

**THE TEMPERATURE REGIME OF NSR S3 SPOT REGION IN THE SOUTH POLE OF THE MOON.** Pugacheva<sup>1</sup> S. G., Feoktistova<sup>1</sup> E. A. and V. V. Shevchenko<sup>1</sup>, <sup>1</sup>Sternberg State Astronomical Institute, 119899, Moscow, Russia; [katk@sai.msu.ru](mailto:katk@sai.msu.ru)

**Introduction:** According to data from neutron spectrometer LEND onboard the probe LRO the five statistically most stable areas of high hydrogen abundance was registered in the south pole region of the Moon [1]. One of such areas is NSR S3 spot region which is located in the vicinity of the South Pole of the Moon between the craters Shoemaker (88° S, 44,9° E, 51 km) and Hawort (86,9° S, 356° E, 50 km). In paper [1] the area of this site was estimated as 647 km<sup>2</sup>.

**Method** The temperature of the surface depends on the altitude of the sun above the horizon, the slope and orientation of the surface and the angular height of the horizon. For the investigation of the illumination conditions and temperature regime in NSR S3 area we used altimetry data from altimeter LOLA onboard probe LRO [2]. The NSR S3 spot region is divided into a number of elements of given size with step in latitude that is equal 0,05 degrees and step in longitude that is equal 1 degrees. The total number of the elements of this region is 2700. We used the algorithm described in [3] to calculate the height, slope and orientation of each element of the surface. To determine the position of the sun at each time step its angular height and the orientation were calculated. We used time period of one lunar day or 29.5 Earth's days in our calculations.

According to our results the full range of topography of NSR S3 spot region is about 7.8 km, excluding the areas of crater Shoemaker and Hawort. The deepest points of this region are reached the depth of 1.6 km and located in two small craters on outer slopes of craters Shoemaker and Nobile (85.3° S, 53.4° E, 79.3 km). The highest point of this region is on the western rim of the crater Nobile and rise above the surrounding rerraines by 5.5 - 6 km. The slopes of this area is about 20° – 25°. The flat area is located between the crater Nobile and the crater Hawort. The heights in this area are varied from -0.8 km to 1.2 km and the slopes don't exceed 7°. The area of this site is 2200 km<sup>2</sup>.

#### **Temperature regime and illumination conditions of NSR S3 spot region.**

Fig. 1 and 2 demonstrate the results of our calculations of the illumination conditions and maximal temperatures in NSR S3 spot region, respectively. 100% corresponds permanently shaded cases. The hottest area where maximal temperature reaches 300 – 350 K is situated on the slope of crater Nobile. Many small cold spots are located in the central flat part of NSR S3 spot region. These spots are shaded during 85 - 100% of time. The maximal temperatures in these spots do not exceed 50K.

The linear sizes of such spots are about 3 km. According to our calculations the areas of such spots are equal to 450 – 460 km<sup>2</sup>.

**Stability of deposits of volatile species in the NSR S3 spot region.** We investigated the thermal stability of such volatiles species as H<sub>2</sub>O, H<sub>2</sub>S, NH<sub>3</sub>, SO<sub>2</sub>, C<sub>2</sub>H<sub>4</sub>, CO<sub>2</sub>, CH<sub>4</sub> in the NSR S3 spot region. These species were detected in impact plume during the LCROSS impact experiment [4]. The evaporation rate of the deposits of volatiles were estimated from [5]. The vapor pressures data for H<sub>2</sub>O, H<sub>2</sub>S, NH<sub>3</sub>, SO<sub>2</sub>, C<sub>2</sub>H<sub>4</sub>, CO<sub>2</sub> and CH<sub>4</sub> were taken from [5] and [6], respectively. Our results demonstrate that the deposits of such volatile species as H<sub>2</sub>O, H<sub>2</sub>S, NH<sub>3</sub>, SO<sub>2</sub>, C<sub>2</sub>H<sub>4</sub>, CO<sub>2</sub> and CH<sub>4</sub> can be stable on the surface against thermal evaporation in some permanently areas in the NSR S3 spot region. The distribution and areas of these regions are represented in Fig. 3 and Table 1, respectively.

Table 1. Areas of thermal stability in NSR S3

Species	Areas, km <sup>2</sup>
CH <sub>4</sub>	400
C <sub>2</sub> H <sub>4</sub>	400
CO <sub>2</sub>	450
H <sub>2</sub> S	460
NH <sub>3</sub>	465
SO <sub>2</sub>	470
H <sub>2</sub> O	530

**Conclusions:** In this paper we investigated the temperature regime and illumination conditions in the NSR S3 spot region near south pole of the Moon. The areas of permanently shaded regions and regions where the existence of the deposits of the volatile species regions were estimated. Some of such areas are located in the northern part of the flat areas in NSR S3 spot region. The high abundance of hydrogen accordingly to data from LEND in this area supports the existence here the deposits of volatiles? Including the water ice. It make given region an interesting as a possible landing area for future lunar missions.

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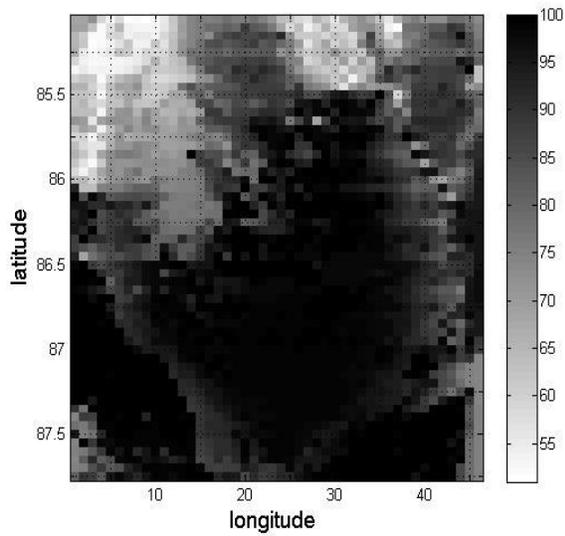


Figure 1. The illumination conditions in NSR S3 spot region.

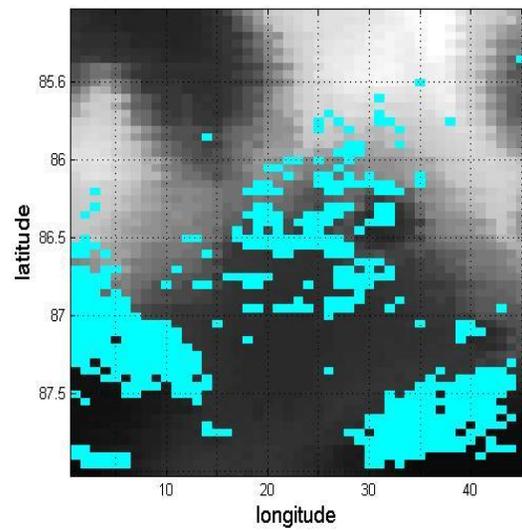


Figure 3. Areas of thermal stability of deposits of volatile species (blue) in NSR S3 spot region.

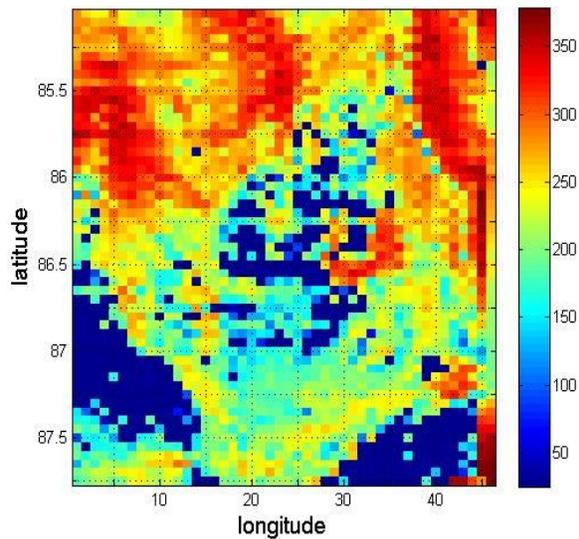


Figure 2. The distribution of maximal temperatures in NSR S3 spot region.