**GLOBAL DISTRIBUTION OF NEAR-SURFACE RELATIVE HUMIDITY LEVELS ON MARS.** B. Pál[1]
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**Introduction:** The global seasonal variations of near-surface relative humidity and relevant attributes on Mars were investigated. These might influence the process of deliquescence and the emergence of microscopic liquid water [1,2], as it has an impact on the possibility of survival of any hypothetical organism there [3,4] and astrobiology in general [5]. This work is the continuation of the earlier activity detailed in [6]. Using calculations from modelled and measurement data the seasonal effects on deliquescence were studied by examining four specific dates in the Martian year: the northern spring equinox, summer solstice, autumn equinox and winter solstice. Three specific zones were identified, where the near-surface relative humidity (RH) levels are systematically higher than in their vicinity, regardless of season. These areas coincide with low thermal inertia features.

**Methods:** First, model calculations by the Laboratoire de Météorologie Dynamique Mars General Circulation Model (LMDZ GCM) detailed in [7] including a water cycle as described in [8] was examined. Second, the measurements of Mars Global Surveyor Thermal Emission Spectrometer (MGS TES) [9] and calculated relative humidity values from the available temperature [10], pressure and water vapor data [11] were looked at. Method of calculation will be detailed in a coming paper (2019).

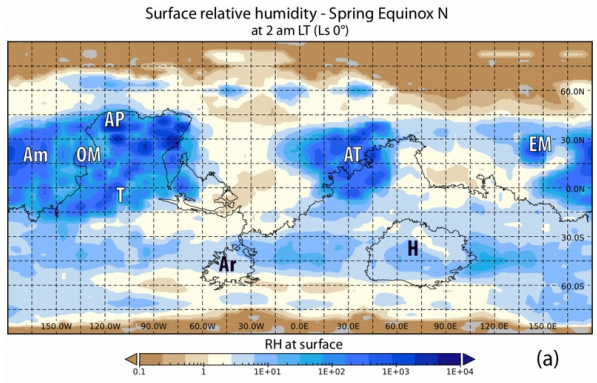


***Fig. 1.*** *Global distribution of surface relative humidity at 2 am local time, created from GCM model calculations.*

**Results:** The four representative seasonal phases throughout the Martian year are presented, the northern spring equinox (Ls 0°), summer solstice (Ls 90°), autumn equinox (Ls 180°) and winter solstice (Ls 270°). During all seasons at 2 am local time (LT) three distinct areas appear as oversaturated regions; the first zone being encircled by Amazonis (Am), Alba Patera (AP) and Tharsis (T); the second around Arabia Terra (AT); and the third in the region around Elysium Mons (EM).

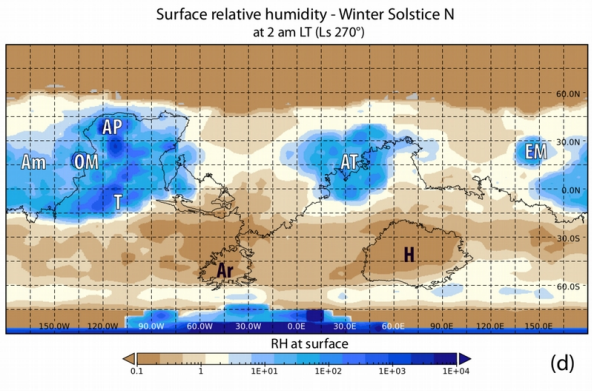


***Fig. 2.*** *Relative humidity distribution at 2 am local time, created from GCM model calculations.*

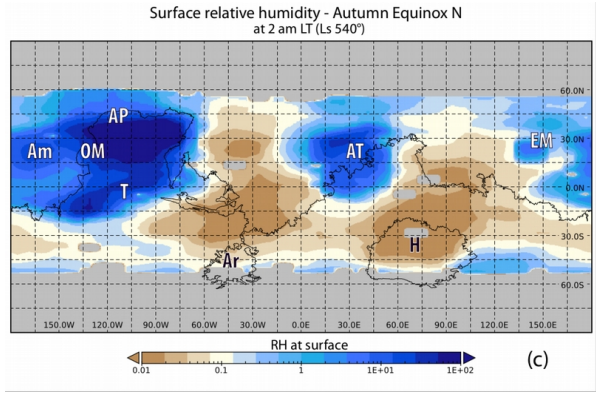


***Fig. 3.*** *Nighttime humidity distribution calculated from TES water wapor measurements.*

*Results from TES measurements.* The three humid zones defined above are visible here as well. The regions showing the highest RH values are east from Alba Patera (AP) and around Arabia Terra (AT). These areas have about one order of magnitude higher RH values than the other regions of the humid zones, and about 2-3 order of magnitude higher than the dry

sectors, shown with brown and cream colors on the maps. The gray areas in the figures correspond to places where relative humidity could not be calculated due to unavailable data.

*Thermal Inertia map.* The Thermal Inertia (TI) map below (Figure 4) was created from data measured by TES during the night. The three zones defined previously are visible here as blue colored low thermal inertia zones. The low thermal inertia area around Elysium Mons (EM), as well as the slightly higher, but still low TI region north from there are also distinct and form the same specific shape resembling a crescent moon, as seen in the relative humidity figures.

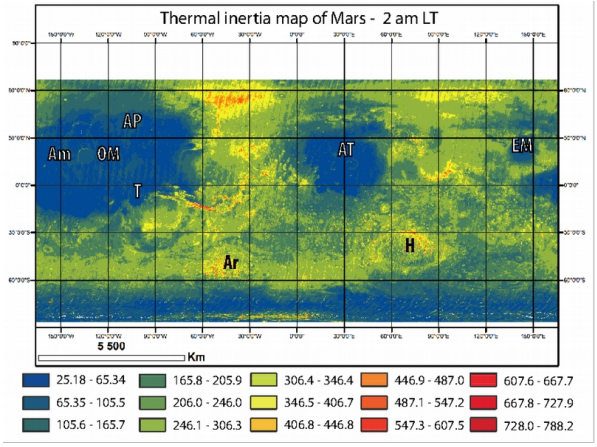


***Fig.4.*** *Thermal Inertia map from nightly TES measurements. The data intervals are color coded as shown below the map.*

**Conclusion:** The identified three ``humid'' zones show elevated near surface relative humidity levels compared to other areas during nighttime regardless of season, with certain variations discussed in detail in our upcoming paper (2019). The name ``humid'' refers to the relative humidity levels being higher than in the same latitudinal zone around 2 am local time, although it does not necessarily mean that there is a large mass of $H_2O$ in the atmosphere. These three areas are most likely regions on Mars, where the thermal inertia is low and the albedo is high. This suggest that they are covered by unconsolidated fine dust with grain sizes less than ~40 μm and cool down during the night, increasing the humidity above them.

**References:** [1] Martín-Torres et al. (2015) Nat. Geosci. 8, 357-361. [2] Kereszturi & Rivera-Valentin (2016) Plan. & Space Sci. 125, 130-146. [3] de Vera et al. (2014) Int. J. Astrobio. 13, 35-44. [4] Marschall et al. (2014) Plan. & Space Sci. 71, 146-153. [5] Domagal-Goldman et al. (2016) Astrobio. 16(8), 561-653. [6] Pal & Kereszturi (2017) Icarus 282, 84-92. [7] Forget F. et al. (1999) J. Geophys. Res. 104, 24155–24176. [8] Navarro T. et al. (2014) J. Geophys. Res. 119, 1479-1495. [9] Smith M. D. (2006) in Forget F. et al. Mars Atmosphere Modelling and Observations p. 211. [10] Conrath B. J. et al. (2000) J. Geophys. Res. 84, 8335-8340. [11] Smith M. D. (2002) J. Geophys. Res. 107, 5115.

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