REGOLITH MIXING IN PERMANENTLY SHADDED REGIONS IN THE LUNAR SOUTH POLE, INFERRING THE DISTRIBUTION OF WATER ICE. P. E. Montalvão, M. Hirabayashi, and D.T. King Jr., 1Department of Geosciences, Auburn University, Auburn AL 36849 USA, 2Department of Aerospace and Engineering, Auburn University, Auburn AL 36849 USA. (pem0020@auburn.edu).

**Introduction:** In the lunar south pole, the major regions that host water ice materials are permanently shaded regions (PSRs) [e.g., 1–6]. The distribution of water ice may be controlled by mixing of materials, heat transfer [e.g., 7, 8], and transported and eventually cold-trapped in PSRs [e.g., 9, 10, 11]. We interpret that once water ice is accumulated by heating and cold traps in PSRs on the lunar surface, water ice may be stable even though impact cratering events mix the top layer. Thus, if the crater distribution is obtained, we can give constraints on the intensity of mixing and thus the distribution of water ice [12–14].

**Objectives and Methods:** This study investigates the regolith mixing depth in the lunar south polar region by using the crater distributions and by applying a statistical approach. Here, we preliminarily report the spatial distribution of the regolith mixing depth in the crater floor of Amundsen due to constant cratering events. We used ArcGIS CraterTools [16] and data from the Lunar Orbiter Laser Altimeter (LOLA) [17] at pixel resolutions between 5 to 20 m to perform crater counting. We analyzed the depth of regolith mixing using the technique by Hirabayashi et al. [15]. Using crater populations and modeled mixing depths, we mapped the spatial distribution of regolith mixing depths by calculating the number of craters in a moving neighborhood [e.g., 18] of 15 km in radius (sampling area of ~706 km²).

**Results and Discussion:** The crater distribution in the floor of Amundsen is described in Figure 1A. It is observable from the CSFDs that crater distributions vary within the crater floor and yield different crater productions. Then, we calculated the regolith mixing depths (Fig. 1B). The 90% fraction of mixing reaches varies spatially, ranging from ~1 m to ~3 m. Fig. 2 shows the spatial distribution of regolith mixing in the crater floor of Amundsen. These results indicate that the crater production within a single target crater can significantly control the depth of lunar regolith mixing. Therefore, if water ice is present, it may exist at various depths within a single host crater.

Complex craters that host water ice [6] will be analyzed to investigate the water ice mixing depth spatial distributions in PSRs. In the current presentation, we will analyze the mixing depth distribution in Faustini, Shoemaker, and Haworth to give insights into the variations in the water ice distribution at higher resolutions. The crater distribution may give strong hints on the distribution of water ice and provide inputs to future lunar south polar exploration missions (e.g., Artemis) that will sample water ice.