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The Antarctic permafrost as a testbed for REMS (Rover Environmental Monitoring Station-Mars Science Laboratory)

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The present climatic characteristics of Mars favor the presence of extense permafrost areas in this lonely planet. Therefore environmental parameters that are included in Martian Rover missions are also used for monitoring thermal soil surface evolution in order to study the permafrost active layer thickness and the energy balance in the soil-atmosphere boundary limit layer. The REMS (Rover Environmental Monitoring Station) is an environmental station designed by the Centro de Astrobiología (CAB- Spain) with the collaboration of national and international partners (CRISA/EADS, UPC and FMI), which is part of the payload of the MSL (Mars Science Laboratory) NASA mission to Mars (http://mars.jpl.nasa.gov/msl/overview/). This mission is expected to be launched in the final months of 2009, and mainly consists of a Rover, with a complete set of scientific instruments; the Rover will carry the biggest, most advanced suite of instruments for scientific studies ever sent to the Martian surface. Five sensors compose the REMS instrument: ground (GT-REMS) and air temperatures, wind speed and direction, pressure, humidity and ultraviolet radiation (UV-REMS). A simplified setup of the REMS was deployed on Antarctica in the surroundings of the Spanish Antarctic Stations on Livingston and Deception Islands (Maritime Antarctica), where the permafrost distribution is well-known. The aim of the experiment was to check REMS's sensors response against hard environmental conditions and calibrates their measures with standard Antarctic devices. The experimental apparatuses included some standard meteorological and thermopiles sensors corresponding to the REMS. All the sensors are mounted in a 1.8 m mast and include a Pt100 air temperature sensor with shield solar protection on the mast top, a Kipp and Zonnen CNR1 net radiometer for measuring infrared (5-50 μm) and short wave solar (305-2800 nm) radiation at 1.5 m high, GT-REMS sensor and its amplification box at 0.7 m high and finally two soil temperature plates based on Pt100 sensors are in close contact with the surface in the angle of view of the GT-REMS thermopiles. In this work, we present a preliminary analysis of the data obtained in the Antarctic field campaign 2008-2009. For the analysis we developed a theoretical model which is briefly outlined here. We also present the results of simulations carried out with the model and their validation against the antarctic data. Complementary to the Antarctic experiments, we carried out an experience with all the instruments during the last summer in the CAB-Spain which are also used in the analysis. Finally, we compare the results of the last polar and CAB experiments in order to check the improvements introduced in GT-REMS.