

Supporting Information for "Solar and solar wind energy drivers for O^+ , and O_2^+ ion escape at Mars"

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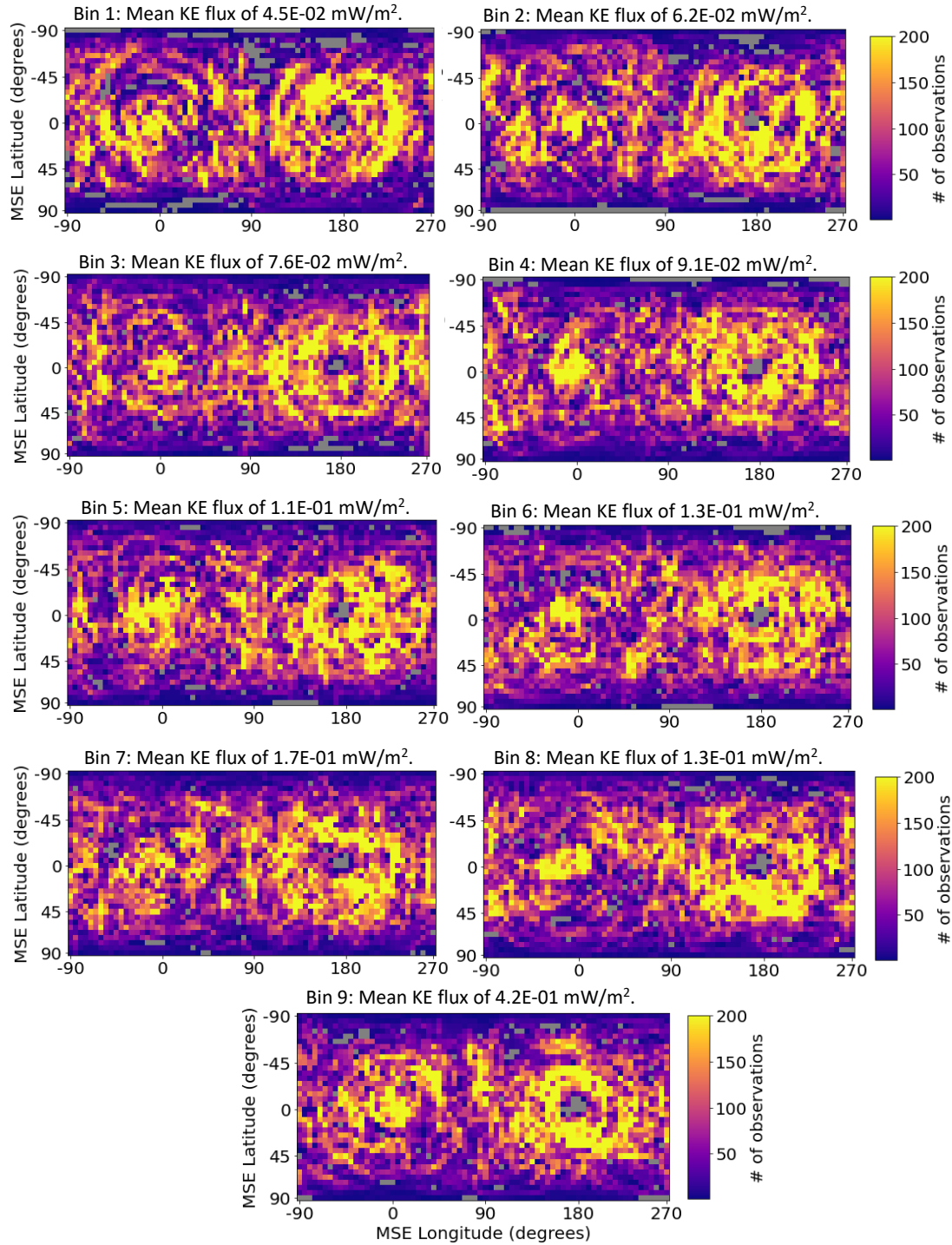
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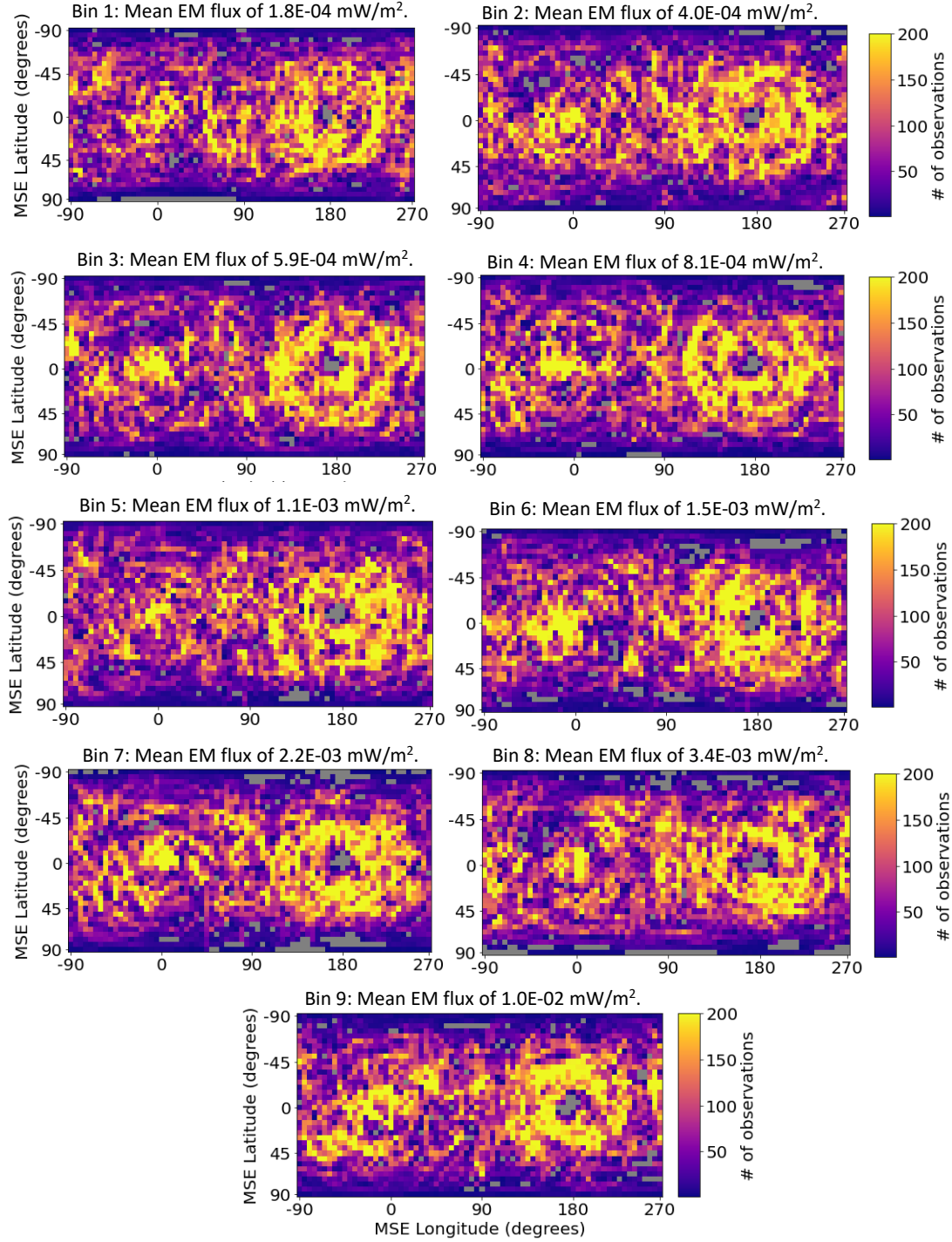
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July 13, 2023, 9:24pm

Data density for solar wind kinetic energy flux bins:

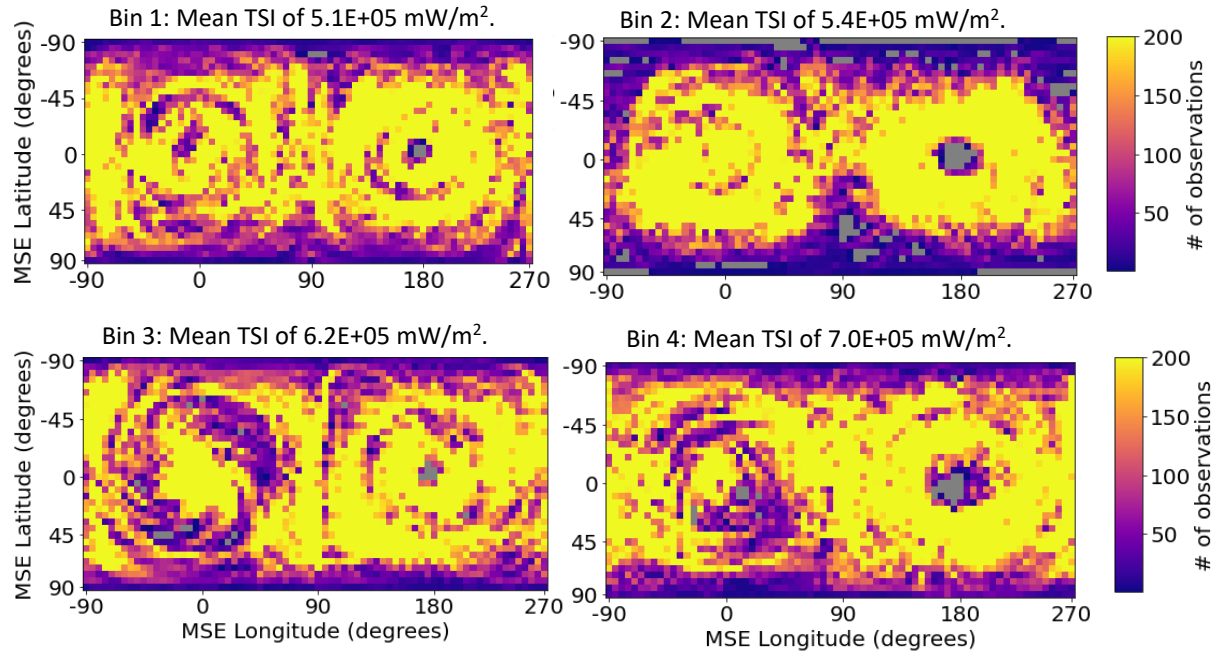
S1. The density of ion flux observations in each grid cell is shown for each solar wind kinetic energy flux bin.

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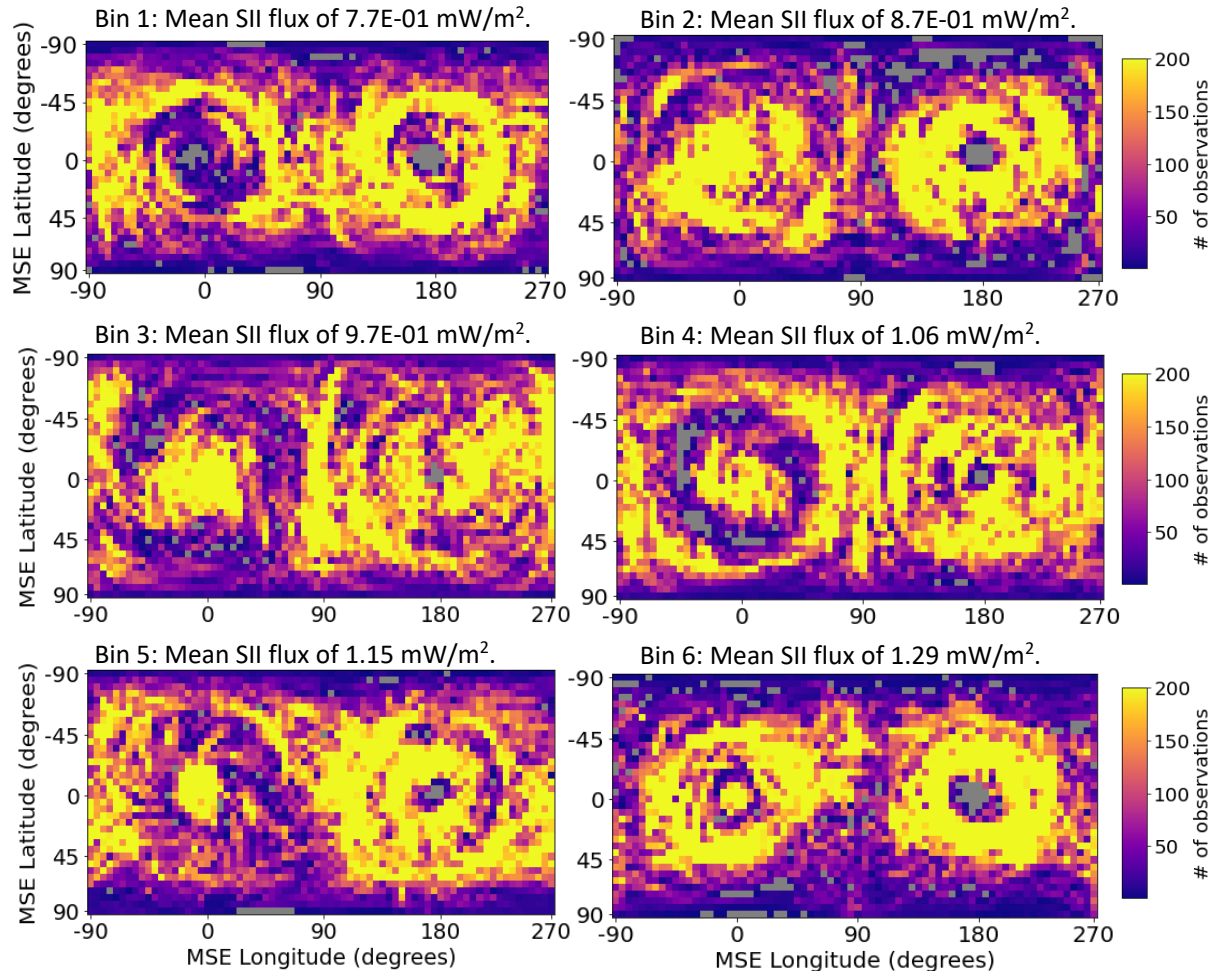
Data density for solar wind electromagnetic energy flux bins:

S2. The density of ion flux observations in each grid cell is shown for each solar wind electromagnetic energy flux bin.

July 13, 2023, 9:24pm

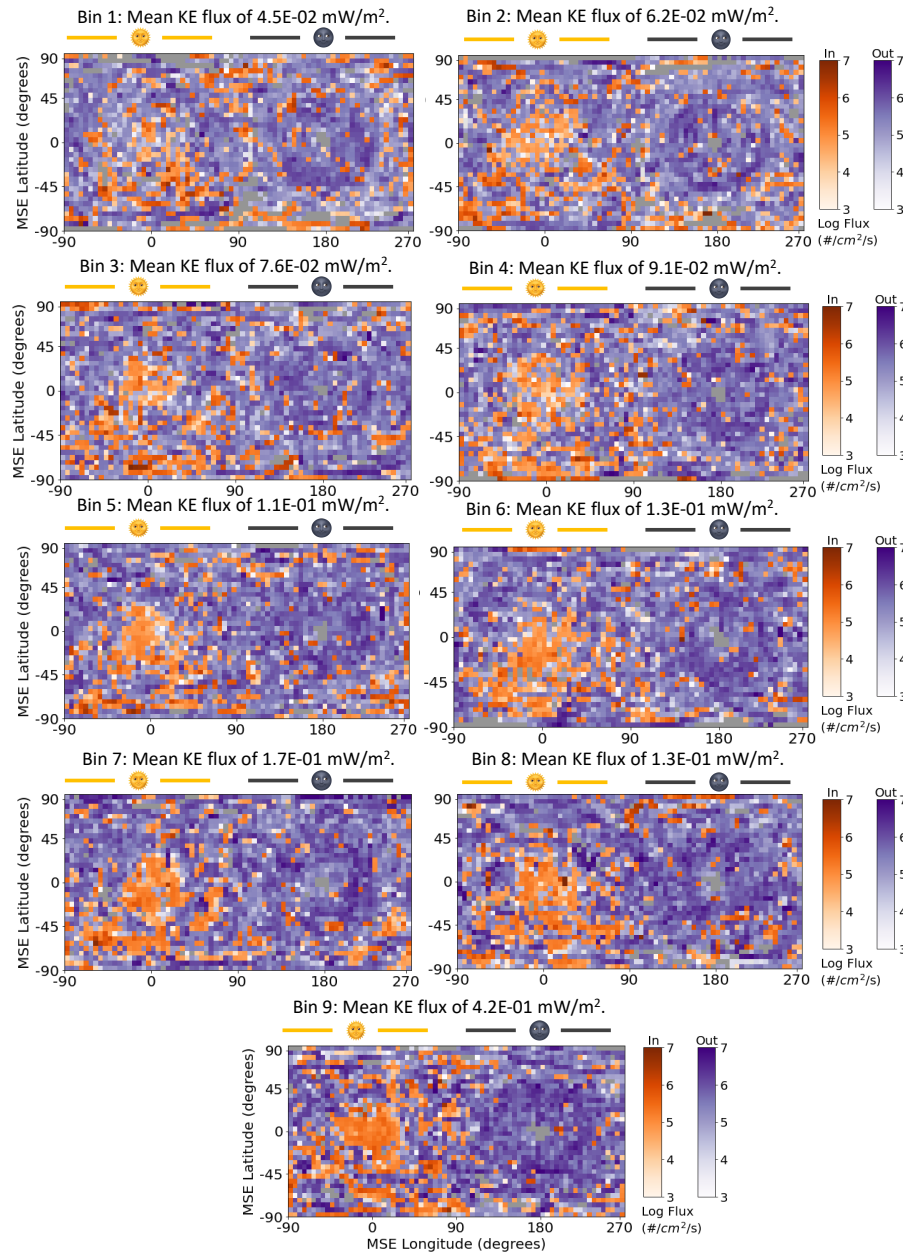
Data density for total solar irradiance bins:

S3. The density of ion flux observations in each grid cell is shown for each total solar irradiance bin.

Data density for solar ionizing irradiance bins:

S4. The density of ion flux observations in each grid cell is shown for each solar ionizing irradiance bin.

Ion flux maps for the solar wind kinetic energy bins, O^+ :

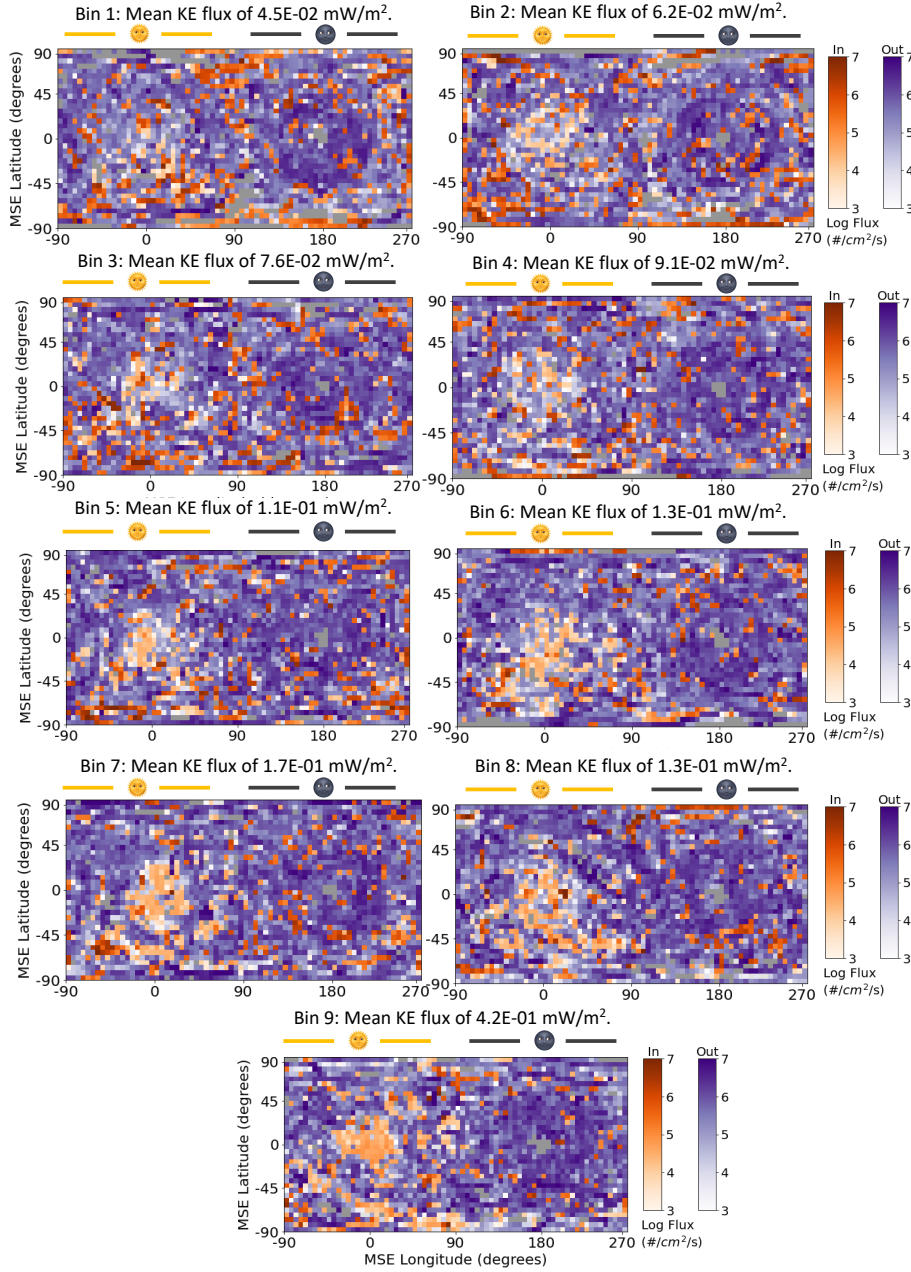


S5b. The average observed outwards (purple) and inwards (orange) net flux for O^+ from February 1, 2016 to May 21, 2022

for the solar wind kinetic energy flux bins. The data is on a Mars Solar Electric grid; the day-side and night-side of Mars are denoted accordingly.

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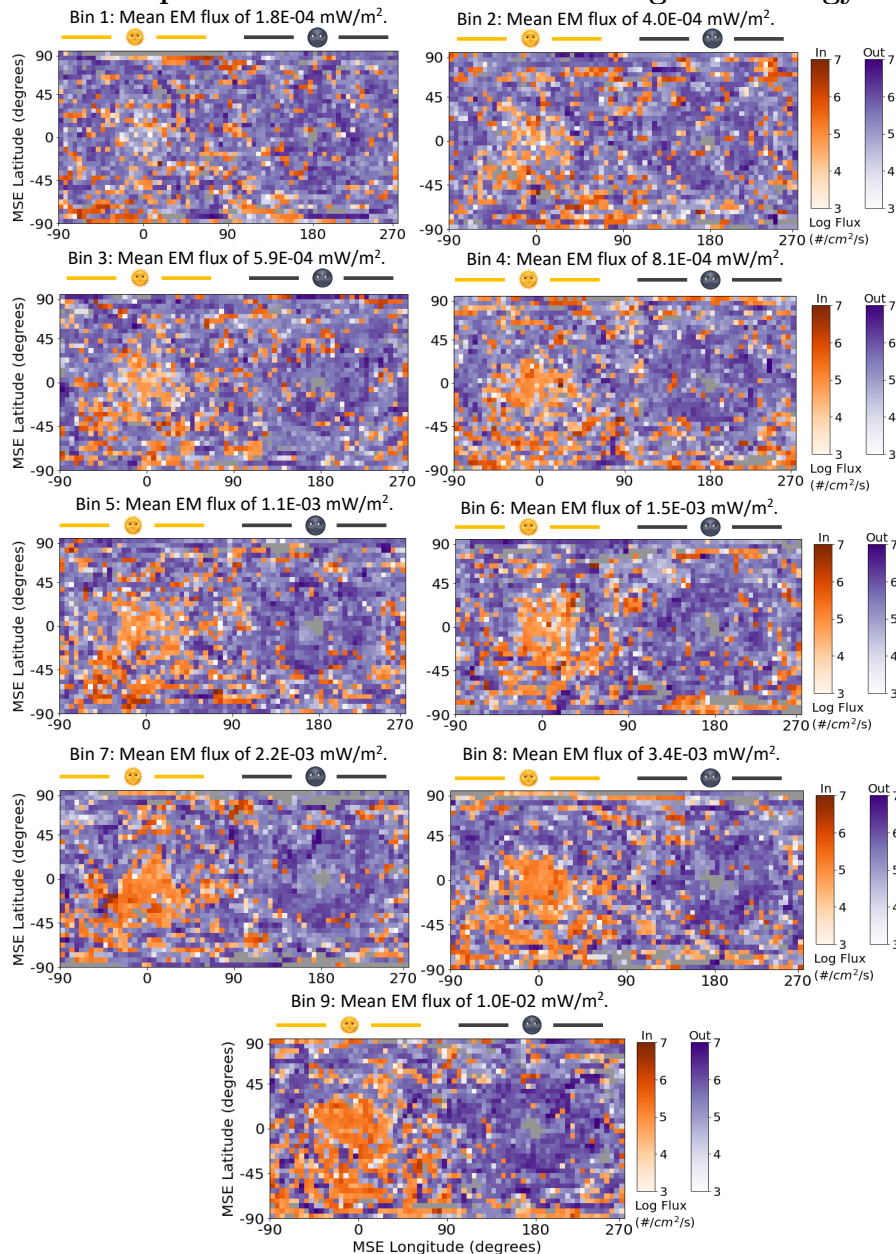
Ion flux maps for the solar wind kinetic energy bins, O_2^+ :



S5c. The average observed outwards (purple) and inwards (orange) net flux for O_2^+ from February 1, 2016 to May 21, 2022 for the solar wind kinetic energy flux bins. The data is on a Mars Solar Electric grid; the day-side and night-side of Mars are denoted accordingly.

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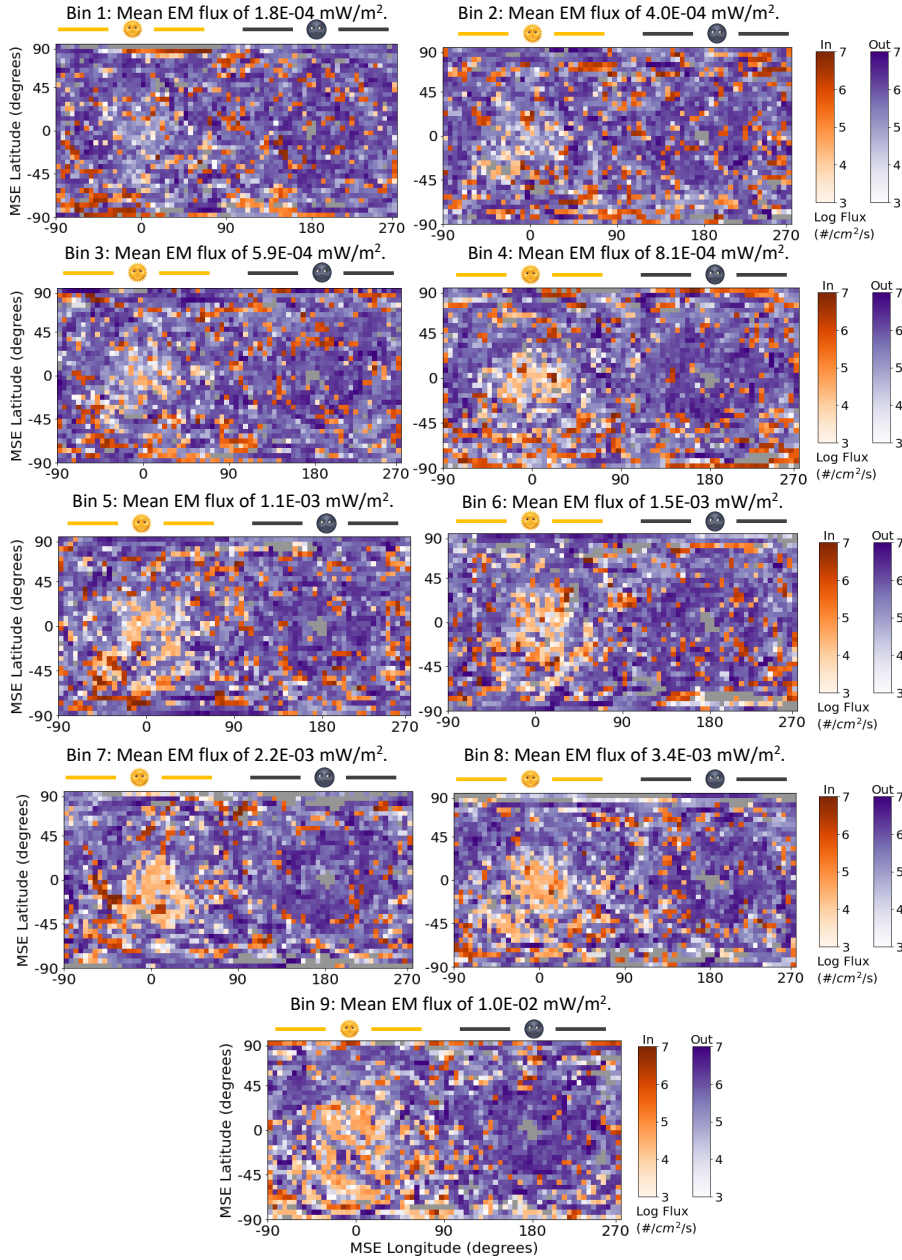
Ion flux maps for the solar wind electromagnetic energy bins, O^+ :



S6b. The average observed outwards (purple) and inwards (orange) net flux for O^+ from February 1, 2016 to May 21, 2022 for the solar wind electromagnetic energy flux bins. The data is on a Mars Solar Electric grid; the day-side and night-side of Mars are denoted accordingly.

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Ion flux maps for the solar wind electromagnetic energy bins, O_2^+ :

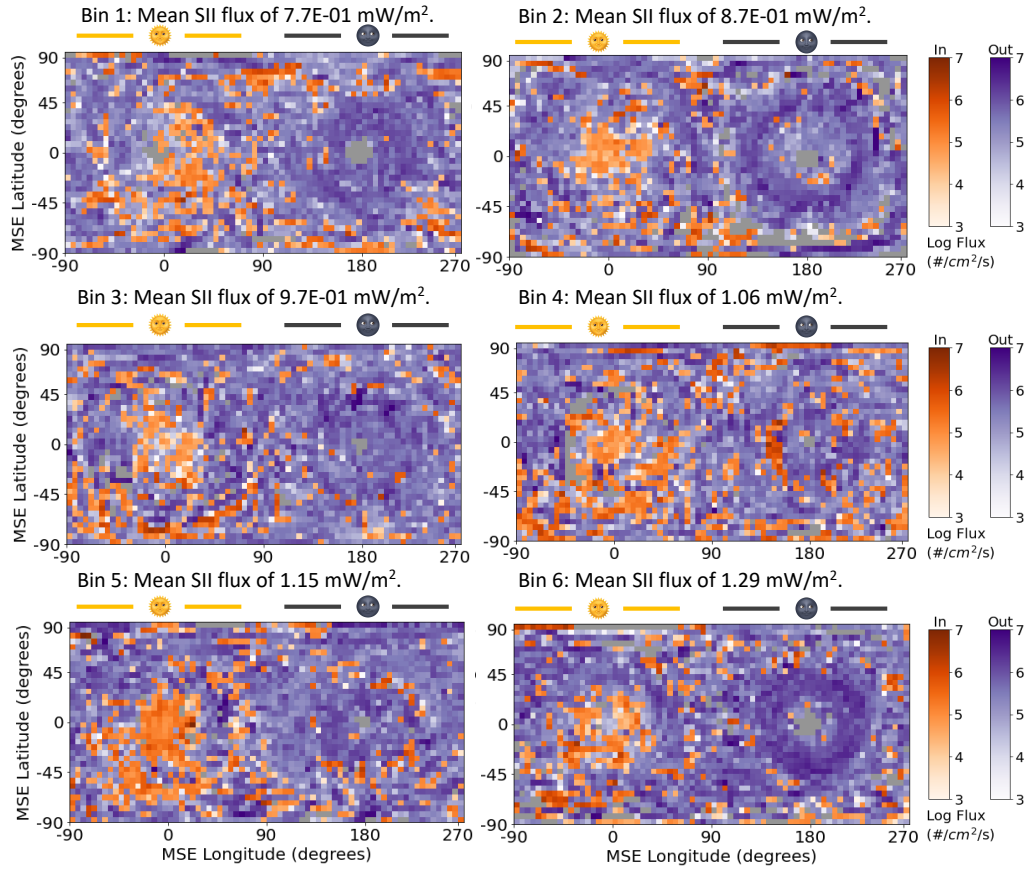


S6c. The average observed outwards (purple) and inwards (orange) net flux for O_2^+ from February 1, 2016 to May 21, 2022

for the solar wind electromagnetic energy flux bins. The data is on a Mars Solar Electric grid; the day-side and night-side of Mars are denoted accordingly.

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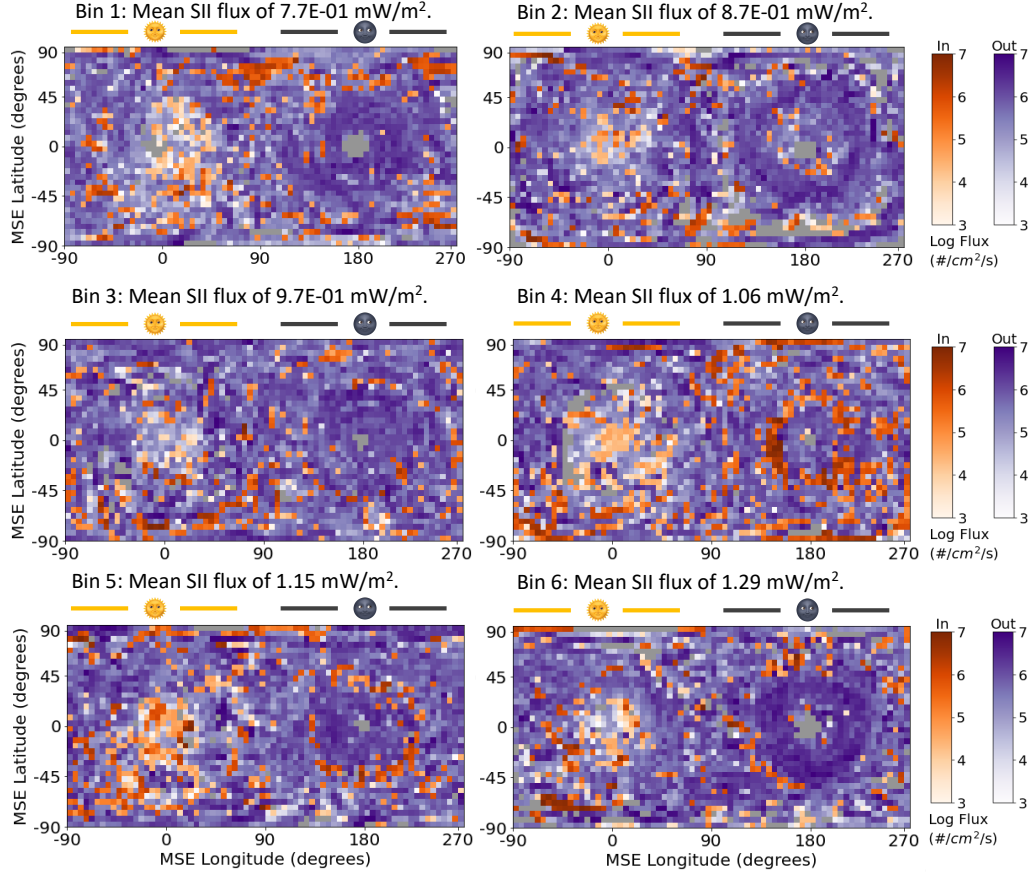
Ion flux maps for the solar ionizing irradiance bins, O^+ :



S7b. The average observed outwards (purple) and inwards (orange) net flux for O^+ from February 1, 2016 to May 21, 2022 for the solar ionizing irradiance bins. The data is on a Mars Solar Electric grid; the day-side and night-side of Mars are denoted accordingly.

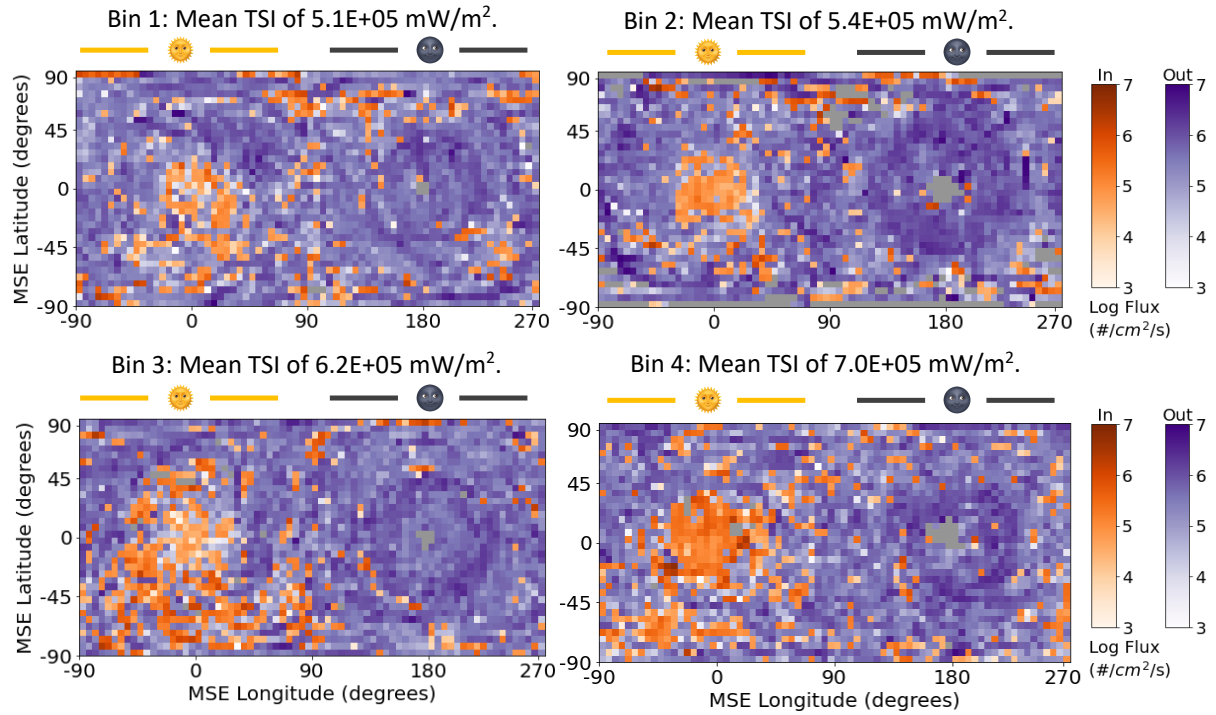
July 13, 2023, 9:24pm

Ion flux maps for the solar ionizing irradiance bins, O_2^+ :



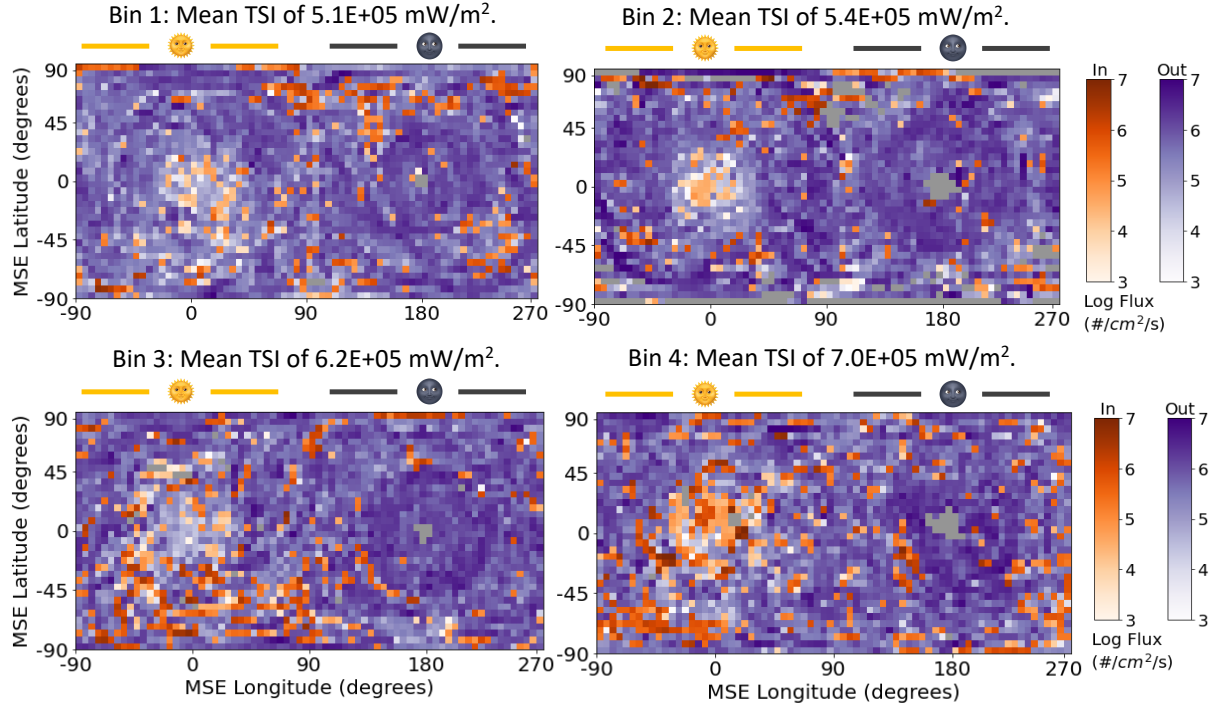
S7c. The average observed outwards (purple) and inwards (orange) net flux for O_2^+ from February 1, 2016 to May 21, 2022 for the solar ionizing irradiance bins. The data is on a Mars Solar Electric grid; the day-side and night-side of Mars are denoted accordingly.

Ion flux maps for the total solar irradiance, O^+ :



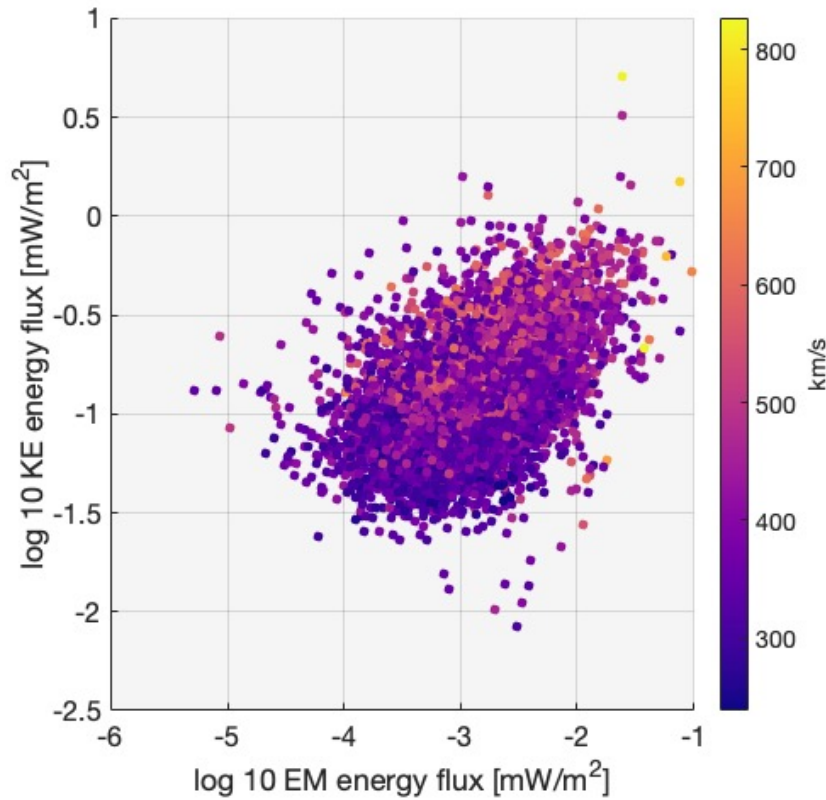
S8b. The average observed outwards (purple) and inwards (orange) net flux for O^+ from February 1, 2016 to May 21, 2022 for the total solar irradiance bins. The data is on a Mars Solar Electric grid; the day-side and night-side of Mars are denoted accordingly.

Ion flux maps for the total solar irradiance, O_2^+ :

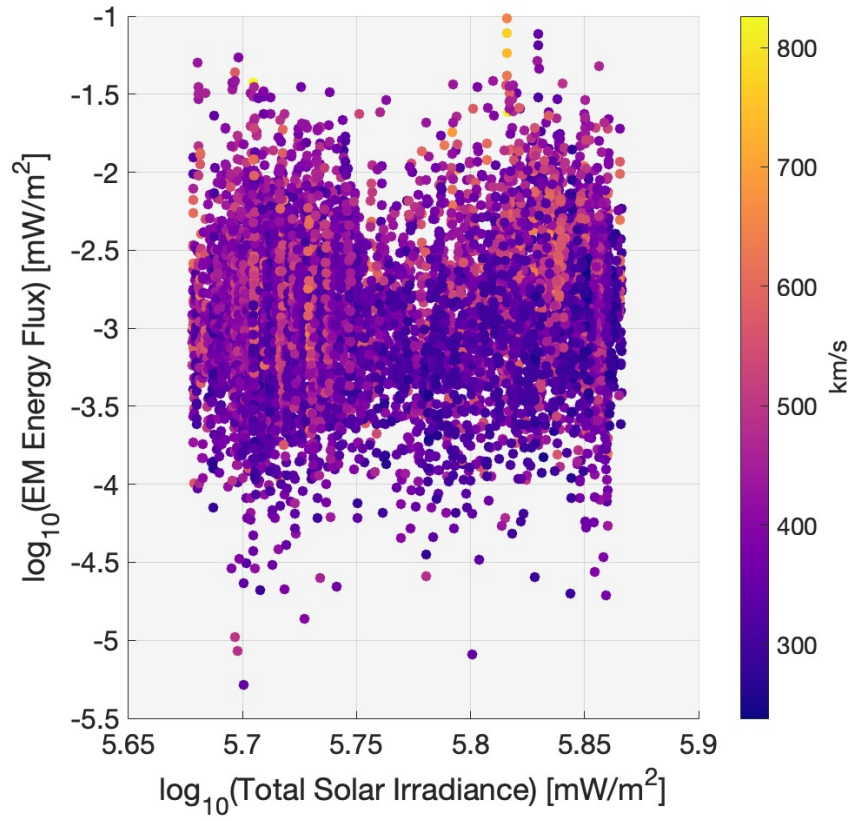


S8c. The average observed outwards (purple) and inwards (orange) net flux for O_2^+ from February 1, 2016 to May 21, 2022 for the total solar irradiance bins. The data is on a Mars Solar Electric grid; the day-side and night-side of Mars are denoted accordingly.

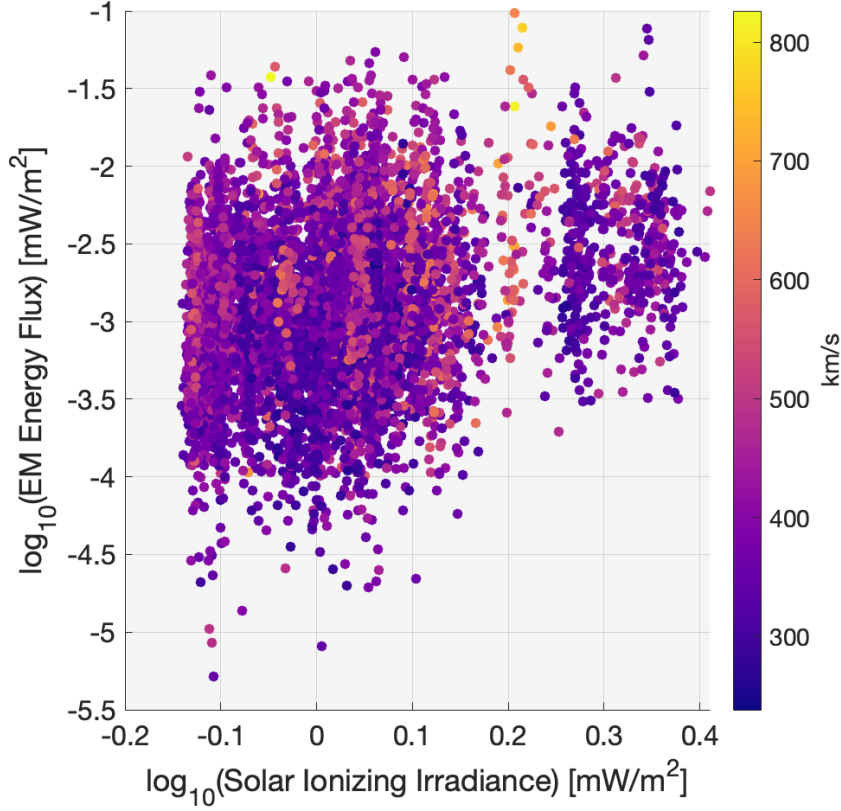
Solar wind kinetic energy flux versus solar wind electromagnetic energy flux:



S9. Solar wind kinetic energy flux versus solar wind electromagnetic energy flux with observations color coded by solar wind proton velocity. These solar wind energy fluxes are mutually correlated. Accounting for this was beyond the scope of our study, but should be considered in future work seeking to empirically fit for either driver.

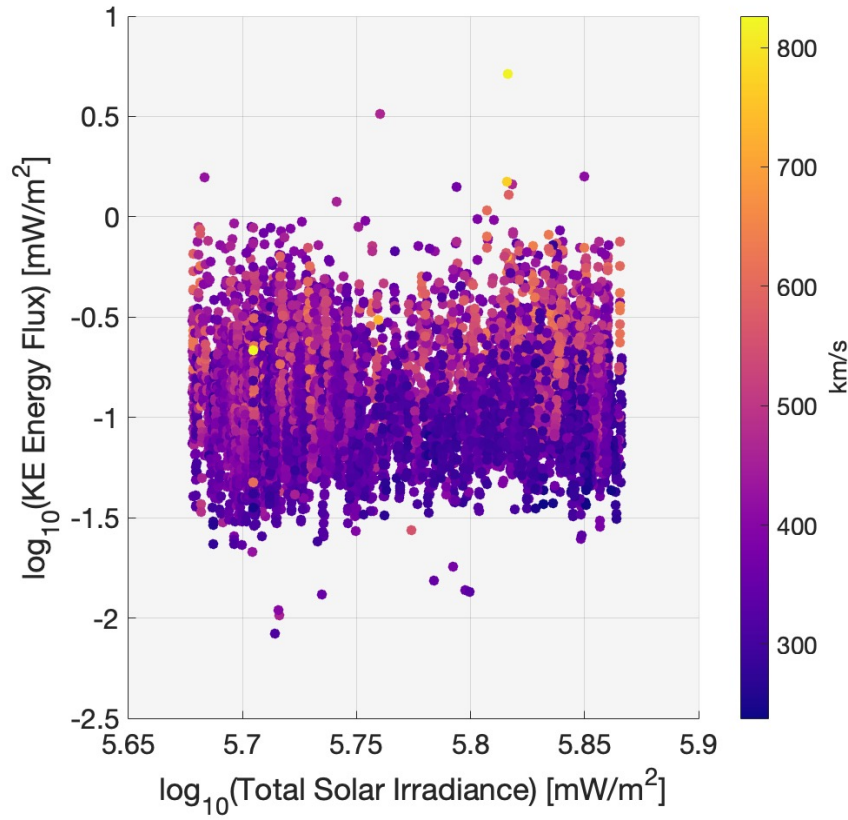
Solar wind electromagnetic energy flux versus total solar irradiance:

S10. Solar wind electromagnetic energy flux versus total solar irradiance with observations color coded by solar wind proton velocity. There is no obvious correlation between solar wind electromagnetic energy flux and total solar irradiance.

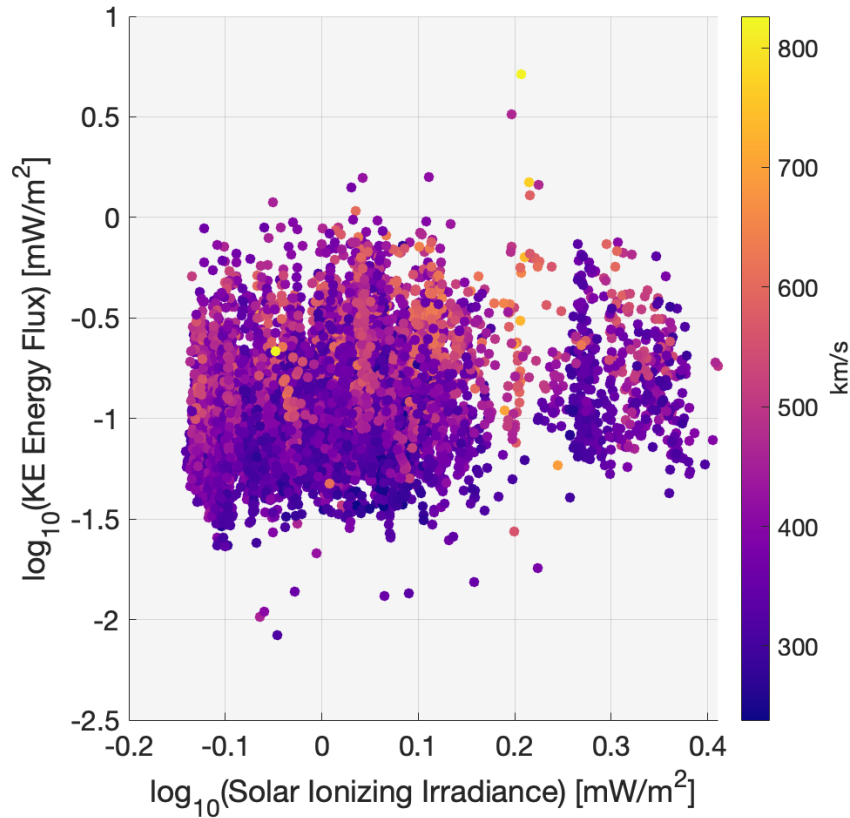
Solar wind electromagnetic energy flux versus solar ionizing irradiance:

S11. Solar wind electromagnetic energy flux versus solar ionizing irradiance with observations color coded by solar wind proton velocity. There is no obvious correlation between solar wind electromagnetic energy flux and solar ionizing irradiance, although there certainly are more solar wind observations for smaller values of solar ionizing irradiance. Using Mars mission data during solar maximum could better fill observations for higher solar ionizing irradiances.

Solar wind kinetic energy flux versus total solar irradiance:

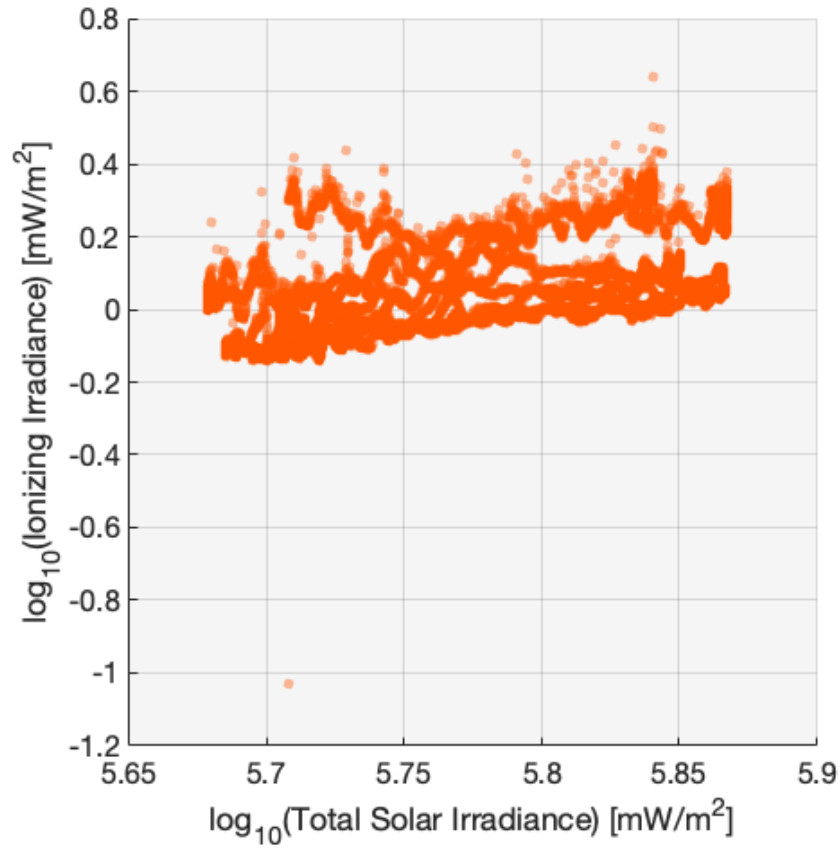


S12. Solar wind kinetic energy flux versus total solar irradiance with observations color coded by solar wind proton velocity. There is no obvious correlation between solar wind kinetic energy flux and total solar irradiance.

Solar wind kinetic energy flux versus solar ionizing irradiance:

S13. Solar wind kinetic energy flux versus solar ionizing irradiance with observations color coded by solar wind proton velocity. There is no obvious correlation between solar wind kinetic energy flux and solar ionizing irradiance, although there certainly are more solar wind observations for smaller values of solar ionizing irradiance. Using Mars mission data during solar maximum could better fill observations for higher solar ionizing irradiances.

Solar ionizing irradiance versus total solar irradiance:



S14. Solar ionizing irradiance versus total solar irradiance. There is mutual correlation between these solar irradiances.