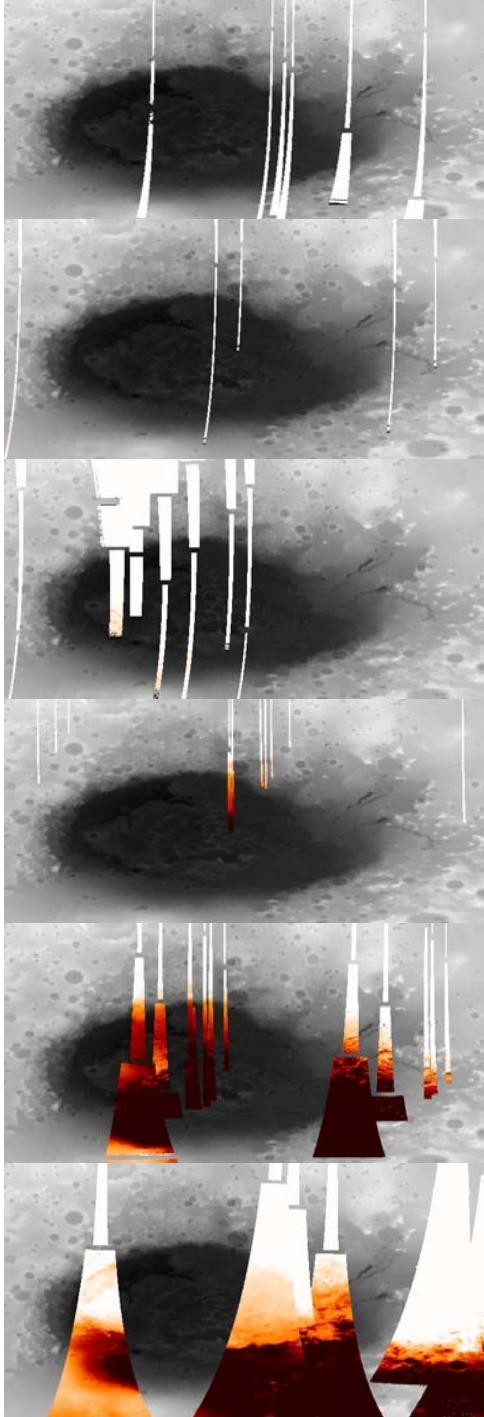
$L_s = 120^\circ$

$L_s = 145^\circ$

CO_2 frost



H_2O



$L_s = 335^\circ$

$L_s = 15^\circ$

$L_s = 45^\circ$

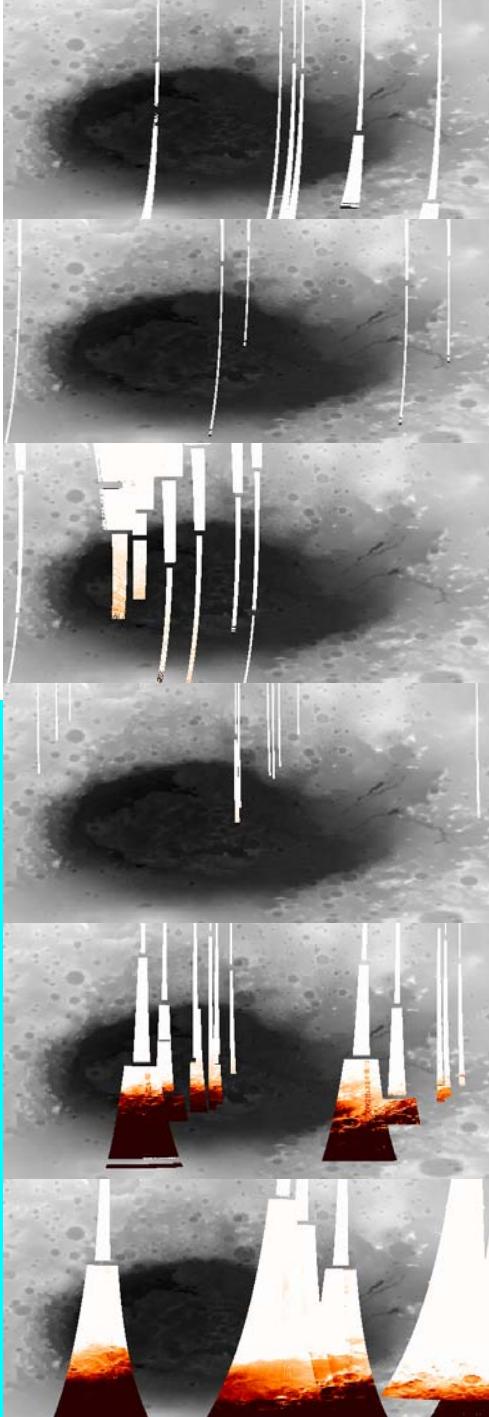
S winter S winter

↓ ↓

$L_s = 105^\circ$

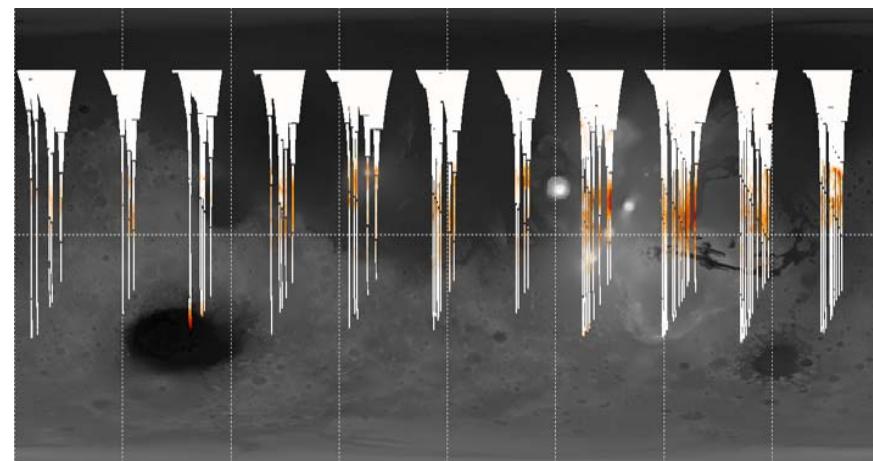
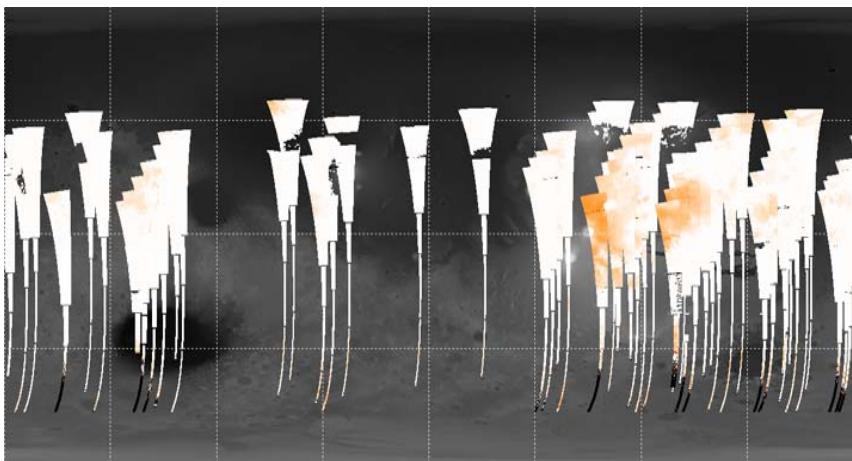
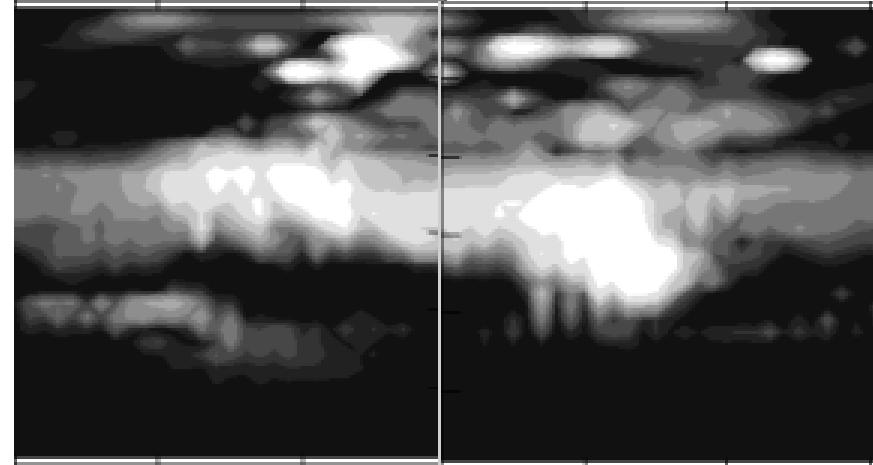
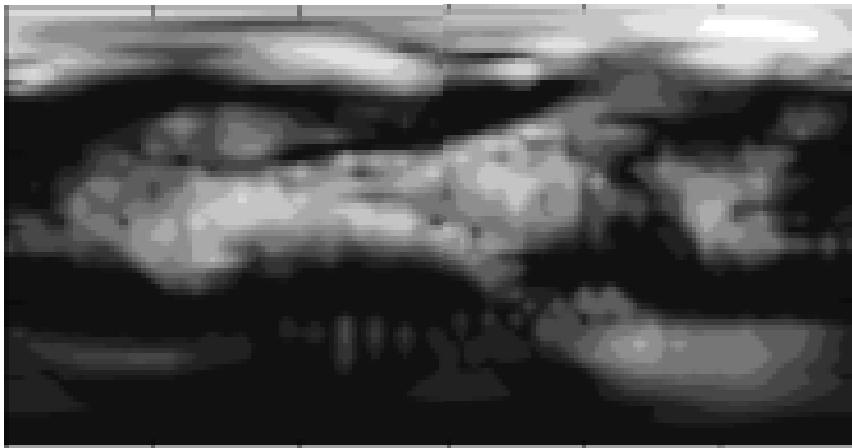
$L_s = 120^\circ$

$L_s = 145^\circ$



CO_2 frost

model predictions (M. Richardson et al. 2002) vs OMEGA observations



$L_s = 45^\circ$

$L_s = 90^\circ$

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Future prospects

- Complete mapping over a full Martian year
 L_s from 180° to 320° (up to orbit 2440 nov 06)
- Cooperate with SPICAM and PFS
if they will !