QUANTIFYING THE LATITUDINAL DISTRIBUTION OF LANDFORMS ON MARS' SOUTHERN HEMISPHERE, NOACHIS TERRA – PRELIMINARY RESULTS. M. Voelker[1], C. Orgel[2], J. D. Ramsdale[3], A. Séjourné[4], A. Cardesín-Moinelo[1], and P. Martin[1], [1]European Space Agency, European Space Astronomy Center, Camino Bajo del Castillo s/n, Villanueva de la Cañada, E-28692 Madrid, Spain (martin.voelker@esa.int), [2]Freie Universität Berlin, Institute of Geological Sciences, Planetary Sciences and Remote Sensing, Malteserstr. 74-100, D-12249 Berlin, Germany, [3]Department of Physical Sciences, The Open University, Walton Hall, Milton Keynes, Buckinghamshire MK7 6AA, UK, [4]GEOPS, Univ. Paris-Sud, CNRS, Université Paris-Saclay, 91405 Orsay, France.

Introduction: We applied the newly developed grid-mapping method to quantify the geography of given landforms [1-6]. Grid-mapping allows to map extensive areas with efficiency and objectivity [2,3,4,5], it also helps to reveal relations between distribution and morphologies which are only visible from a wider perspective. Thus, we studied the distribution of water- and ice-related landforms by latitude to derive information about the climatic environments between equator and south pole in Noachis Terra.

Methods: The grid-mapping approach is based on a tick box system/layer, overlaying various remote sensing datasets. It requires a multi-layer GIS-environment in order to combine both remote sensing imagery and a polygonal vector shapefile containing the grid boxes (each 20×20 km; Cassini-projected map). Every box is being investigated for the presence or absence of pre-selected landforms. This approach is able to increase the level of intersubjectivity, as it is based on simple "Yes" and "No" decisions of the mapper. Hence it is possible for every reader to follow each of the mapper's decisions. Mapping scale was 1;25,000 and is based on CTX imagery [7].

The research area is a 100 km wide swath extending from the equator (9.8°-11.5°E, Fig. 1) to the south pole. The study area has been selected as it consists of a representative portion of the southern highlands without any other significant large topographical features in its vicinity that might influence the distribution of landforms.

Results: Among 30 pre-selected landforms, we are focusing on seven landforms in this abstract. They can be separated into two genetic landform assemblages:

Assemblage 1 (airfall deposits; Fig. 2): Dust [8], latitude-dependent mantle deposits LDM [9], lower and upper polar deposits [e.g., 10]. While dust is a dry airfall deposit, the three other ones (LDM, lower and upper polar deposits) contain high amounts of volatiles. Dust covers most of the low latitudes. It vanishes around 30°S, when it is superseded by LDM. Around 65°S LDM is getting replaced by (or transits into?) the lower polar deposits, that are overlaid by the upper polar deposit around 75°/80°S.

Assemblage 2 (landforms indicative for a volatile-rich (periglacial) environment; Fig. 2): Filled craters [11], segmented gullies (segmented into alcove, channel, and fan) [12], and pedestal craters [13]. We found this assemblage around 5°-10°S (Population (N) in Fig. 3) and 25°-85°S (Population (S) in Fig. 3). Between 15° and 25°S none of these features were found. So these two populations are separated from each other.

Discussion: *Assemblage 1* provides geomorphological evidence for at least three large-scale layers containing ice. The transition zone from dry dust to LDM (~30°S) suggests a relation between the two landforms. Possibly, dust might be a dry sort of LDM, having more or less the same age. The two polar deposits (starting at 60°S and 70°S) show some features that are typical for the polar ice cap; the lower layer shows dark material (dark dune spots and Martian spiders). Additionally, the upper layer shows polar sublimation pits, and resembles even more to polar ice cap deposits than the lower deposit. Altogether, these three layers may show deposits of the most recent Amazonian obliquity changes. Stratigraphically, the lower polar deposits can be distinguished very well from the upper polar deposits, while the integration of LDM within the stratigraphical column cannot be unambiguously determined yet (crater counts are still pending).

The results of *Assemblage 2* support theories that ice has been deposited at lower latitudes due to high obliquity change. [14]. The landforms found at 5°-10°S must have been formed when the climate at these latitudes was more favorable for the deposition of volatile-rich materials [15]. Below 85°S none of these feature is visible due to a thick cover of polar deposits; but we cannot exclude that they are present underneath.

Future Work: Future work will provide a completion of the results for Noachis Terra by adding the results obtained in the northern hemisphere [3,4,5]. Thus, it is possible to quantify the landforms on a global scale, and to juxtapose the distribution of landforms on both hemispheres: How different is each hemisphere? Are there asymmetries of the zonal environments? How much does the global topography influence the distribution of water- and ice-related landforms?

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Fig. 1 (right): *Study area (red box) in Noachis Terra, Mars. Elevation key: blue=low, red=high (Google Earth, basemap MOLA)*

Fig. 2 (center): *Graph showing the normalized distribution of Assemblage 1 by latitude.*

Fig. 3 (below): *Graph showing the normalized distribution of Assemblage 2 and its two populations North (N) and South (S) by latitude.*