EUROPA NIMS DATA REPROCESSING PIPELINE FOR DETAILED SURFACE ANALYSIS. M.J. Malaska[1], J.H. Shirley[1], C.B. Phillips[1], A.A. Fraeman[1], M. Valenti[2], T. Verlander[3], L. Prockter[4], R.M.C. Lopes[1], J.T.S. Cahill[5], K. Becker[6]. [1]Jet Propulsion Laboratory / California Institute of Technology, Pasadena, CA. [2]SETI Institute, Mountain View, CA. [3]University of Oklahoma, Norman, OK. [4]Lunar and Planetery Institute, Houston, TX. [5]Johns Hopkins University Applied Physics Laboratory, Laurel, MD. [6]University of Arizona, Tucson, AZ. (Michael.J.Malaska@jpl.nasa.gov).

Introduction: NASA's planned Europa Clipper mission provides a strong motivation for reprocessing the Galileo Near Infrared Mapping Spectrometer (NIMS) dataset. Due to the complex nature of the NIMS dataset (calibration, projections), many of the observations have not been analyzed in detail. In the few cases where precise registration of Galileo imaging and near-infrared data has been achieved, remarkable new insights into Europa's complex surface geology have been obtained [1-3]. Availability of the reprocessed NIMS data coupled with surface geomorphology could allow key compositional interpretations and contribute to the understanding of Europa's surface and interior [4].

As part of a funded effort from the ROSES PDART program, we are reprocessing the highest-resolution NIMS Europa observations currently available on the PDS, and delivering to the PDS a selection of 25 reprojected and wavelength recalibrated NIMS image cubes that have been accurately registered to the USGS Europa basemap.

Methods: The general outline of our data pipeline is shown in Fig. 1. For each NIMS observation, corresponding Galileo Solid State Imager (SSI) images are mosaicked together. This mosaic is then registered to the USGS Europa basemap. As described below, for the Argadnel Regio area we used over 300 ground control points. From spot measurements well away from the ground control points, our error is below the image scale of the USGS mosaic (which is approximately 1 km per pixel in the Argadnel Regio area). The SSI mosaic is rectified, exported, and will be made available to the community via the PDS as as part of our effort.

Using standard mapping techniques with ArcGIS (ESRI) and previously described terrain units from the literature [5-7], contacts were drawn on our high resolution SSI mosaic between the geomorphological units in and around the footprint of the NIMS observation. This activity is required to allow accurate registration of the NIMS and imaging datasets. We mapped at approximately 1:800,000 scale, in line with other mapping efforts at a 300 m per pixel image scale [8].

Next, the NIMS data are downloaded from the PDS in the form of an Experimental Data Record (EDR). Using the VICAR program "NIMSCMM2" we employ the embedded ancillary information describing observation geometery and instrument pointing, as well as other parameters, and convert the data from the EDR into a series of tubes, cubes and co-cubes. The latter contain the backplane information such as latitude, longitude, emission angle, etc. The output is a PDS format file that can be read into ENVI. From ENVI, the NIMS observation is exported as a .tiff containing all of the spectral bands as well as the backplanes.

Using GIS software (both ArcGIS and QGIS have been used), the NIMS dataset is registered to the mapped terrain contacts.

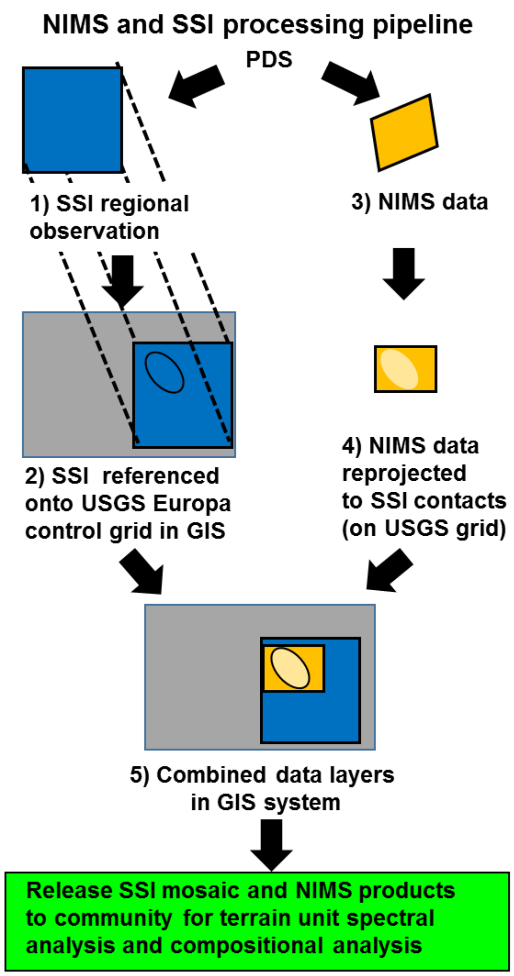

Fig. 1. Processing pipeline for the SSI and NIMS data products. SSI mosaics are registerd to the USGS Europa basemap, and then the VICAR reprojected NIMS data is stacked on top of that. The registered products are then ready for release to the community.

Results: A newly reprocessed, co-registered SSI image mosaic and NIMS spectral dataset for a portion of Argadnel Regio is shown in Fig. 2. This area has been previously analyzed by Prockter et al. [6], Shirley et al. [1], and Prockter et al. [3], allowing us to directly compare our data products with previously published work.

Our preliminary examination shows an excellent correlation with the results of previous studies. In addition, we have also compared our work with the global mapping effort for Europa currently in progress [9, 10]. We have found a direct correspondence between the multi-band images and geomorphologic units. This indicates that the different geomorphological units have distinctive spectral characteristics [1]. There appears to be minimal spectral variation within the geomorphological units. We have used this correspondence as a cross-check in our registration process as a synthetic multi-band spectral response based on terrain units can be compared to the registered NIMS dataset (see Fig. 2, panel D).

By combining both SSI albedo and morphology with NIMS multiband data, we can clearly differentiate between multiple types of chaos units, low-albedo plains, dark and gray bands, and the ubiquitous ridged plains.

Benefit to Community: Our final products will allow determination of regions of interest to enable detailed spectral analysis and comparison of multiple terrain types as well as evident outliers. As an additional benefit, our work will also generate preliminary detailed regional geomorphological maps, used in the registration process, that will complement the global Europa mapping effort [9, 10].

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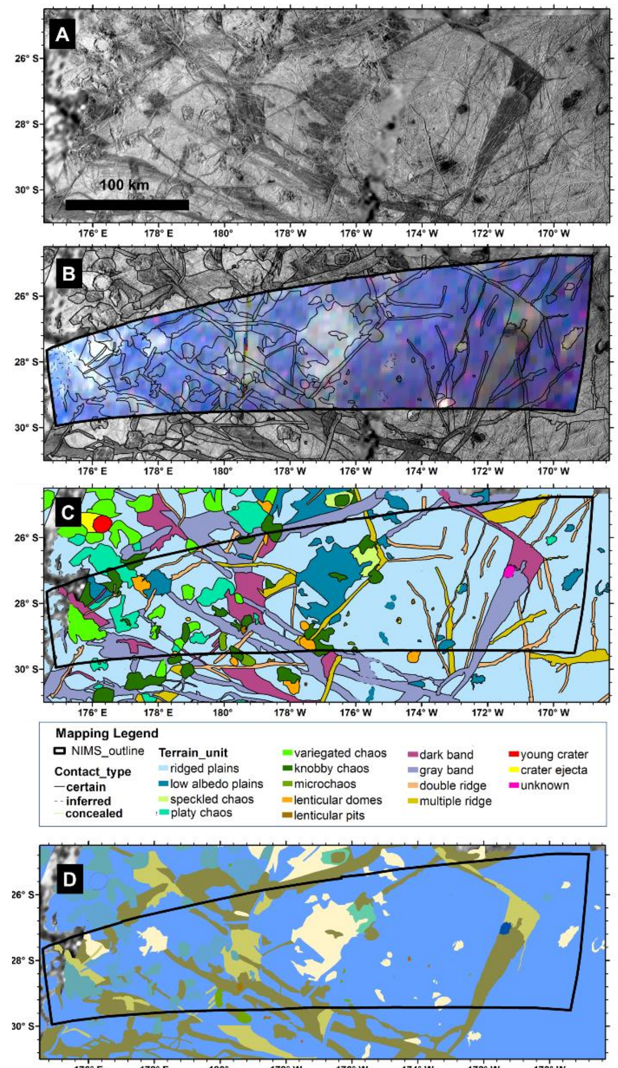

Fig. 2. Graphic showing Argadnel Regio data. A) SSI mosaic registered to USGS basemap. Scale bar at lower left. B) NIMS data registered to SSI mosaic and terrain contacts. RGB mosaic of Galileo NIMS bands 112, 65, 90 at wavelengths of 2.031, 1.486, 1.790 microns respectively. Terrain contacts shown as an overlay. C) Geomorphological mapping of various terrain units performed to allow accurate registration of the datasets. Legend shown. D) Synthetic map colorized to estimated NIMS RGB [112, 65, 90] multiband colors for the various mapped terrain units. Compare with panel B.