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Near surface environment specifications for Lunar South Pole exploration sites

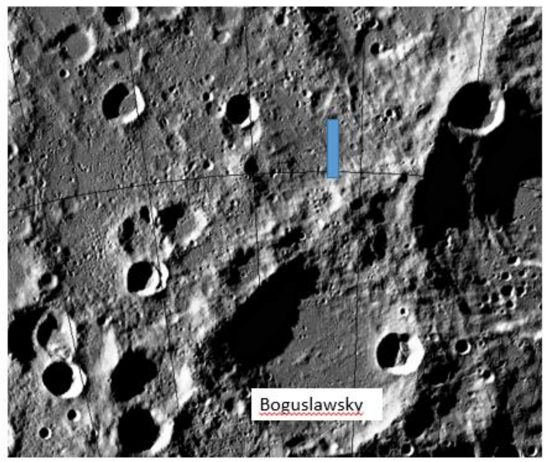
Fabrice Cipriani (1), Ilya Kuznetsov (2), Bernard Foing (1)
(1) ESA/ESTEC, Keplerlaan 1, 2200AG, The Netherlands (fabrice.cipriani@esa.int), (2) IKI, Российская академия наук, Profsoyuznaya ul., 84/32, Moskva, Rusland, 117342

Abstract

Lunar exploration scenarii such as ROSCOSMOS Luna 25 to 29 landers planned between 2019 and 2030 include landing in the Lunar South Pole regions in order to characterize trapped volatiles and usable resources, study the lunar dusty exosphere, plasma and radiation environments, and prepare for the future deployement of robotic and humans explorers and humans infrastrucutres. In the years to come some steps will be undertaken to test technologies for landing, communication, and resources charachterization in a collaborative frame between ROSCOMOS and ESA [1,2].

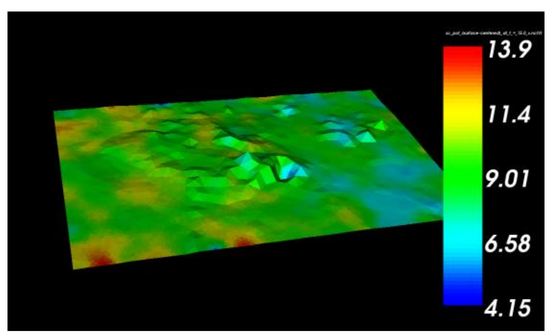
Those activities will benefit from a better understanding of both the lunar regolith properties as well as close lunar surface environment characteristics at scales relevant to habitat, and surface operations. Here we present some predicted effects due to the Solar Wind plasma and Solar EUV illumination interactions with the lunar surface such as regolith surface charging, topology driven fields and potential surface dust mobilization.

We explore a range of environmental parameters corresponding to varying Moon location as well as Solar activity while specific to the South Pole Region of the Moon at a possible area of interest North of the Boguslawsky crater (72.9°S, 43.3°E, ~100 km in diameter), a region of interest for future landers such as Luna Glob[3]. In particular we have used a LRO based DTM on a restricted (~100mx100m) 69.545°S, 43.544°E centered area of interest where some topological variations can be identified (see Figure 1).



. Figure 1: context map (LRO/WAC) showing the area container (blue rectangle North of Boguslawsky crater).

A coupled PIC-Monte Carlo approach is used to calculate surface potential (e.g. Figure 2) and lunar dust charging and near surface transport.



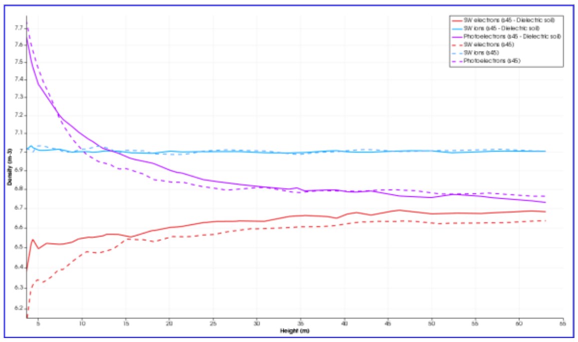


Figure 2: top : surface potential map associated with a DTM of a 130mx90m lunar surface patch (with reduced resolution) at 60 illumination angle in the solar wind. Bottom : density profiles of plasma species and dust

This provides an illustration of possible study cases that can be performed for specific landers, rovers and payloads scenarios at the lunar surface.

References

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