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Histogram-based radar geometry normalisation of global SAR data: Applications to Venus

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Global Synthetic Aperture Radar (SAR) data sets are of immense scientific value in interpreting planetary surfaces, their morphology, compositions, and textures. A consequence of the method in which these data are generated is that the backscatter coefficient values (sigma-0) vary as a function of the radar incidence angle, an effect for which the data are not easily corrected. This is the case as they also vary as a function of the radar wavelength and material properties; isolating the effect of incidence angle is therefore not straightforward and doing so may compromise the scientific integrity of the characteristics under investigation. This dependence propagates into all derived properties that are obtained using the backscatter value, such as the material roughness parameters. In smaller localised scenes observed under the same, or very similar, radar geometry, these values and derived quantities may be directly compared in a variety of planetary studies. However, where the data to be compared are collected from geographically separated regions that were observed at differing look angles, the discrepancy related to radar geometry must be considered in any conclusions drawn based on the direct comparison of these observations.

A histogram-based mechanism of normalising these data for radar geometry previously implemented in regional terrestrial studies is here proposed for global planetary studies, using the Venus Magellan data set as a case study. The Magellan data were collected at S-band (12.6 cm wavelength), and vary from ∼15-46 degrees look angle. This method takes the normalisation approach back to first principles by selecting an angle to which the global set will be corrected and using the mean and standard deviation of that distribution to adjust the histograms of the rest of the range so that they may then be compared with increased confidence. Examples of this approach used with the Magellan data are presented.