

# Simulating global dynamic surface reflectances for imaging spectroscopy spaceborne missions - LPJ-PROSAIL



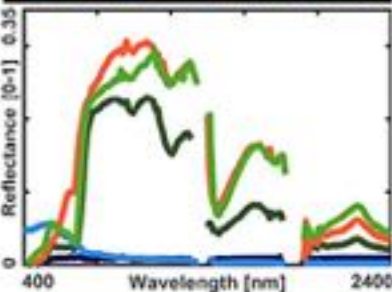
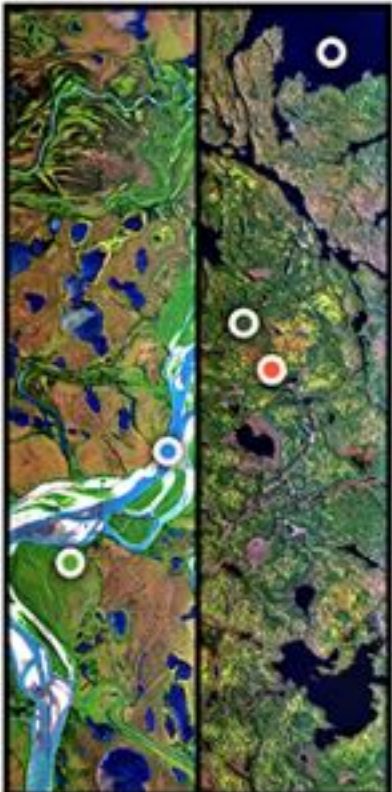
Benjamin Poulter, **Bryce Currey**, Leonardo Calle, Alexey N. Shiklomanov, Cibele H. Amaral, Jack Brookshire, Petya Campbell, Adam Chlus, Kerry Cawse-Nicholson, Fred Huemmrich, Charles E Miller, Kimberley Miner, Zoe Pierrat, Ann M. Raiho, David Schimel, Willaim K. Smith, Shawn Serbin, Natasha Stavros, Jochen Stutz, Phil Townsend, David R. Thompson and Zhen Zhang



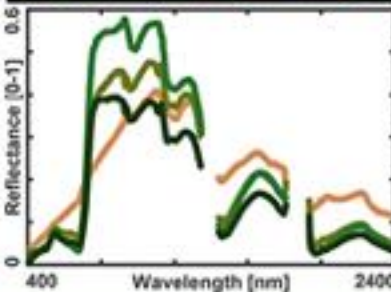
# SBG provides data for many focus areas ...

... and will see the world in two critical spectral regions

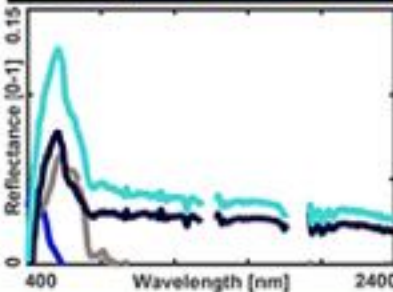
Ecosystems



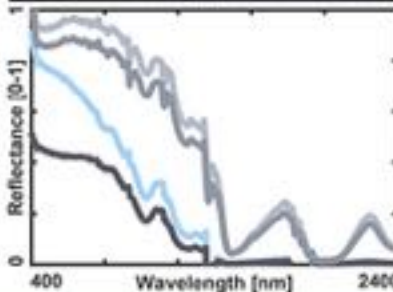
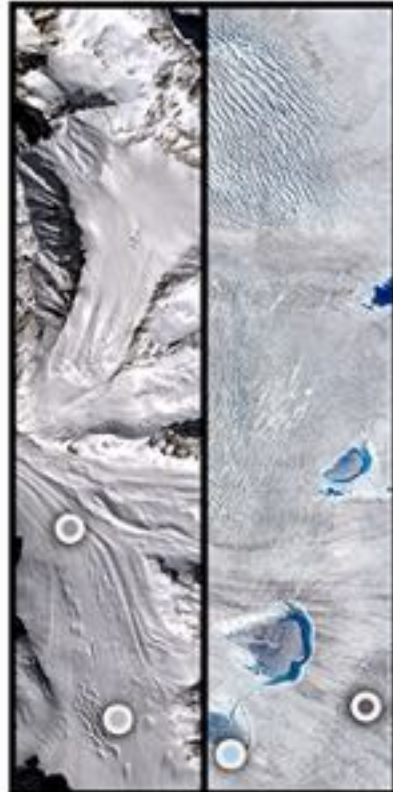
Agriculture



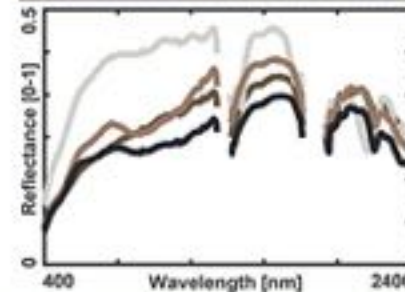
Coastal Zones



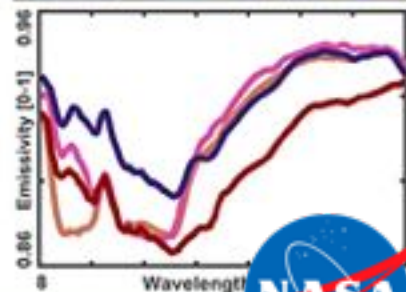
Snow and Ice



VSWIR



Minerals



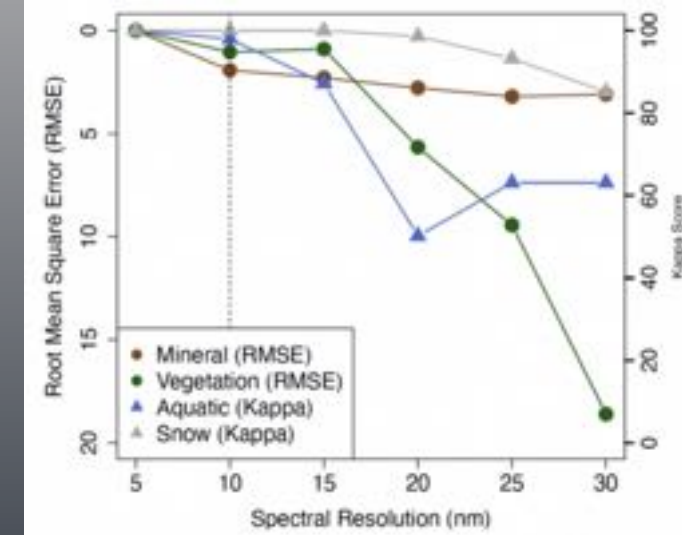
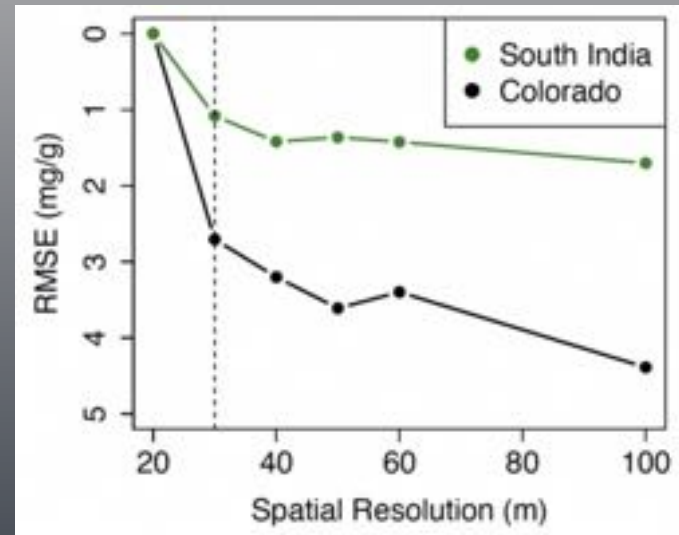
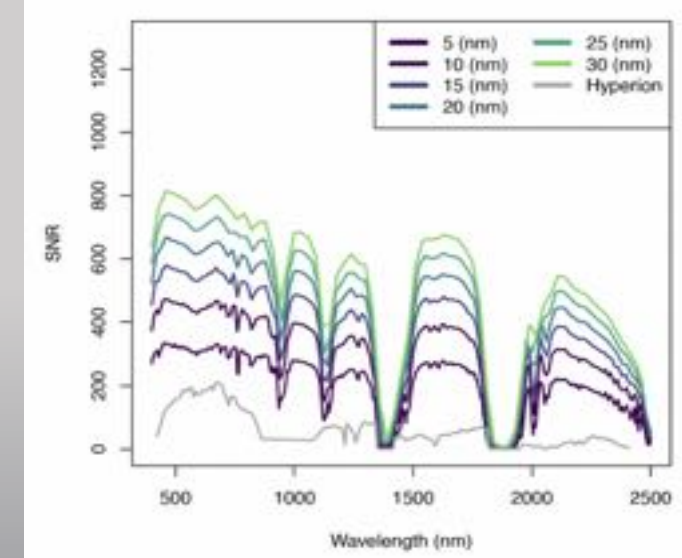
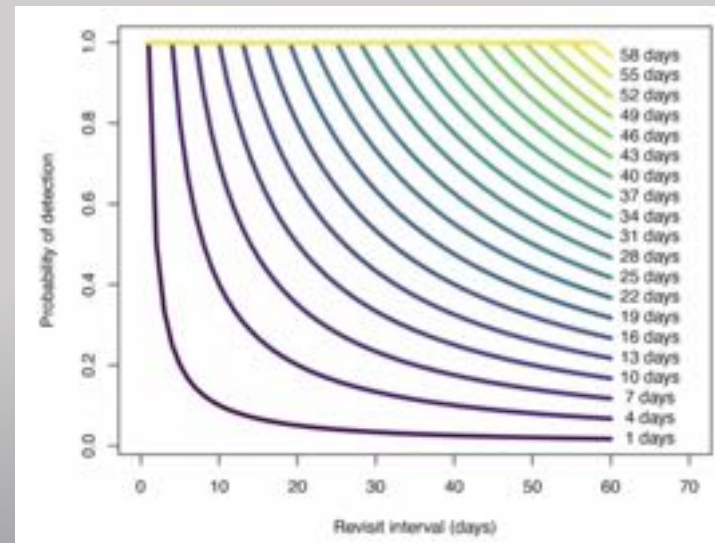
TIR





Previous work led by Ann Raiho from this group tested how error and SNR changed across various potential resolutions.

- High spectral ( $\sim 10\text{nm}$ ), high spatial ( $\sim 30\text{m}$ ), and high revisit (less than 16 days) is needed to constrain geophysical property estimation



# Observing system simulation experimentation (OSSE)

Part of Modeling End-to-End traceability in support of SBG (MEET-SBG)

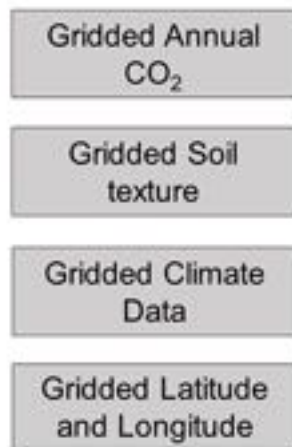
- How algorithms and products generalize globally?
- What happens when spectroscopic data is downscaled spatially?
- High-level products?

*"the world is not ready for hyperspectral data"*



# LPJ-PROSAIL

## Driver Inputs



50km<sup>2</sup> grid cell

### *f*(Latitude, TOD)

- Solar Zenith Angle
- Relative Azimuth Angle
- SKYL

### Abiotic processes

- Soil hydrology
- Thermodynamics
- Fire

### Biotic processes

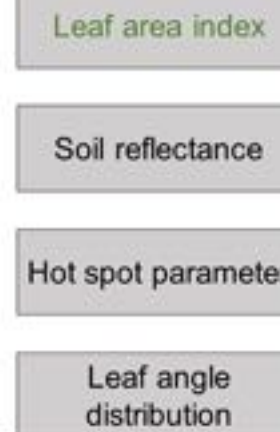
- Plant Functional Types
  - photosynthesis and respiration
  - establishment, growth, mortality
  - competition
- Heterotrophic Respiration
  - litter and soil dynamics

Daily step

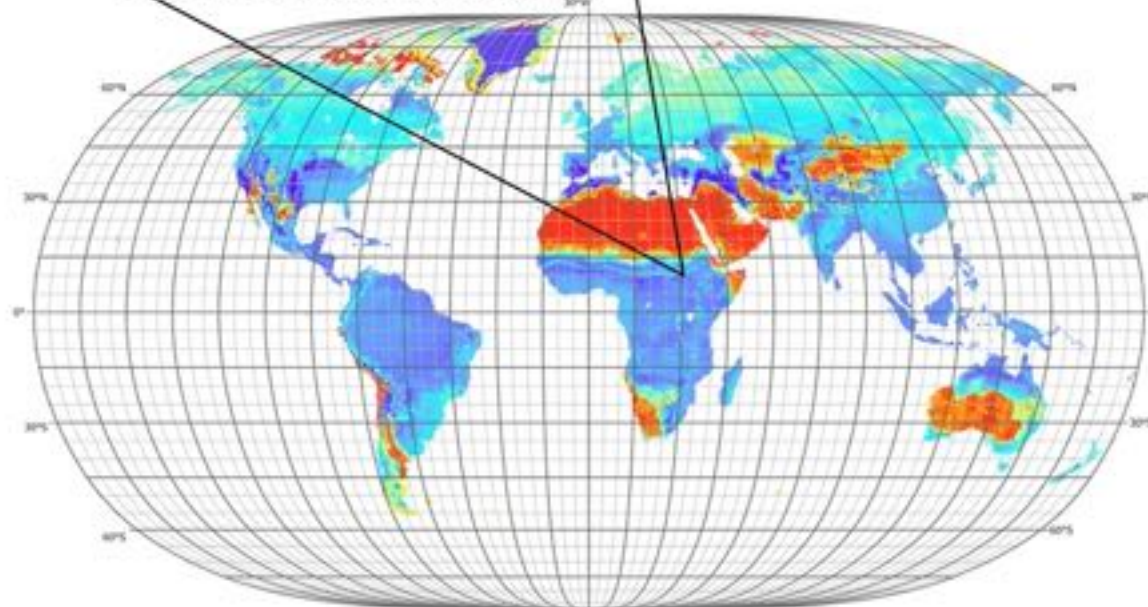
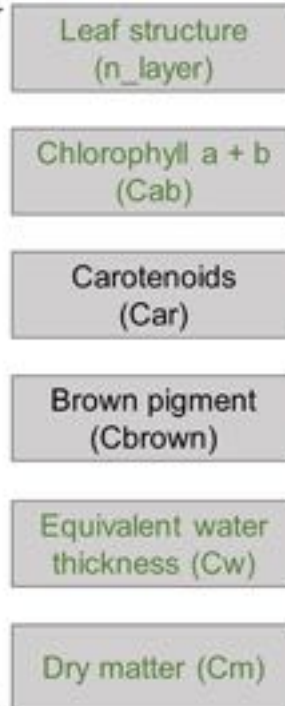
Annual step

Sun-Observer Zenith Angel

## 4SAIL Inputs



## PROSPECT Inputs



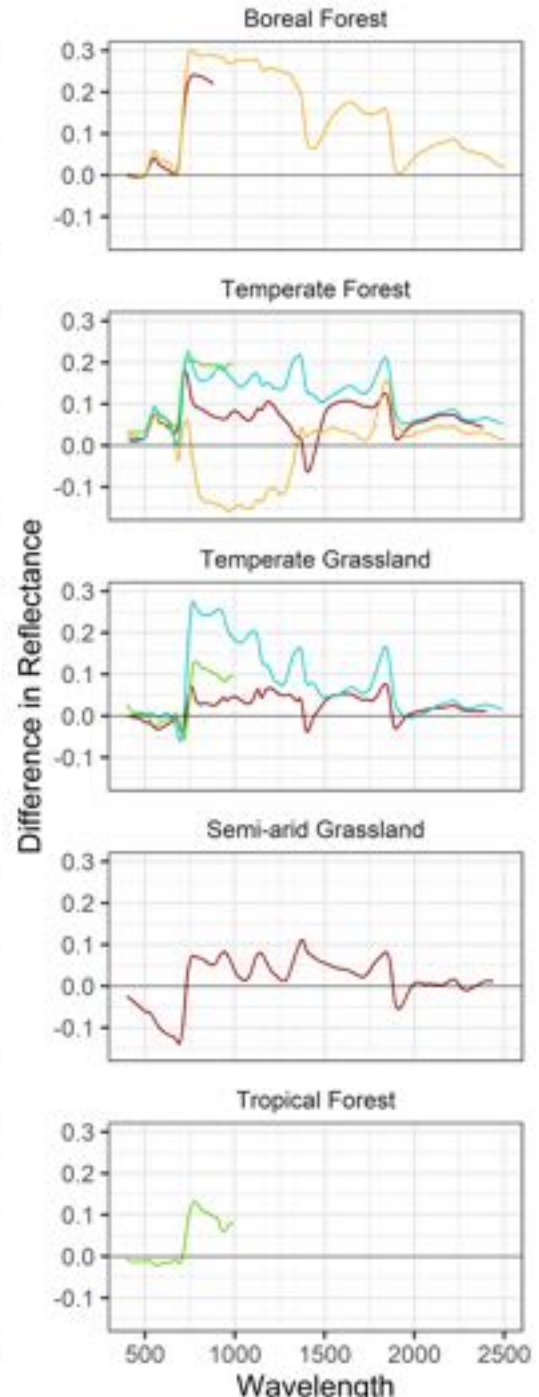
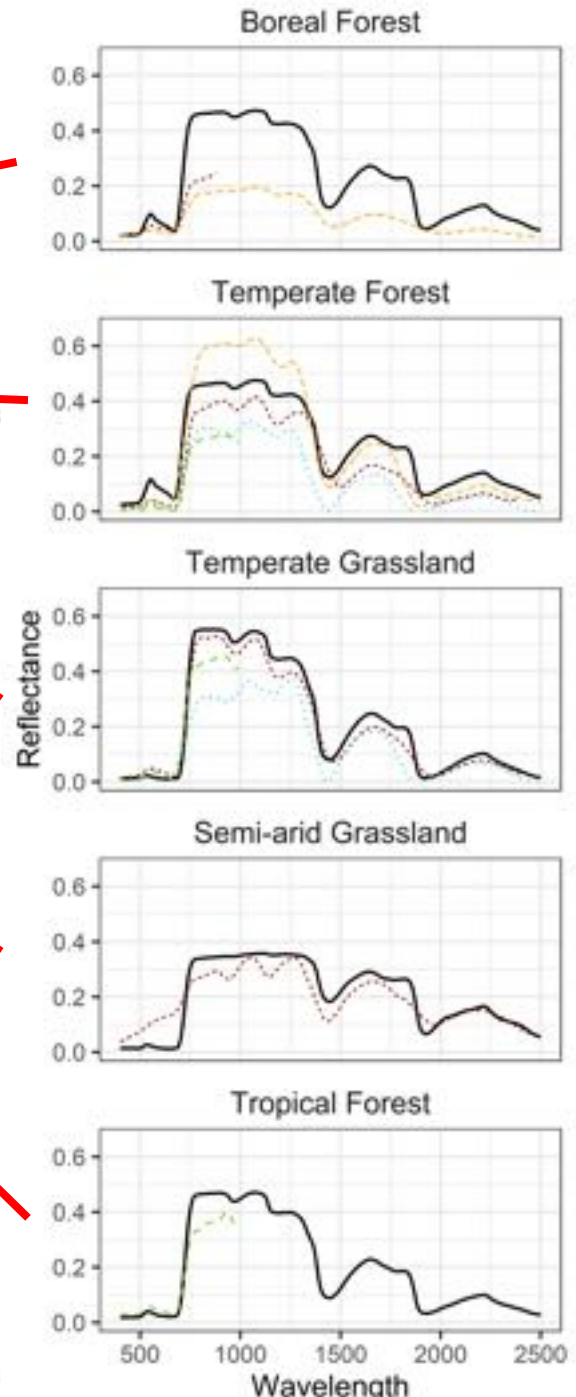
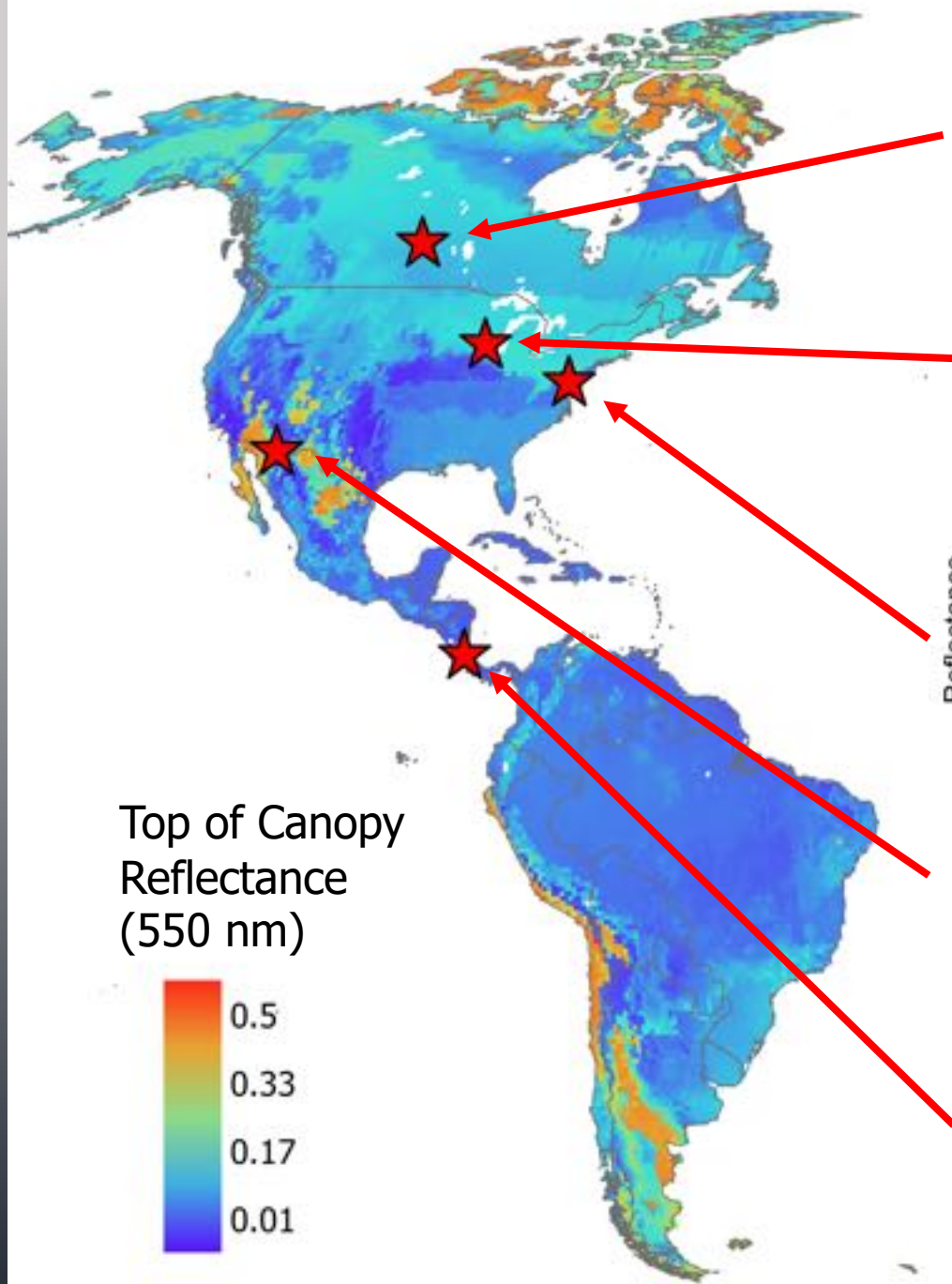
Sitch, S. *et al.* Evaluation of ecosystem dynamics, plant geography and terrestrial carbon cycling in the LPJ dynamic global vegetation model. *Glob. Change Biol.* **9**, 161–185 (2003).

Calle, L. & Poulter, B. Ecosystem age-class dynamics and distribution in the LPJ-wsl v2.0 global ecosystem model. *Geosci. Model Dev.* **14**, 2575–2601 (2021).

Poulter, B., Currey, B. & Calle, L. Simulating global dynamic surface reflectances for imaging spectroscopy spaceborne missions - LPJ-PROSAIL.





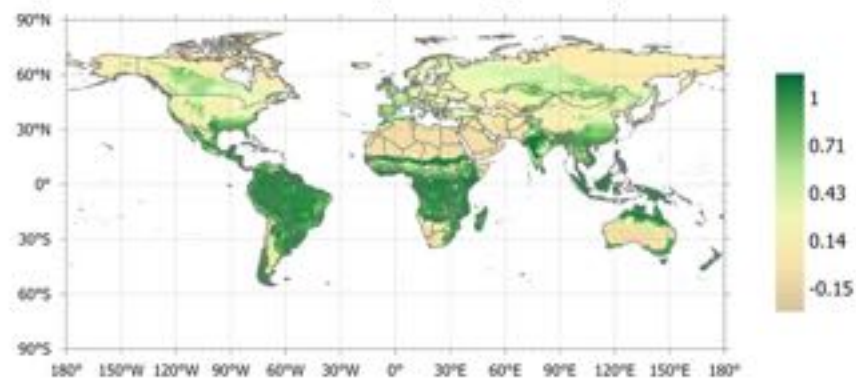


Source

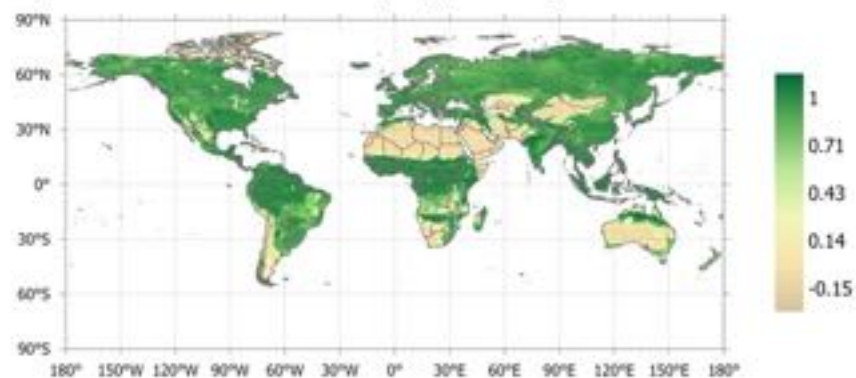
- In situ
- AVIRIS
- DESIS
- PRISMA



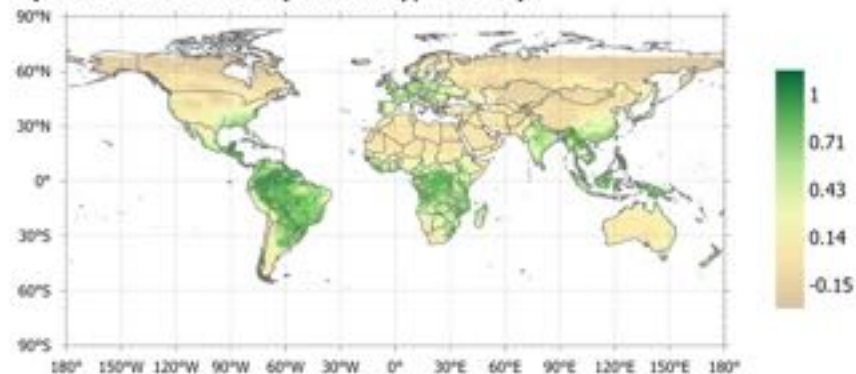
A) LPJ-PROSAIL NDVI (January, 2020)



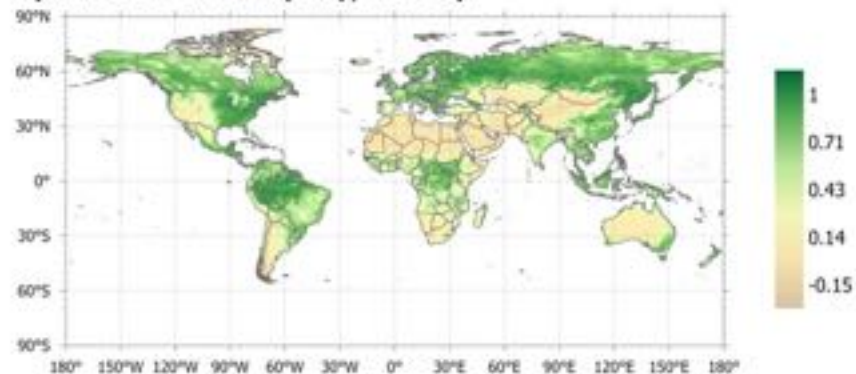
B) LPJ-PROSAIL NDVI (July, 2020)



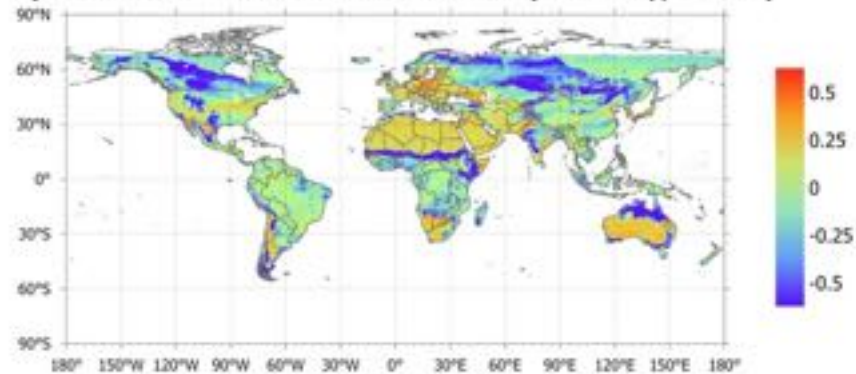
C) MODIS NDVI (January, 2020)



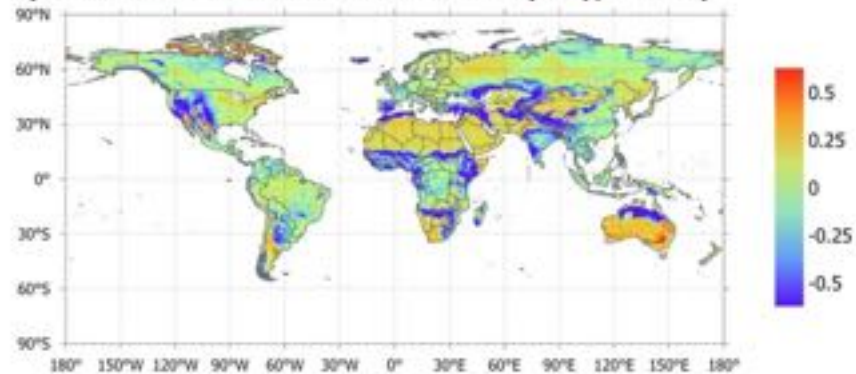
D) MODIS NDVI (July, 2020)



E) MODIS – LPJ-PROSAIL NDVI (January, 2020)

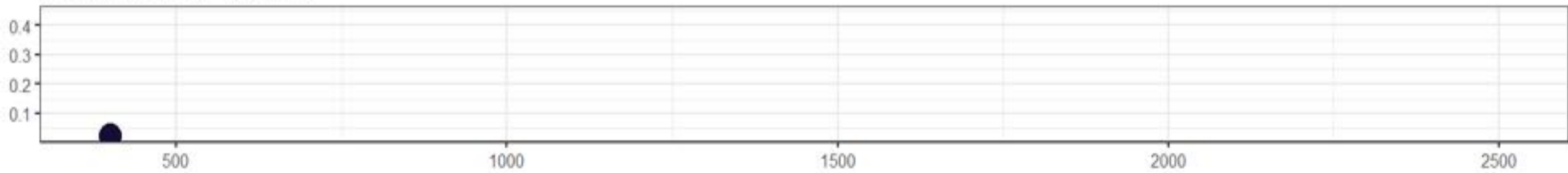


F) MODIS – LPJ-PROSAIL NDVI (July, 2020)

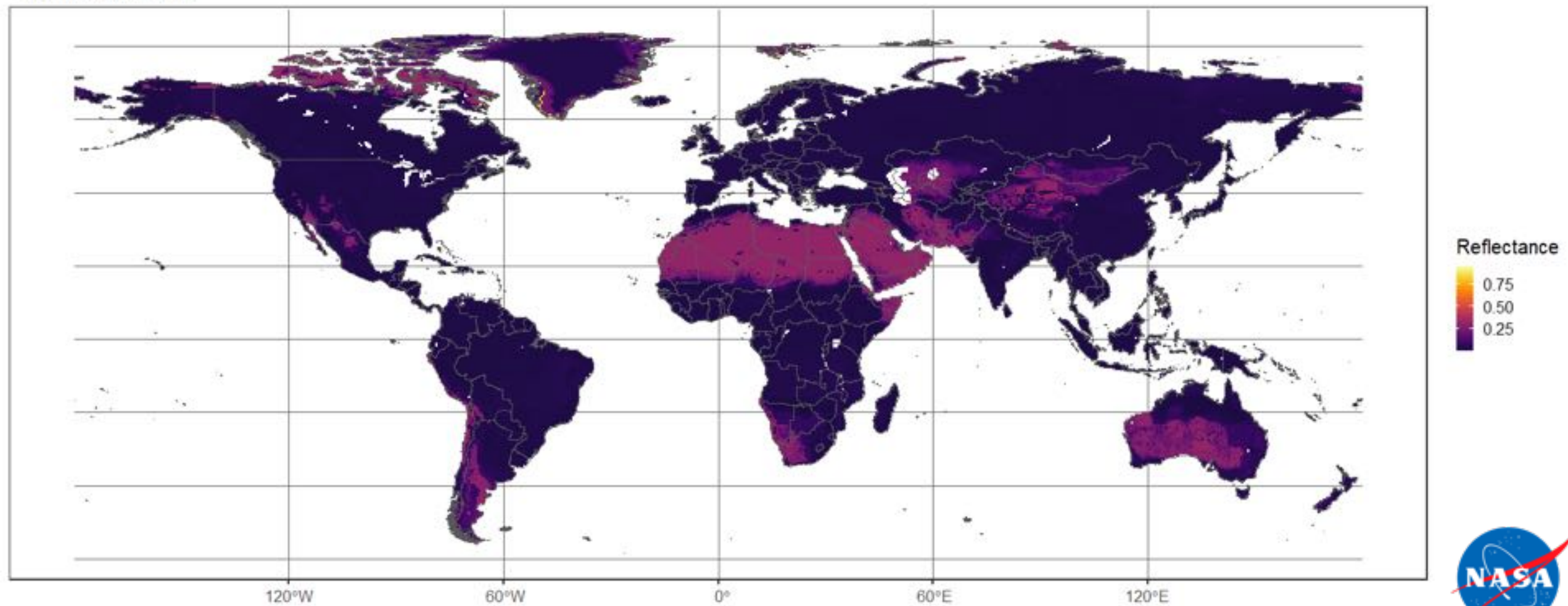




Coords: 45.25N, 111.25W

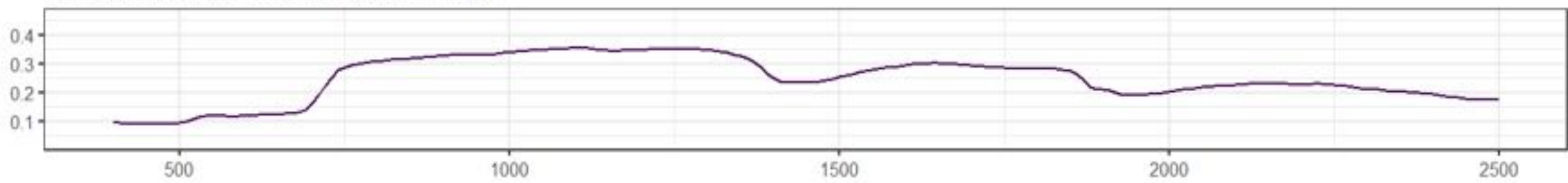


Wavelength: 400



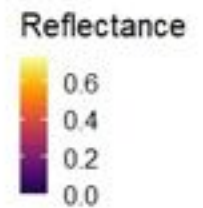
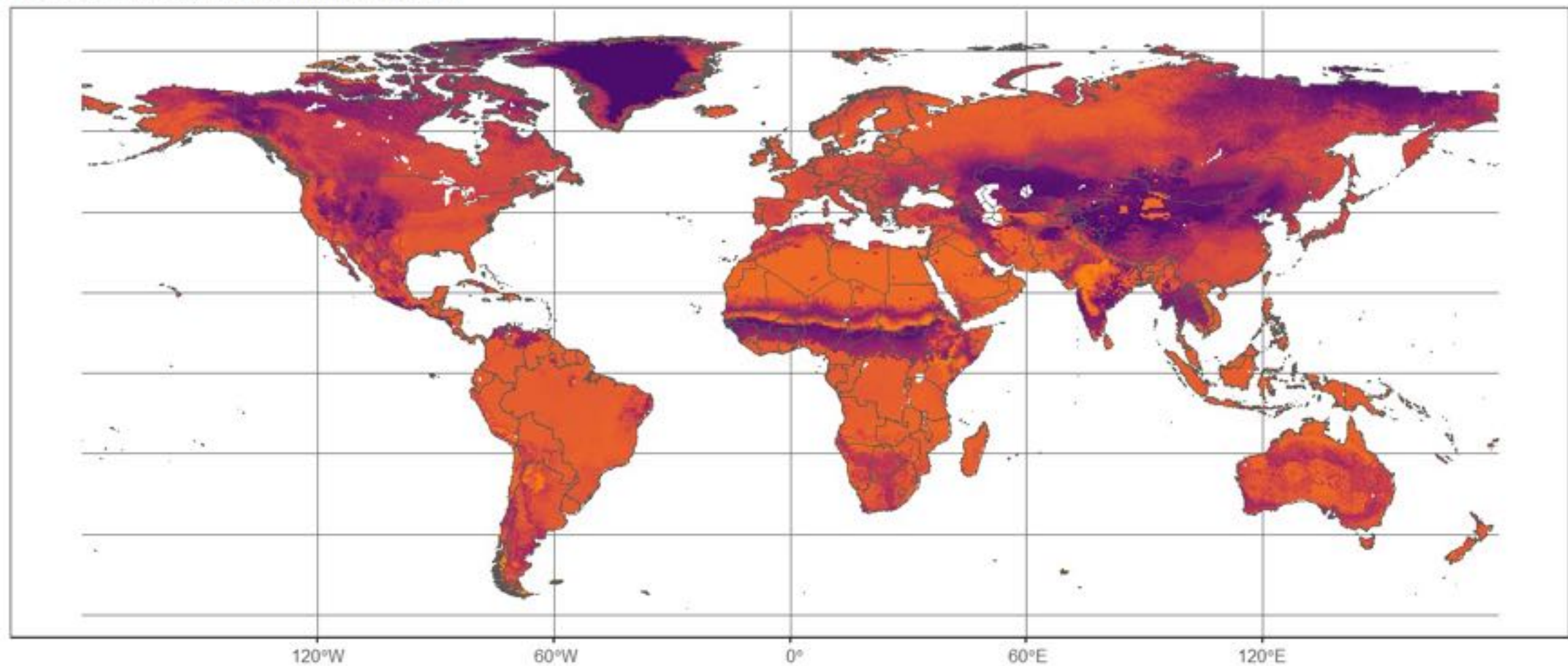


Month: January; Wavelength: 1000nm,



- Month
- January
  - February
  - March
  - April
  - May
  - June
  - July
  - August
  - September
  - October
  - November

Month: January; Wavelength: 1000nm



# Thank you.



- [bryce.currey@montana.edu](mailto:bryce.currey@montana.edu)
- [Greencurrey.com](http://Greencurrey.com)
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- [Benjamin.poulter@nasa.gov](mailto:Benjamin.poulter@nasa.gov)
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