SURFACE WATER AT LUNAR MAGNETIC ANOMALIES. S. Li[1] and I. Garrick-Bethell[2,3], [1]University of Hawaii, [2]University of California, Santa Cruz, [3]Kyung Hee University (shuaili@hawaii.edu).

Introduction: Lunar surface water (OH/H_2O, herein referred to as water) has been remotely measured with infrared (IR) data from ground-based telescopes and spacecraft [e.g. 1,2]. One of the major formation mechanisms of lunar surface water is attributed to solar wind implantation [e.g. 3]. Hence, changes in solar wind reaching the surface may result in variations of lunar surface water content. The Moon's strong lithospheric magnetic anomalies likely reduce the local solar wind flux. The apparent reduction in space weathering effects at certain magnetic anomalies, known as swirls, is supportive of this model [4]. Thus, swirls may also be correlated with suppressions in lunar water. Indeed, such suppression effects were initially reported by [4]. Li and Milliken [5] also reported such an effect at one swirl: Mare Ingenii. However, Bandfield et al., [6] performed different thermal correction to M^3 data and found almost no water variation across the lunar global surface. Here we re-assess water features at several magnetic anomalies at different latitudes and compositional units (mare vs. highland) using our improved water map to confirm that magnetic anomalies show strong suppressions in water content globally, which cannot be introduced by the thermal correction of M^3 data. Since swirls systematically reduce solar wind flux and energy, while locally keeping other confounding variables constant (e.g. temperature and UV photon flux), studying how swirl magnetic fields affect water production may provide essential clues about how surface water is formed everywhere on the Moon.

Methods and Results: Our preliminary results at Reiner Gamma (mare, equatorial), Airy (highland, ~20° S, Fig. 1), and Gerasimovich (highland, ~20° S) swirls show that there is strong water suppression at these magnetic anomalies. The water maps are updated in two respects: 1) a slightly improved thermal model based on the one in [7]; 2) a small negative water content (within detection uncertainty) is allowed during mosaicking. The temperature used to perform the thermal correction for M^3 data in our model exhibits no difference between magnetic and surrounding nonmagnetic regions (Fig. 1d). Much higher temperatures would be required at these magnetic anomalies to create similar water absorptions in M^3 data as the surrounding terrains. The LROC WAC albedo maps show no difference between magnetic anomaly regions and their surroundings and there is no reason to believe that magnetic anomalies should have much higher temperature than surroundings at the same local time, which suggests that the strong suppression of water content at these magnetic anomalies is real and cannot be introduced by the thermal correction of M^3 data.

Conclusions: The suppressed water signatures at magnetic anomalies on the lunar surface support the hypothesis that solar wind implantation is a contributor to lunar surface water. Constraining its exact contribution compared other sources (e.g. meteor-related releases [8]), would by possible with measurements of the near-surface proton flux at lunar swirls.

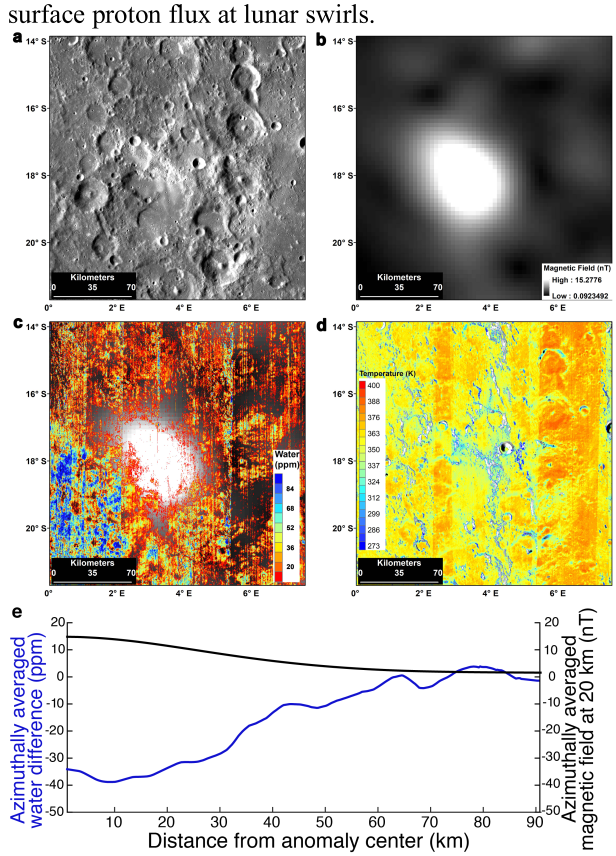

Fig. 1. a. WAC albedo map at the magnetic anomaly Airy; b. magnetic field map; c. water map overlain on magnetic field map; d. temperatures for correcting M^3 data. e. Azimuthally averaged profiles of water and magnetic field from the center of the magnetic anomaly. The water values are relative to the background value calculated between 80 and 90 km.

References: **[1]** Pieters et al., 2009, *Science 326*, 568**.** [2] Honniball et al., 2018, *LPSC*. [3] Tucker et al., 2019, *JGR 124,* 278. [4] Kramer et al., 2011, *JGR 116,* E00G18. [5] Li and Milliken 2017, *Science Adv*. 3, e1701471 [6] Bandfield et al., 2018, *Nature Geo 11,* 173. [7] Li and Milliken, 2016, *JGR 121,* 2081. [8] Benna et al., 2019, *Nature Geo*. in press.