SPRING SUBLIMATION ON MARS: DO NORTHERN AND SOUTHERN HEMISPHERES TELL US THE SAME STORY?

INTRODUCTION

The north polar erg is covered annually by a seasonal volatile layer, a mixture of CO₂ and H₂O, with mineral dust contamination. In spring, this layer sublimes creating visually enigmatic phenomena, e.g. dark and bright fan-shaped deposits, dark–bright–dark “bandings”, dark downslope streaks, and seasonal polygonal cracks. Similar features in southern polar areas are believed to be related to the specific process of solid-state greenhouse effect (so called Kieffer’s model) [1]. In the north, it is unclear if the solid-state greenhouse effect is able to explain all the observed phenomena.

TYPICAL NORTH

The conditions during northern winter and spring are different from those during southern:

- The northern hemisphere is known to be more humid than the southern [2]. Water crystals act as light scatterers inside the slab making it less transparent. They also compromise the integrity of CO₂ crystal structure in hardly predictable ways.
- Topographically north polar areas are lower than southern by up to 7 km which leads to pressure differences during local spring of up to 400 Pa. This is a very different thermodynamical environment for CO₂ and H₂O phase transitions.

TYPICAL SOUTH

In the north, water ice has a stronger influence on the seasonal evolution. We need further investigations to clarify how water ice contamination modifies Kieffer’s model. It might be, for example, responsible for prominent blue halos and dark-bright-dark bandings observed in northern dunes and also in southern crater dunes, known to be more water-rich than other southern polar terrains.

NORTH VS. SOUTH

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NORTH & SOUTH

CONCLUSIONS

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REFERENCES: