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Supporting Information for

Ganymede's UV reflectance from Juno-UVS data

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Introduction

Figure S1 shows Ganymede's reflectance as a function of latitude, in 15° latitude bins from 75° N to 45° S. Each spectrum is normalized to its average reflectance in the 140 – 160 nm region to allow direct comparison without a correction for different longitudinal coverage by Juno UVS, or varying illumination angles.

Figures S2 – S7 provide maps of the total counts detected by Juno UVS, and the associated signal-to-noise ratio (SNR), in longitude-latitude bins of 1°x1°, 2°x2°, and 15°x15°. The SNR is calculated assuming Poisson statistics (SNR = [counts per bin] / [counts per bin]$^{0.5}$). In each figure, counts/SNR values are shown for the two wavelength bands used to produce the ratio map in Figure 1 of the manuscript (150 – 170 nm, and 190 – 210 nm). These maps are intended to demonstrate which regions of the maps shown in the main text should be considered most reliable.

Table S1 contains a summary of materials detected on Ganymede to date, and whether they are known to absorb in the same wavelength region as the Tros crater UV absorption feature. Three materials with UV absorption features – NaCl, KCl, and H2O2 –

were not shown in the main text. All absorb at shorter wavelengths than the feature seen at Tros, as shown in Figure S8.

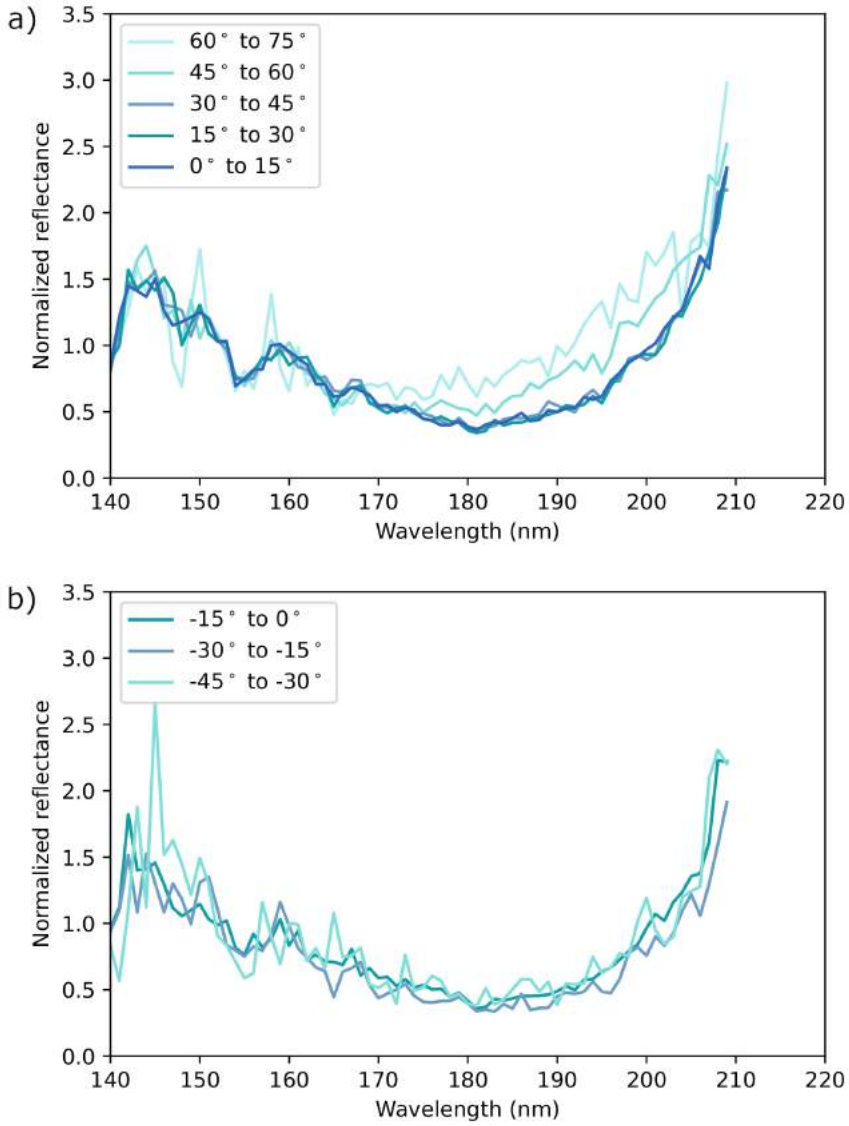

Figure S1. Far UV reflectance spectra of Ganymede in 15° latitude bins, averaged over the dayside longitude range observed by Juno UVS (maximum extent +45 deg W to -90 deg W). a) Northern latitudes; b) southern latitudes. All spectra are normalized to their average reflectance between 140 nm and 160 nm.

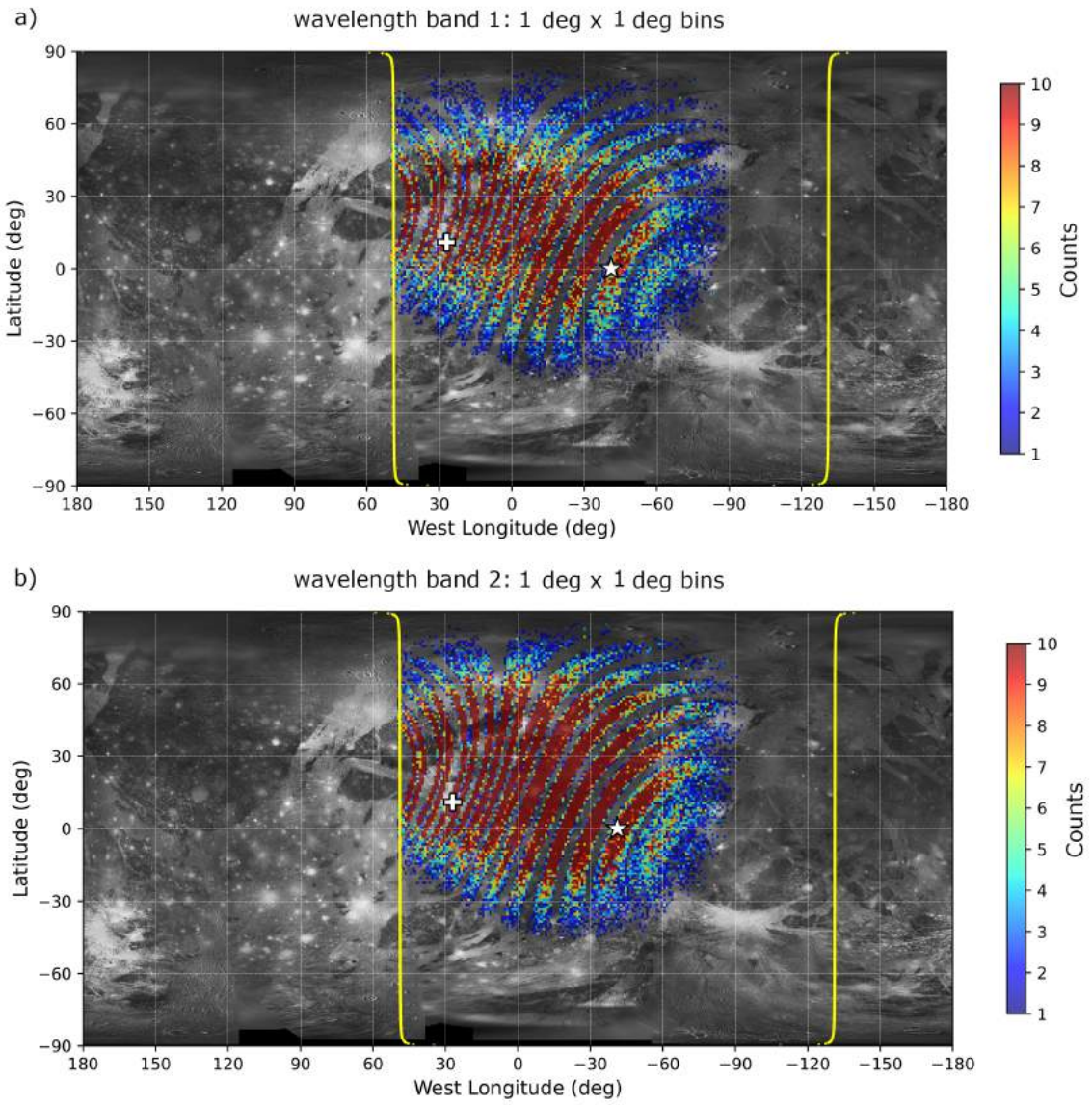

Figure S2. Total UVS count maps for two wavelength bands (a) band 1 = 150 – 170 nm; b) band 2 = 190 – 210 nm) using a longitude-latitude bin size of 1°×1°.

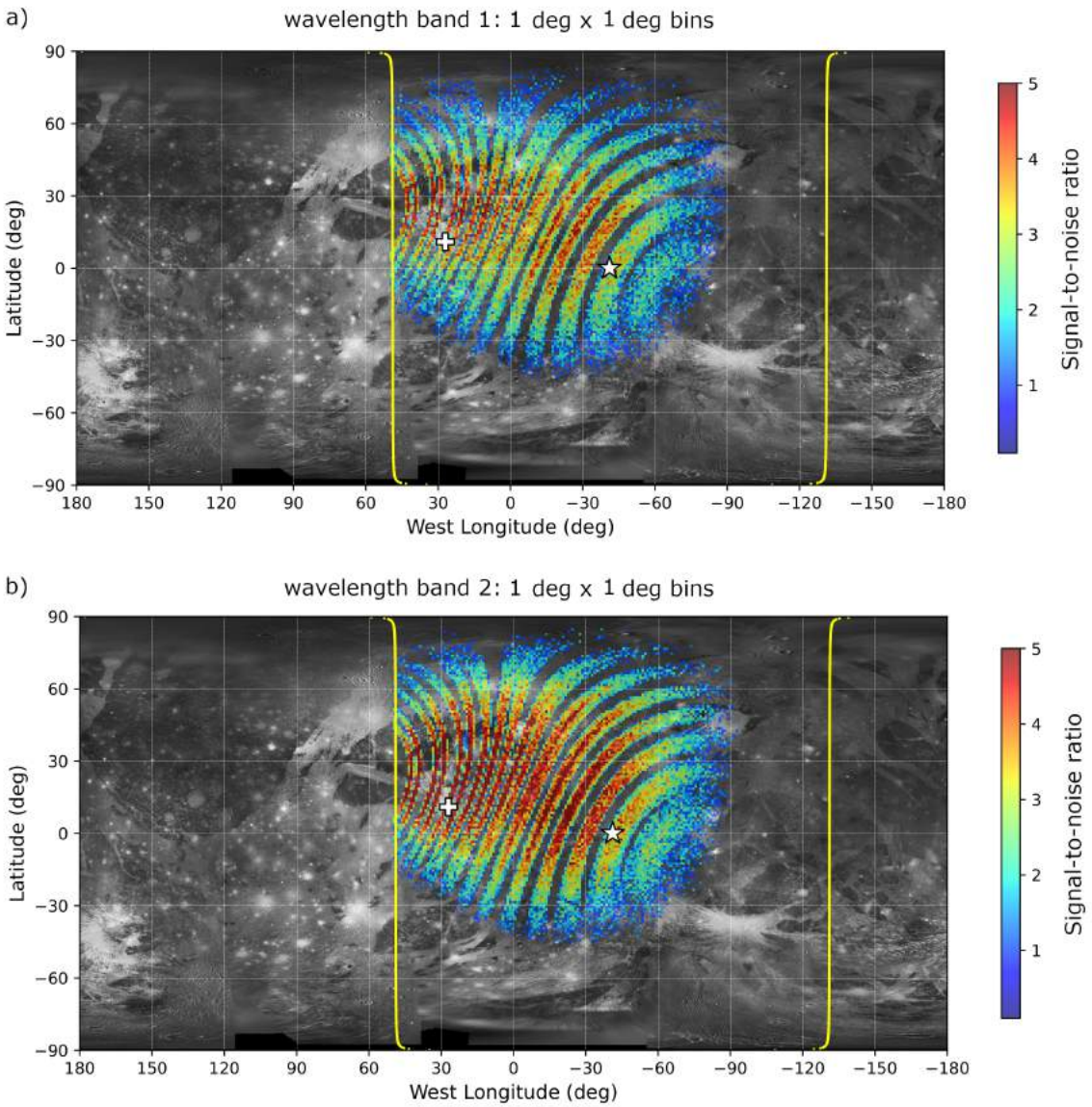

Figure S3. SNR maps for two wavelength bands (a) band 1 = 150 – 170 nm; b) band 2 = 190 – 210 nm) using a longitude-latitude bin size of 1°×1°.

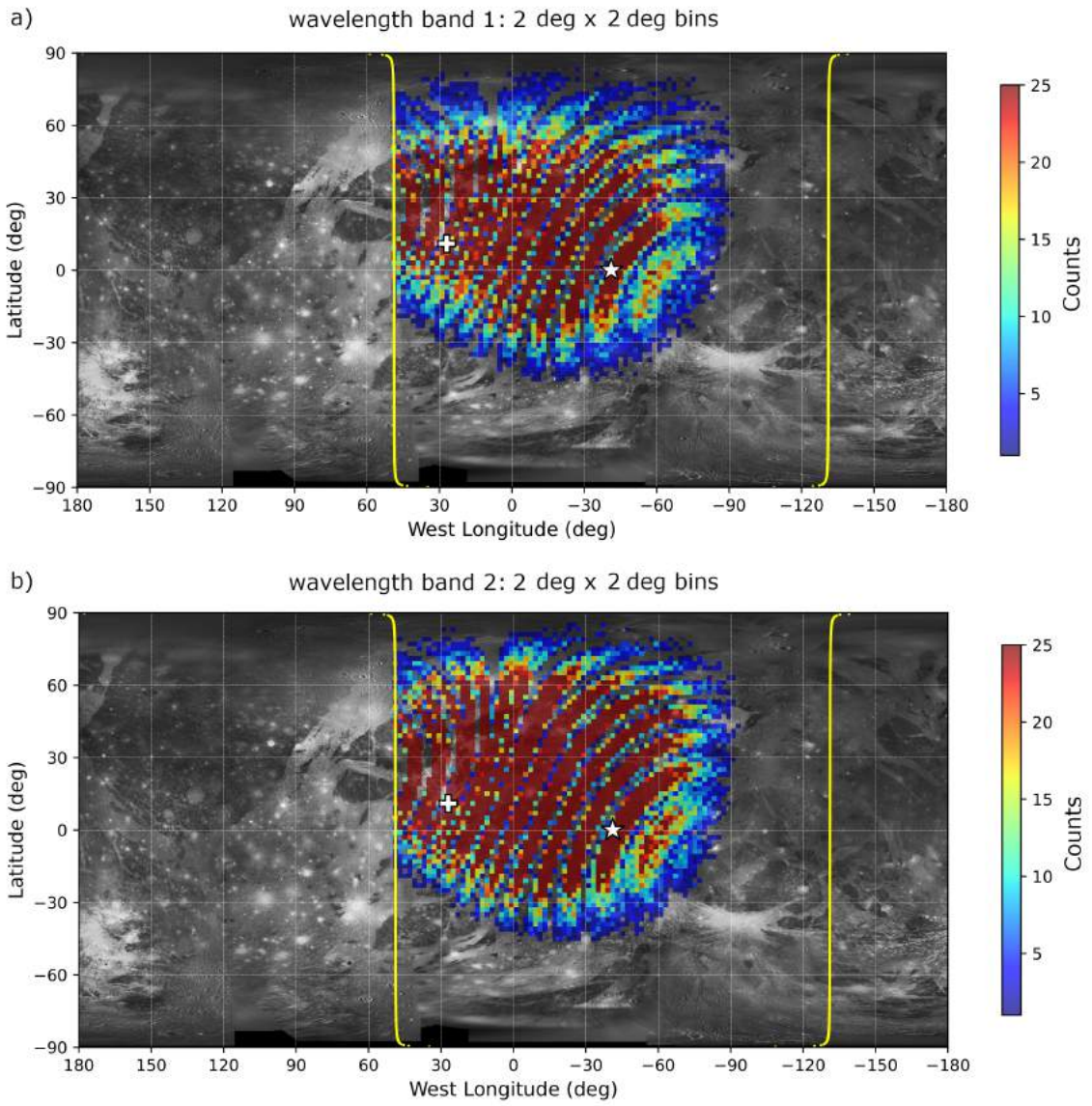

Figure S4. Total UVS count maps for two wavelength bands (a) band 1 = 150 – 170 nm; b) band 2 = 190 – 210 nm) using a longitude-latitude bin size of 2°×2°.

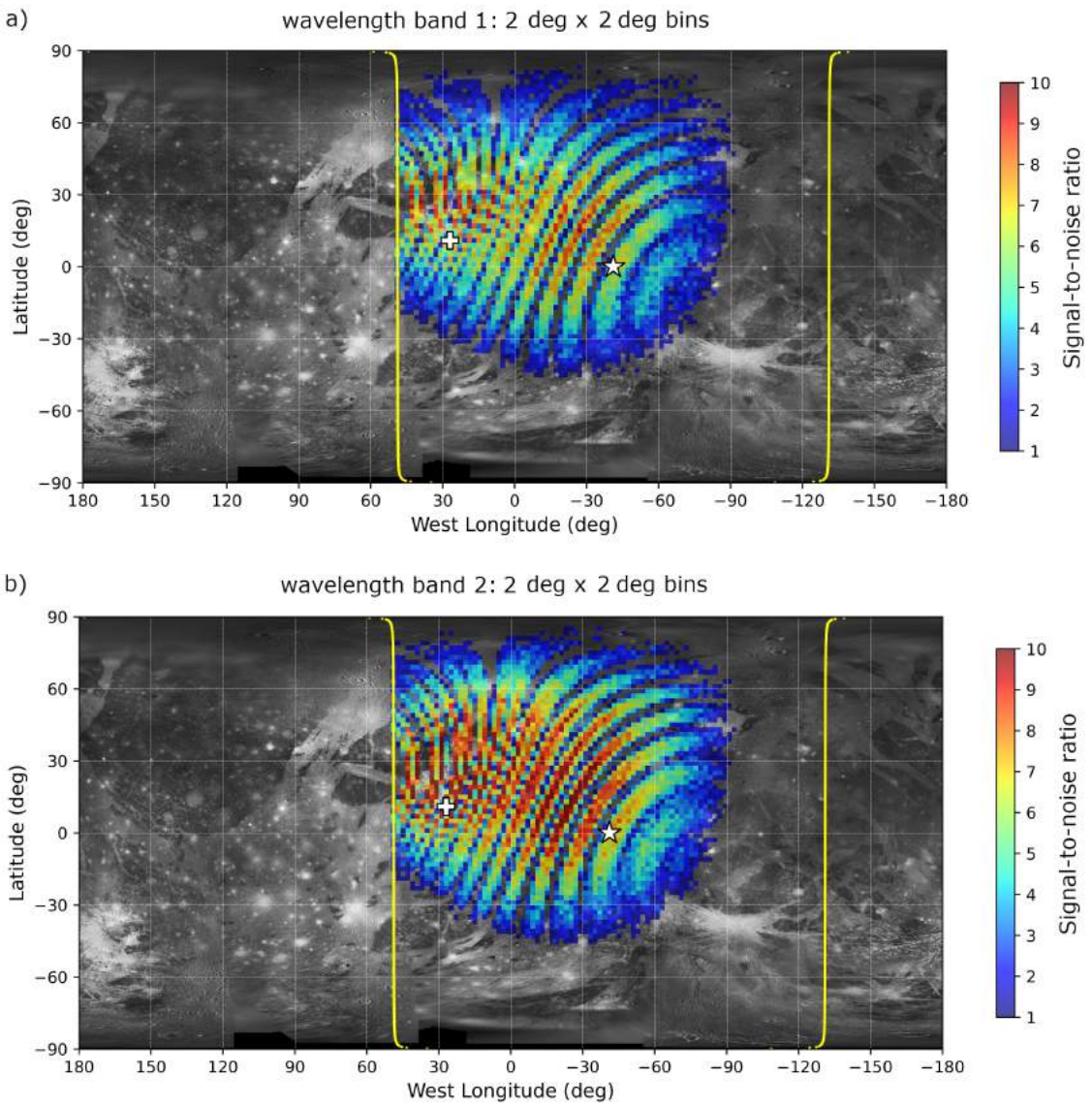

Figure S5. SNR maps for two wavelength bands (a) band 1 = 150 – 170 nm; b) band 2 = 190 – 210 nm) using a longitude-latitude bin size of 2°×2°.

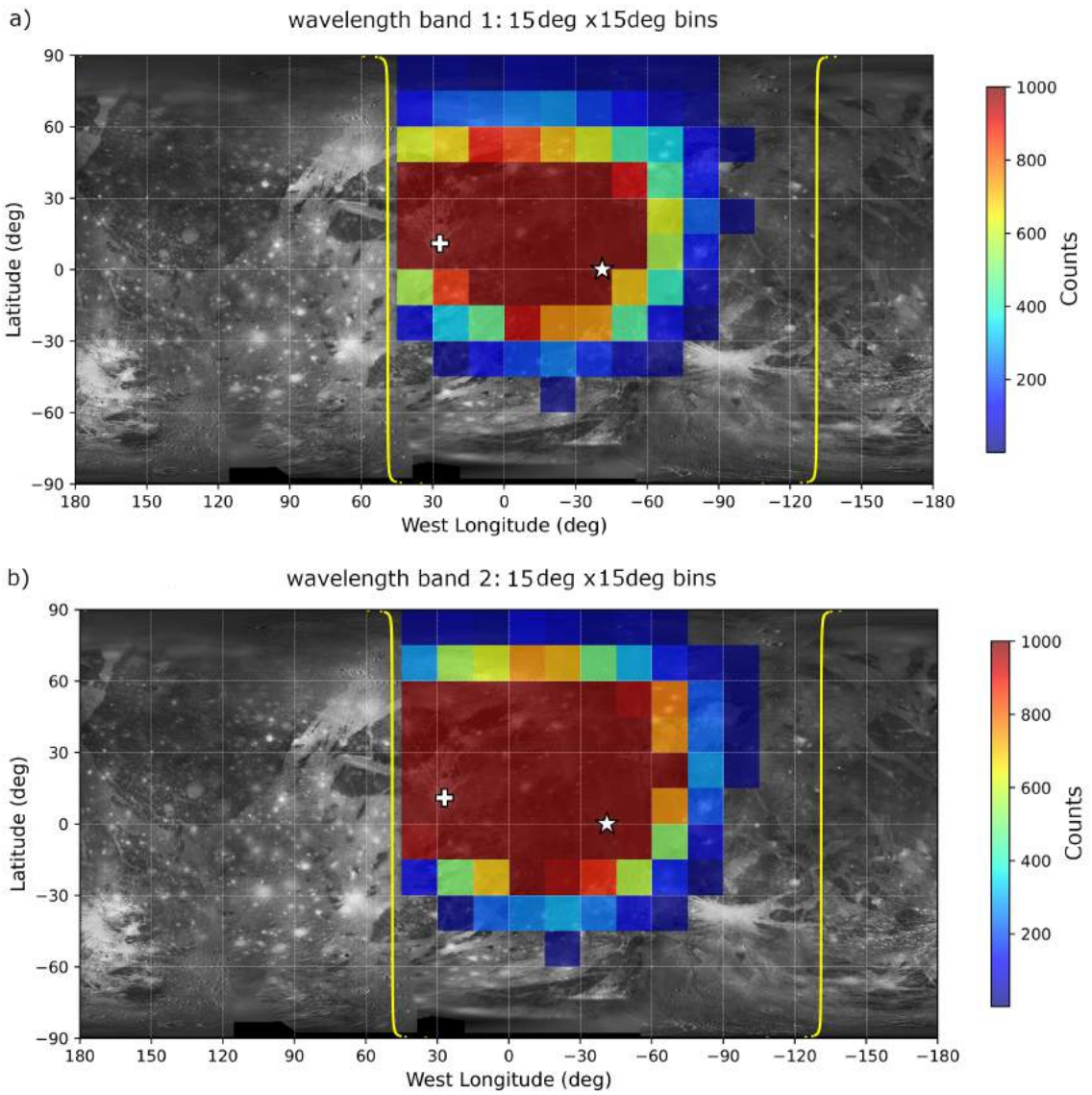

Figure S6. Total UVS count maps for two wavelength bands (a) band 1 = 150 – 170 nm; b) band 2 = 190 – 210 nm) using a longitude-latitude bin size of 15°×15°.

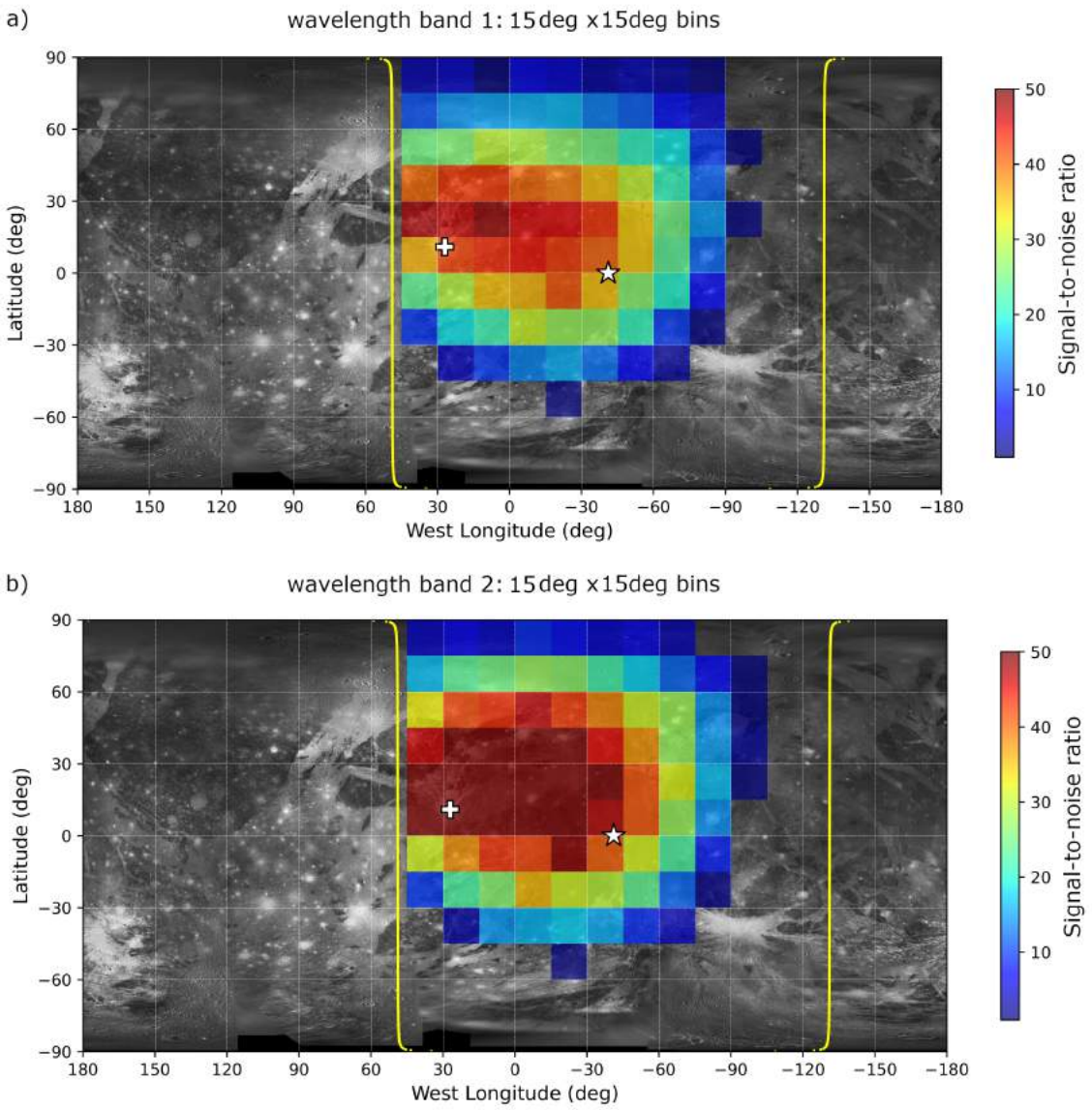

Figure S7. SNR maps for two wavelength bands (a) band 1 = 150 – 170 nm; b) band 2 = 190 – 210 nm) using a longitude-latitude bin size of 15°×15°.

Material	*References*	*UV Optical Constants available?*	*Absorption feature in 150 - 200 nm region?*
H_2O	Kuiper (1957); Moroz (1965); Pilcher et al. (1972); Pollack et al. (1978)	Yes (Warren and Brandt, 2008)	**Yes**. Absorption edge at ~165 nm
O_2	Spencer et al. (1995)	Absorption cross-section (Mason et al. 2006a)	No (absorbs at shorter UV wavelengths)
SO_2	Domingue et al. (1998); McCord et al. (1998)	Absorption cross-section (Mason et al. 2006a)	**Yes**. Absorption peaks at ~150 nm and 200 nm
CO_2	McCord et al. (1998); Mura et al. (2020)	Absorption cross-section (Mason et al. 2006a)	No (absorbs at shorter UV wavelengths)
O_3	Noll et al. (1995); Hendrix et al (1999a)	Absorption cross-section (Sivaraman et al. 2014)	No (absorbs at longer UV wavelengths)
H_2O_2	*Hendrix et al (1999b); Mura et al (2020)*	*Absorption cross-section for gas state only: Schürgers and Welge (1968) [125 – 185 nm] Holt (1948) [187.5 – 217.5 nm]*	***Yes**. Small absorption feature near 165 nm in gas phase.*
silicates	Spencer (1987); Prockter et al. (1998)	Yes (Draine and Lee, 1984; Cuzzi et al., 2018)	No
organics	McCord et al (1997;1998) (tholins); Mura et al. (2020) (benzene rings/aromatic hydrocarbons and aliphatic hydrocarbons)	Some optical constants available for tholins (Khare et al., 1993; Cruikshank et al., 2005); limited data for other organics. Absorption cross section data available for benzene ice, including benzene in H_2O (Dawes et al. 2018)	Tholins - No; Benzene - **Yes**. Absorption peak at ~180 nm
salts	*McCord et al. (2001); Ligier et al. (2019); Mura et al. (2020)*	*Optical constants for NaCl and KCl only (Roessler and Walker, 1968). No FUV data for hydrated or irradiated salts*	***Yes**. Both NaCl and KCl have absorption peaks near 160 nm.*
sulfuric acid hydrate	Ligier et al. (2019)	No	?
NH_3	Mura et al. (2020) - **tentative**	Absorption cross-section (Mason et al. 2006a)	**Yes**. Broad absorption centered at ~180 nm

Table S1. Summary of materials detected on Ganymede or inferred from spectral modelling, and whether they have absorption features near the broad UV absorption observed at Tros crater. Rows in italics indicate materials with UV absorption features that were not plotted in the main text, and are instead shown in Figure S8.

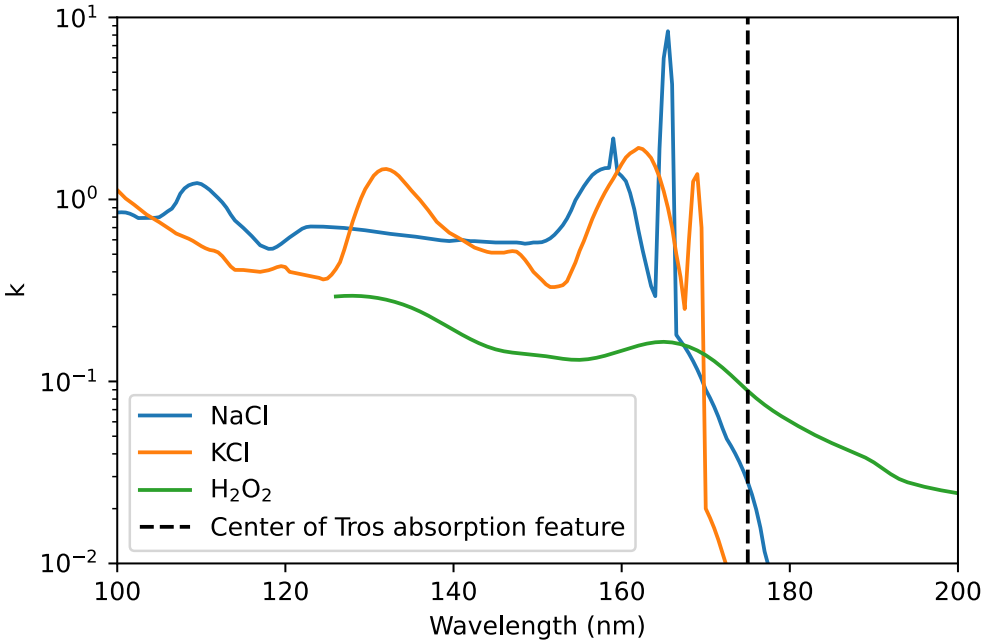

Figure S8. Imaginary part of the refractive index, k, for NaCl, KCl and H_2O_2. The UV absorption features (where k is larger) are at shorter wavelengths than the absorption seen at Tros crater. NaCl and KCl optical constants are from Roessler and Walker (1968). H_2O_2 k values were derived by Molyneux et al. (2020) from the absorption cross sections of Schürgers and Welge (1968) and Holt (1948).