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Introduction: Despite near-global scale coverage with Magellan synthetic aperture radar (SAR) imaging of Venus, first-order questions remain about our closest planetary neighbor. This is in part due to (i) remote sensing of the surface restriction to very few wavelengths in the electromagnetic spectrum, and (ii) the low resolution of our best image, topographic, and geophysical data sets. The Venus Emissivity, Radio Science, InSAR, Topography and Spectroscopy (VERITAS) Discovery mission will map the surface with SAR using X-band (4 cm) using the VISAR instrument, and with 6 finely tuned Near-IR bands using the VEM instrument [1]. As a result, it will achieve unprecedented resolution in imagery and topography, as well as detect surface rock types and change over time. To support interpretation of X-band and NIR data, test data processing algorithms, and comparison with S-band SAR from other missions (Magellan, EnVision), the VERITAS Science Team conducted a field analog campaign over two weeks in August 2023 in collaboration with the German Aerospace Center (DLR), which involved both an airborne radar mapping effort and an in-situ surface characterization task. The latter provides ground truth for parameters that affect radar backscatter (topography, roughness, dielectric permittivity) and NIR emissivity.

Iceland: Venus is covered with familiar geologic features, chiefly volcanic and tectonic in nature. Iceland arises from the intersection of a mantle hotspot and the mid-Atlantic ridge. It presents a wide variety of volcanic and tectonic features that are geologically fresh and largely devoid of vegetation. As a result, the surface of Iceland is quite inviting to radar studies. For the 2023 campaign we focused our efforts on two regions of interest (ROIs): (1) Askja/Holuhraun, and (2) Fagradalsfjall volcanic center (**Fig.1-3**) [2].

Airborne Campaign: The goal for the airborne task is to produce regional-scale coverage using DLR's F-SAR full-polarimetric, multi-band airborne synthetic aperture radar system [3]. We flew 30 primary flightlines over the ROIs and imaged the surface at X-, S-, and L-band (**Fig. 2** & **3**). Flight lines were planned so that successive swaths cover the same key surface features with both Magellan- and VERITAS-like incidence angles, and totaling >1,000 km^2 coverage.

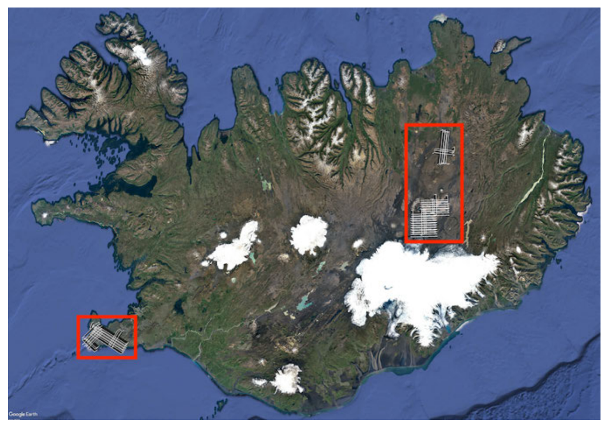

Fig. 1 *– Flight lines (in white) for the Askja/Holuhraun ROI (NE box) and for Reykjanes ROI (SW box).*

The intended products from such coverage are SAR-image mosaics in each of the bands at both full F-SAR resolution (~5 m) and VERITAS-like resolution (30 m) and digital elevation models (DEMs) . Because some of the lines over Fagradalsfjall volcano were flown both at the beginning of the campaign and then again 7 days later, we plan to produce interferograms at this location and obtain change detection maps with respect to Fagradalsfjall F-SAR data collected in 2015 [3]. At this Conference Hensley et al. [4] is presenting the F-SAR radar campaign and preliminary results.

Surface Component: The approach to the surface task was to define 5×5 m patches distributed across the ROIs for detailed measurements. We characterized a total of 41 patches between the ROIs. At least two patches captured each type of surface texture/composition.

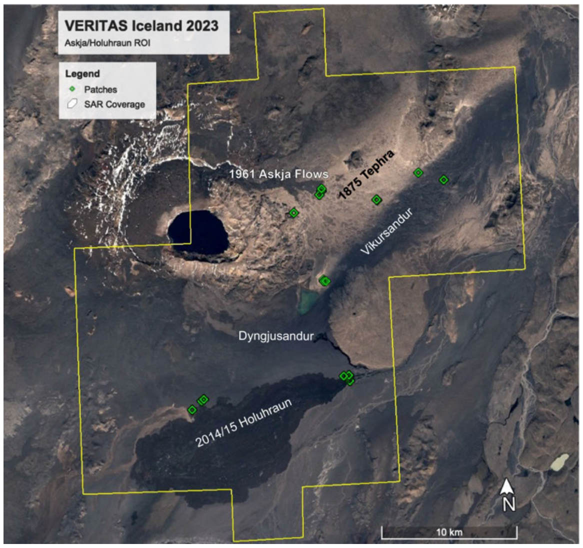

Fig. 2 *– F-SAR coverage (yellow polygon) and location of surface characterization patches (green markers) in the Askja/Holuhraun ROI (Background image: Google Earth).*

Fig. 3 *– F-SAR coverage (yellow polygon) and location of surface characterization patches (green markers) in the Reykjanes ROI. Note that the surface effort concentrated on the 2021-2023 Fagradalsfjall volcanic flows (Background image: Google Earth).*

At every patch we collected 4 to 8 lidar scans of the surface, with different positions and heights of the terrestrial laser scanner (TLS), optimized to provide maximum coverage and minimize shadowing. We collected over 300 individual scans (3.4π steradians) with point-cloud resolutions better than ~1 cm, from which we will produce DEM and roughness maps. TLS acquisition and data processing are described by and Mazarico et al. [5] and Cascioli et al. [6] at this Conference. Over some of the patches in both ROIs, we collected drone-based imagery for photogrammetric processing into DEMs, intended to provide contemporaneous contextual imagery and DEMs.

At select patches, we collected daytime NIR reflectivity data of the patch interior and measured the dielectric constant of the sedimentary fines via a dielectric permittivity probe. We concurrently collected samples at all patches of fines and rocks for laboratory analysis of moisture content, dielectric constant, grain-size distribution, and reflectance and emissivity spectroscopy. Abstracts by Nunes et al. [7] and Adeli et al. [8] in this Conference describe the sample collection and moisture/dielectric analysis and emissivity measurements in the lab. We collected a total of just over 100 kg of rocks and fines of different compositions, which were split between JPL and DLR.

Conclusions: During the two weeks of our field campaign, we collected terabytes of data and many samples. Processing of both the airborne and surface data sets are ongoing [4-8, this Conference]. The planned F-SAR spatial and band coverage were achieved. Collection of airborne SAR and surface in-situ data recorded the contemporaneous radar backscatter, topography, roughness, and permittivity of key types of volcanic/sedimentary surfaces thought to be representative of Venus. The surface data will serve to ground truth and provide constraints to the different contributions to radar backscatter and NIR spectral response, critical to bridging the gap between theory and observations at Venus [9]. Our 2023 Iceland data will guide the processing and interpretation of the upcoming data from VERITAS, as well as those from EnVision and Magellan.

Fig. 4 *– Example of a rough lava flow surface at one of the Holuhraun patch sites, with the TLS on tripod.*

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