CO_2 supersaturation observed in the Martian lower atmosphere by MGS-Radio occultation technique - Preliminary results -

Katsuyuki Noguchi

Nara Women's University, Nara, Japan

nogu@ics.nara-wu.ac.jp

CO_2 supersaturation / condensation in Martian lower atmosphere

- Occurred in polar nights
- Associated with seasonal change of total pressure
- Results in formation of CO_2 clouds and/or snow fall

Recent works

- Convective available potential energy (Colaprete et al. [2008, PSS])

  →vertical integration of supersaturation, losing vertical information

- Hu et al. [2012, JGR]

  →estimating CO2 mass deposited onto polar caps, and particle size, but not mentioned degree of supersaturation

Further detailed analysis of

- Vertical structures of supersaturation
- Occurrence of degree of supersaturation

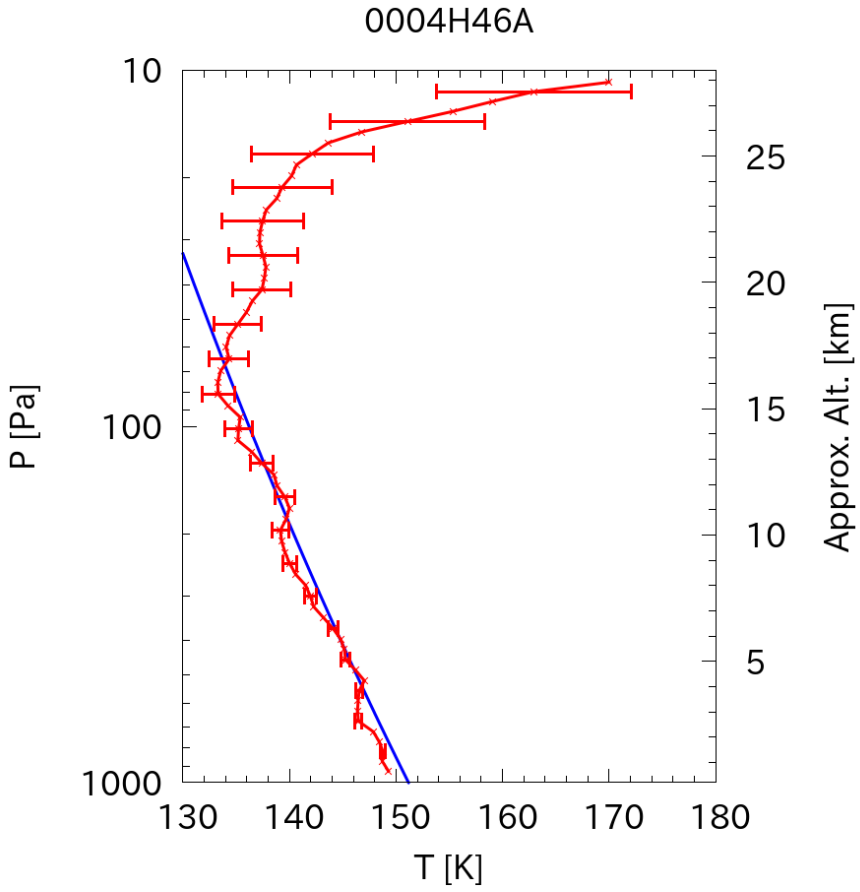
Data

Radio occultation measurements by Mars Global Surveyor (1997-2006)

– Vertical profiles of pressure and temperature (~20000 profiles)

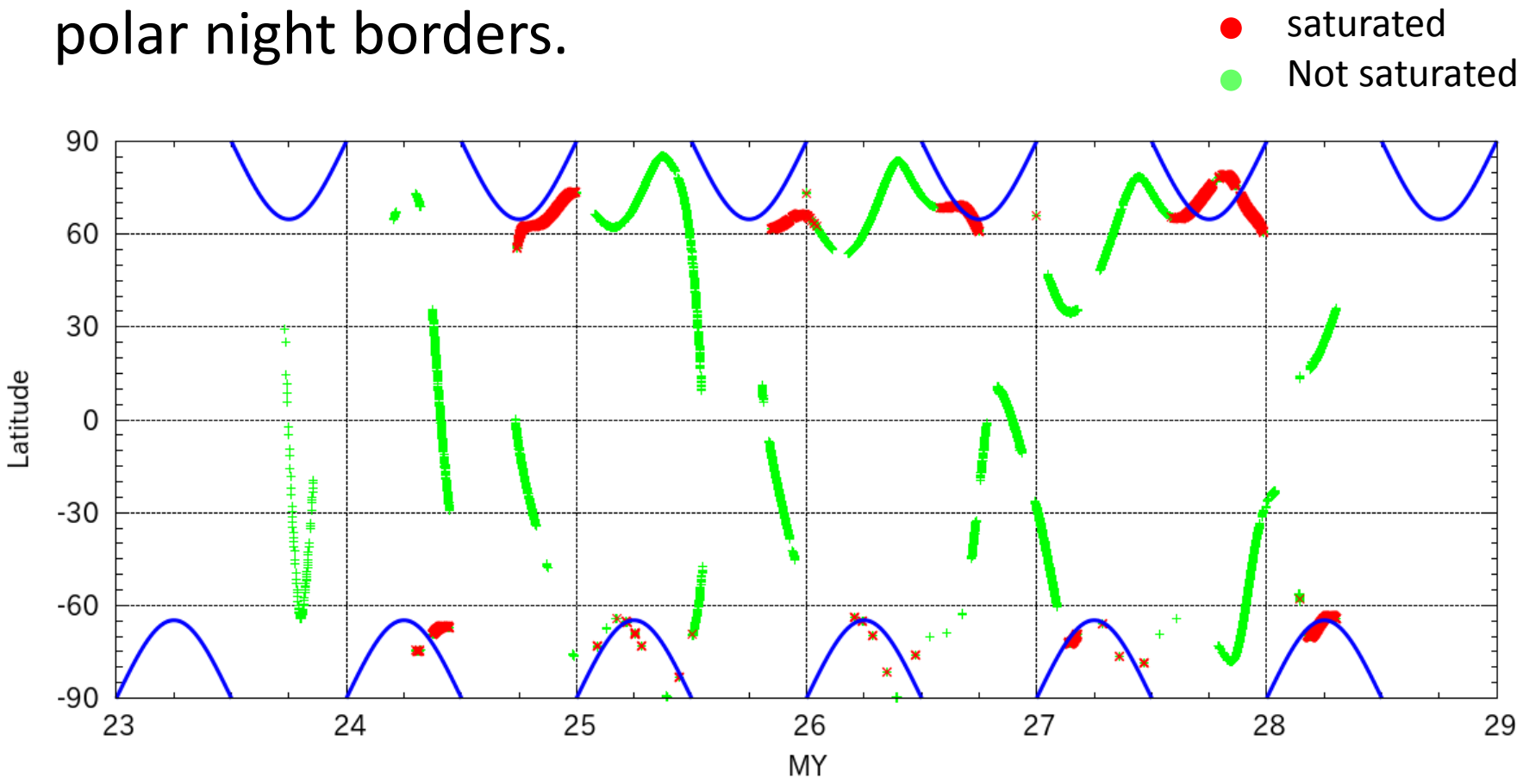
– Fine vertical resolution: <1km

– Temperature error: <~1K in the lower altitude

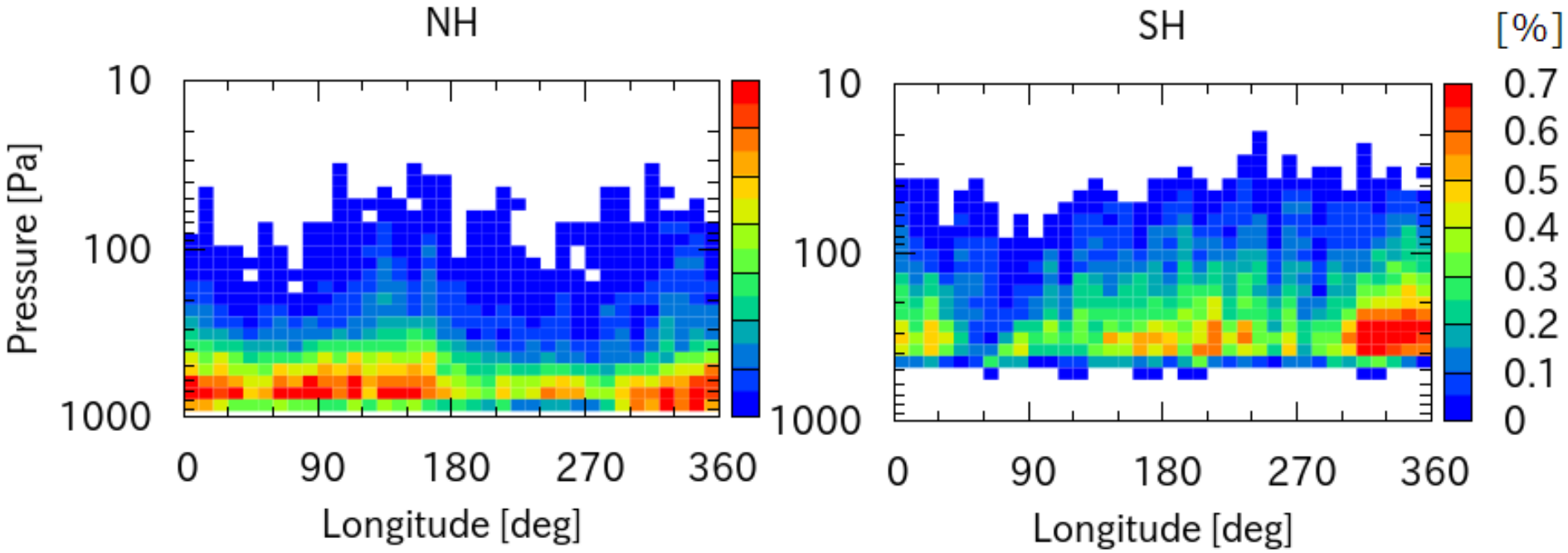


Sampling of Data

- Inhomogeneous (sparse) sampling, because sampling highly depends on the relative geometry among MGS-Mars-Earth locations.
- Supersaturation events are found even outside of the polar night borders.



Longitude-altitude dependence of supersaturation occurrence

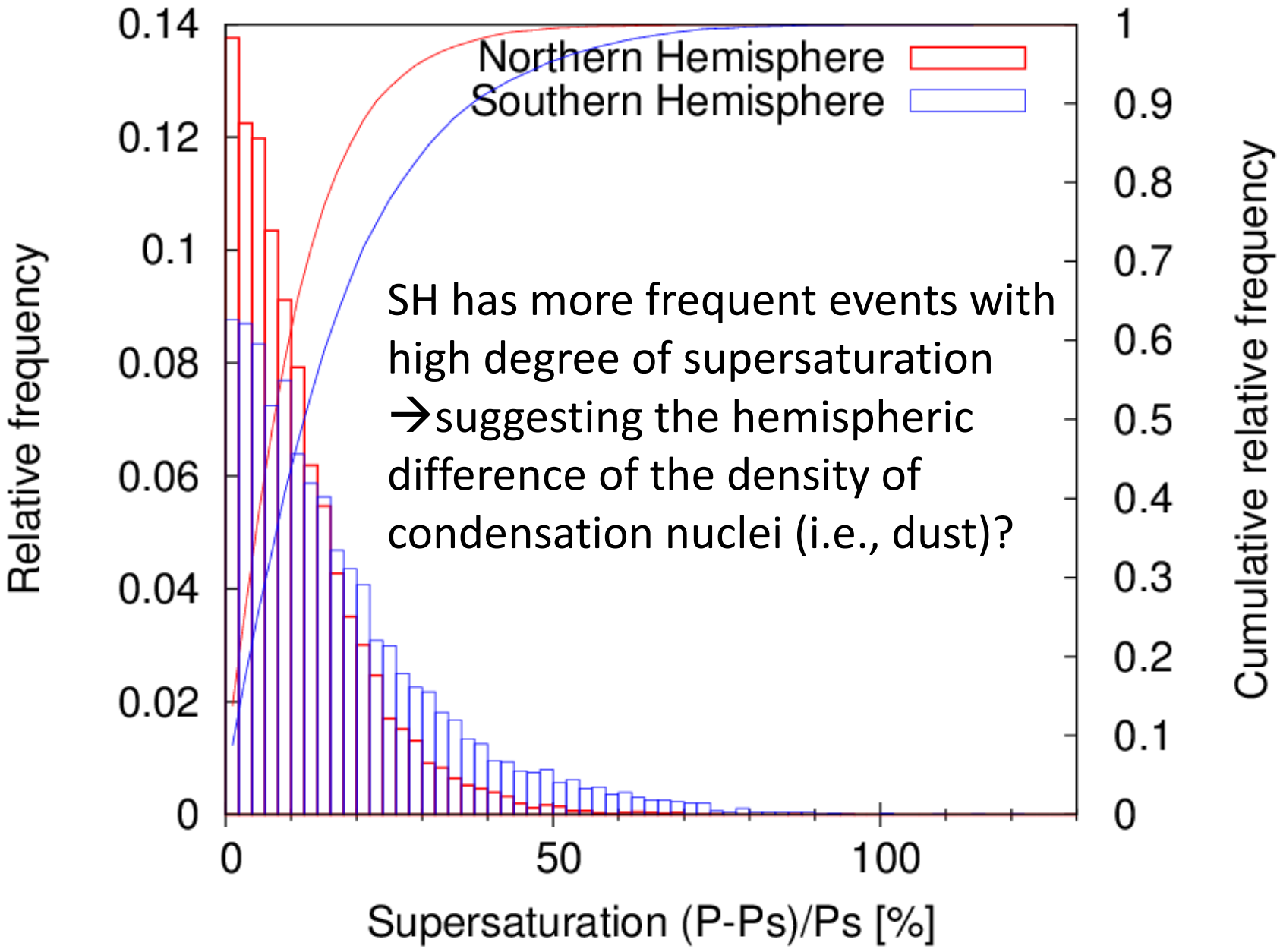


Distinct longitudinal structures:

- NH→"tall" supersaturation events (over 15km or 100Pa) at 120-180E and 330-360E
- SH→ frequent supersaturation at 300-360E

Effect of topography and/or transient waves [Kuroda, private communication]?

Occurrence of high degree of supersaturation in NH&SH



Summary

- Supersaturation events have not only longitudinal but also vertical dependences
- Southern hemisphere has more frequent occurrence of severer supersaturation events than the northern hemisphere.

  →suggesting the hemispheric difference of dust density or/and transport?

- Future works:
  - Using other data like MRO-RS and MRO-MCS CO2 clouds (cf. Hayne et al., [2012]) to confirm the results based on MGS-RS
  - Analysis with the aid of model outputs