**CHARACTERIZING POLYGONAL TERRAINS IN-SITU ON ADVENTDALEN (SVALBARD) FOR COMPARISON WITH MARTIAN ANALOGUES: THE 2010 FIELD CAMPAIGN.** P. Pina[1], G. Vieira[2], H.H. Christiansen[3], M.T. Barata[4], J. Saraiva[1,3], L. Bandeira[1], C. Lira[1], M. Jorge[2], C. Mora[2], A. Ferreira[2], M. Oliva[2], A. Trindade[2], E. Poelking[2], A. Machado[4], M. Neves[2], M. Lousada[1], [1]CERENA/IST, Lisboa, Portugal (ppina@ist.utl.pt), [2]CEG/IGOT, Lisboa, Portugal, [3]UNIS, Svalbard, Norway, [4]CGUC, Coimbra, Portugal.

**Introduction:** Terrestrial polygonal networks are being studied in detail at test sites in the Arctic region at 78ºN of latitude, Svalbard (Norway), by three Portuguese and one Norwegian research teams [1]. The common and diversified occurrence of this type of patterned ground, previous basic process studies [2-3] and the easy access to the Svalbard archipelago make it a good choice for terrestrial analogue studies, as other teams testing probes for future planetary missions or working on similar studies on these and other geomorphological features have demonstrated [4-5]. The features measured on these terrestrial networks will be confronted with those of Martian networks [6-11] to help in their understanding. This text summarizes the campaign carried out in June 2010 and presents some preliminary results.

**Field test site and imagery:** A field survey was conducted in a selected region of about 0.65 km$^2$ in the valley of Adventdalen (Figure 1) to gather accurate data on the geometry and topology of the polygons, on the characteristics of the soils and vegetation (if present), and on the depth of the active layer. This was greatly aided by the two available sets of remotely sensed imagery with very high spatial resolution of the test site. The first is constituted by aerial images acquired by the Norsk Polarinstitutt in 2009 with a spatial resolution of about 20cm/pixel in true-colour and near-infrared modes (Figure 2-top). The second set of images (RGB), of even higher spatial resolution (4-6 cm/pixel), was captured during the 2010 campaign by a camera mounted on an UAV-Unmanned Aerial Vehicule operated by Kolibri GeoServices (Figure 2-bottom). The respective geometric corrections were performed and permit us to have all the images and data acquired in the field in the same geographic reference.

**Data acquisition:** The data acquired on the field from intensive measurements with a D-GPS consists of detailed topographic information on a regular grid for the complete test site, mapping of the contours or wedges of 121 polygons of the network (at all the vertices and several points of the edges, Figure 3) and height variations within some polygons in a very dense grid. Additional measurements of the thickness and depth of the wedges of the polygons and the depth of the active layer in several points inside each polygon were also acquired. A qualitative description of the test site from the geomorphological point of view, together with a rough inventory of the vegetation, was achieved too.

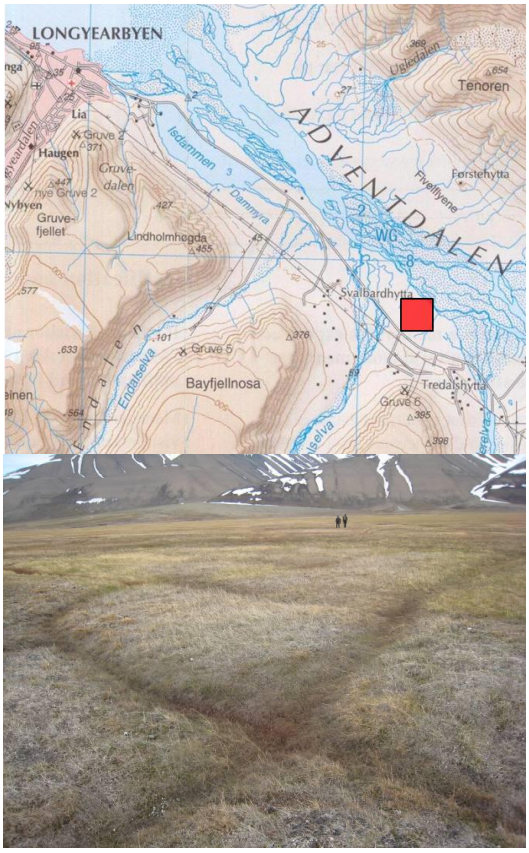


Figure 1 – Field test site in Adventdalen (red square over the topographic map of the Norsk Polarinstitutt) (top) and polygons observed in-situ during June 2010 (bottom).

**Preliminary results and on-going work:** The amount and density of data acquired on the field permitted us already to construct a number of maps. A DTM based on about 4000 control points was built; the detail available allowed an equidistance of 0.25m for the contour lines. Some of the polygons were analysed in much more detail and the acquisition of several hundreds of ground control points permitted the modelling of their surface with the detail seen for the low-centred polygon of Figure 4. Other maps, such as the one related to the active layer depth (based on more than 10,000 experimental measurements) and the one based on ge-

omorphological features (vegetated polygons, wet low-centred polygons, channels, mud-boils, small polygons and salt extrusion surfaces) are currently under construction. Image analysis algorithms developed to segment and characterize martian polygonal networks [8-10] are being adapted and calibrated for these aerial images (the presence of vegetation and liquid water marks a clear departure from the Martian images).

Figure 2 – Details of polygonal terrains on Adventdalen in aerial images of 20 cm/pixel (top) and 6 cm/pixel (bottom) (scale bars measure approx. 20 m).

**Conclusions:** These are very preliminary results of a first field campaign in the Arctic to gather information on polygonal networks for martian analogue studies. Their importance resides on the fact that this data is a "true" ground-truth which is expected to be of great value for the validation and calibration of the segmentation and characterization algorithms we have been developing for Martian networks. Another campaign in Svalbard is being prepared for the summer of 2011, where ground surveys in other field sites with polygonal networks will be performed.

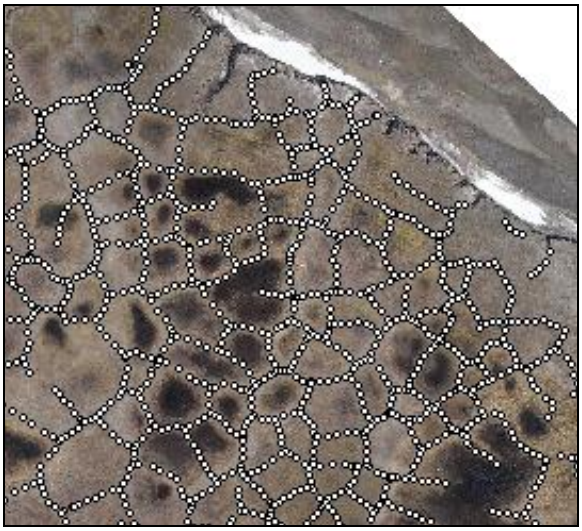

Figure 3 – Ground survey points on wedges, obtained by D-GPS (white circles over an aerial image).

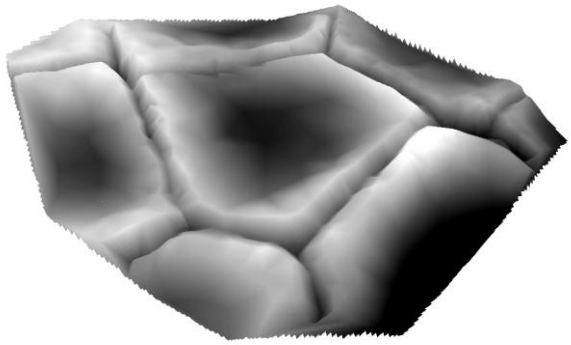

Figure 4 – Modelling the surface of a low-centered polygon of about 15 m in diameter and respective neighbourhood (vertical exaggeration for visualization purposes).

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