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Wildfires promoted by contrasting soil moisture anomalies in humid versus arid regions

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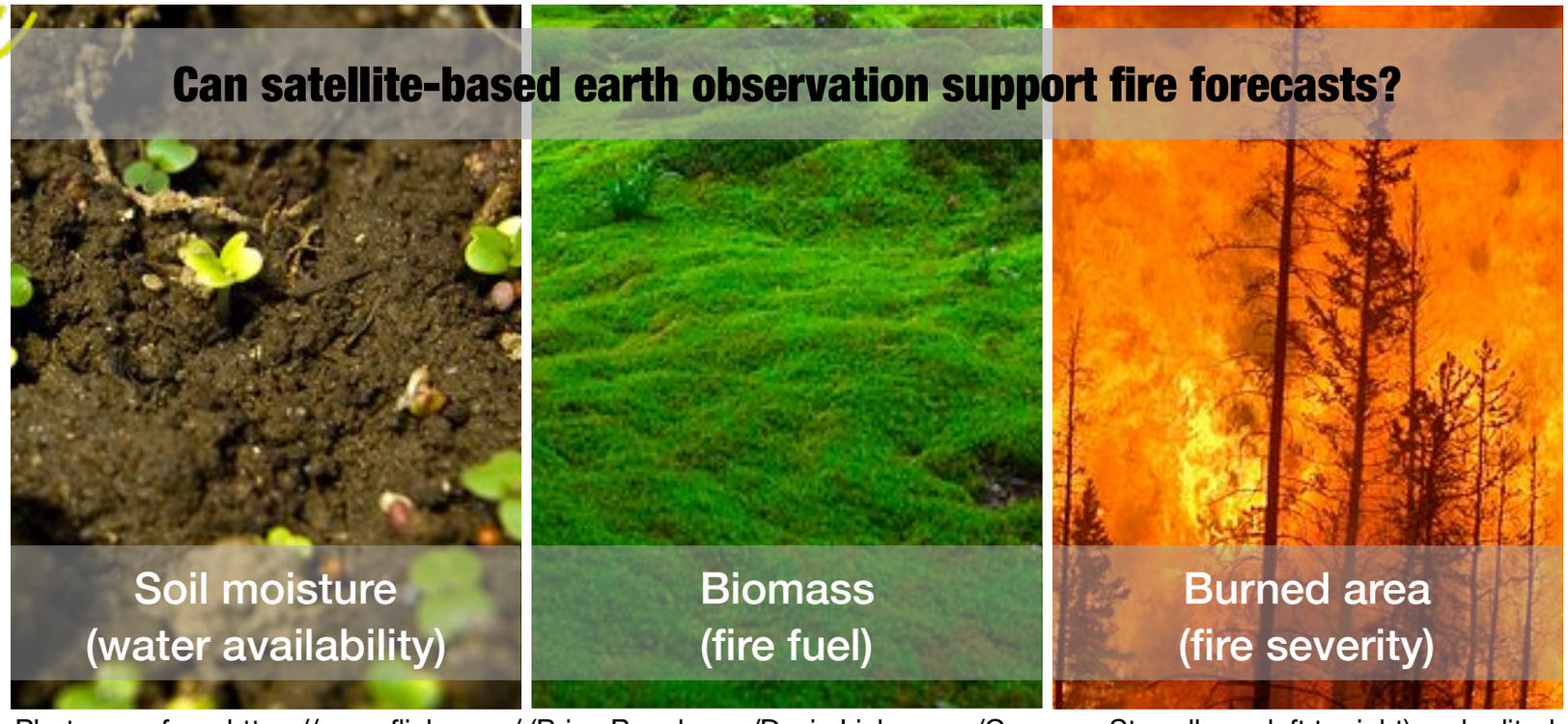
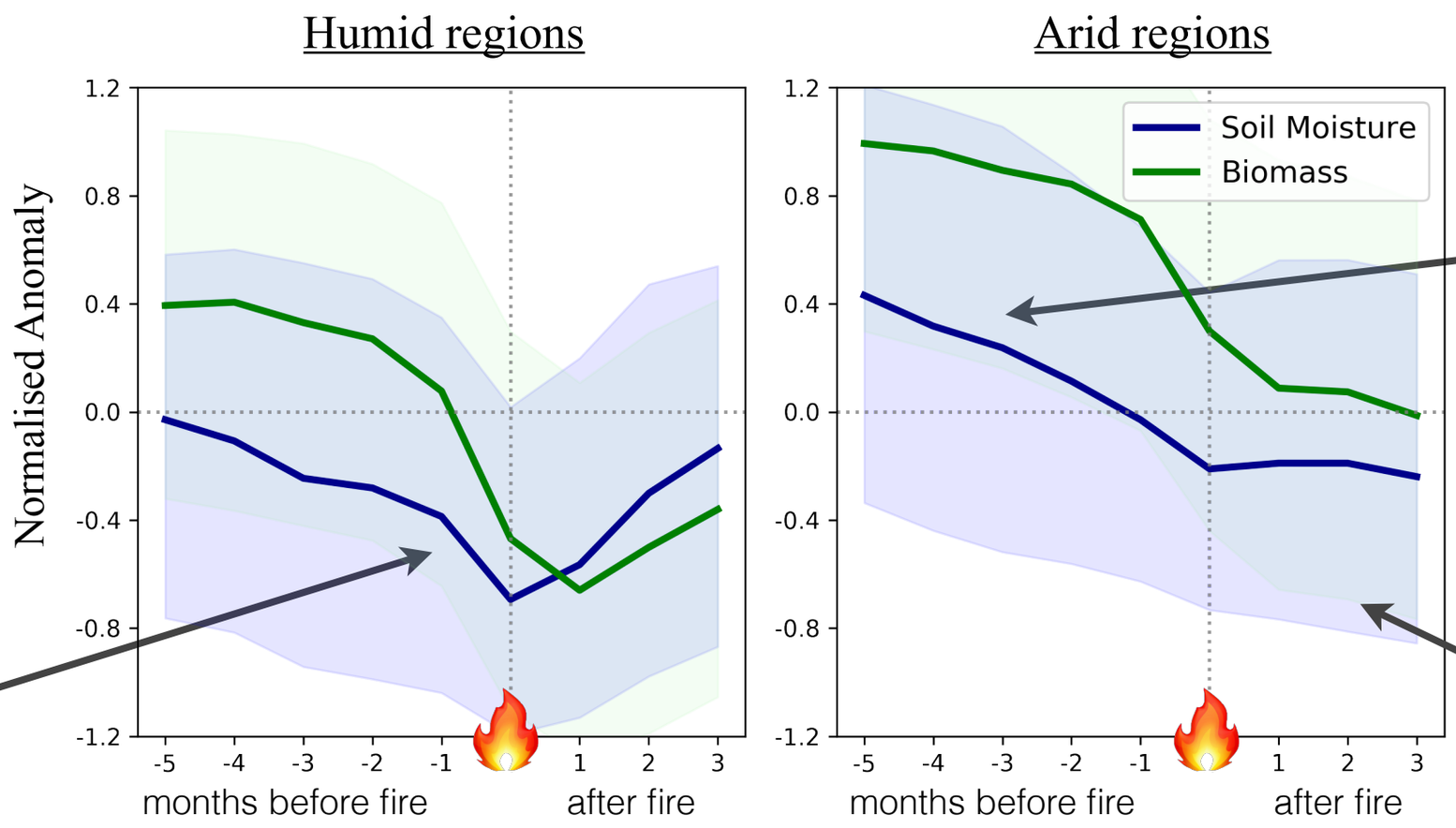


Photos are from https://www.flickr.com/ (Brian Boucheron/Devin Lieberman/Cameron Strandberg; left to right) and edited

1. Main Results

Soil moisture and biomass during large wildfire events across the globe;
median values and interquartile range across the considered grid cells (see Method & Data)



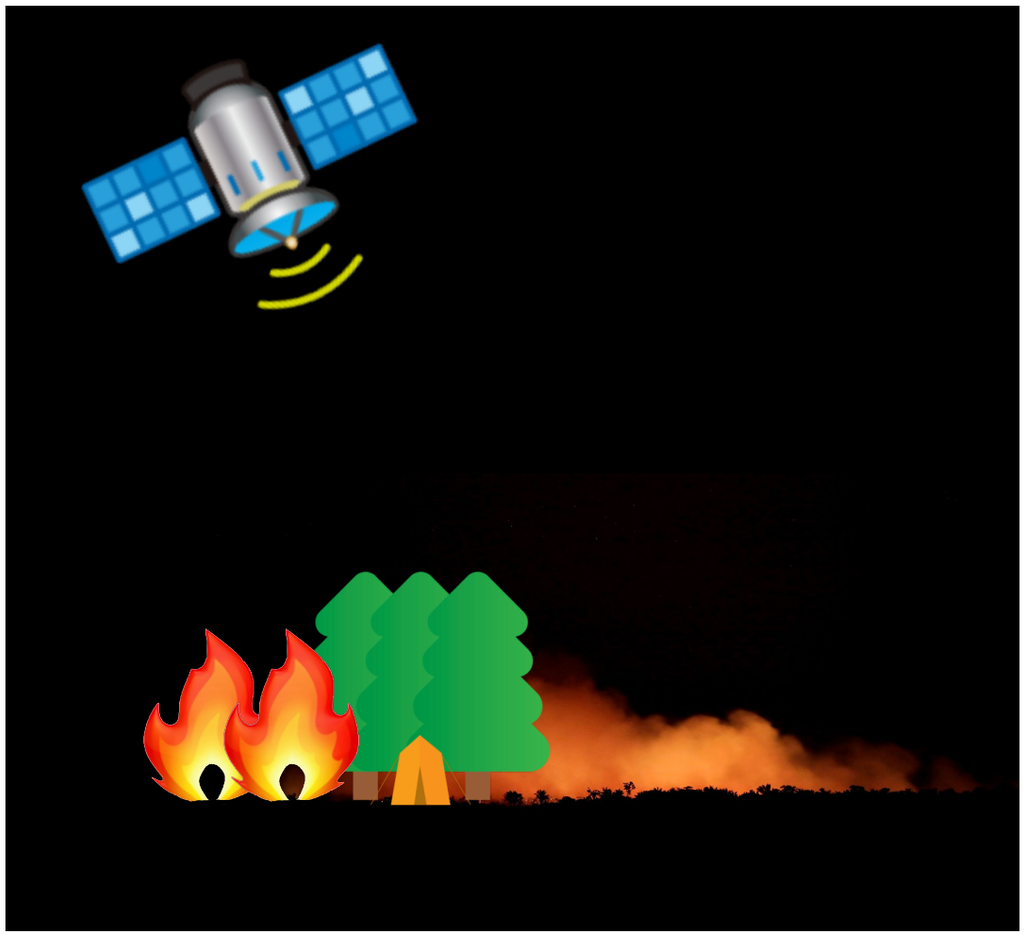
Drier-than-average soils before large fires => highly flammable fire fuels (biomass)

Wetter-than-average soils => sufficient fire fuel accumulation

Large uncertainty ranges reflecting other natural/ anthropogenic controls on fires

We show **characteristic soil moisture anomalies prior to large wildfires using *satellite observational data***. Soil moisture (1) determines vegetation moisture content and therefore the flammability ***in humid regions***, while (2) it controls biomass growth and hence fuel accumulation ***in arid regions***.

2. Take-home message



☑ Characteristic soil moisture anomaly patterns prior to large wildfires are found from satellite observational data.

☑ Soil moisture controls biomass (=fuel) development, and can therefore inform fire hazards.

☑ Our study highlights that novel global land surface data can contribute to more reliable fire predictions and early warning.

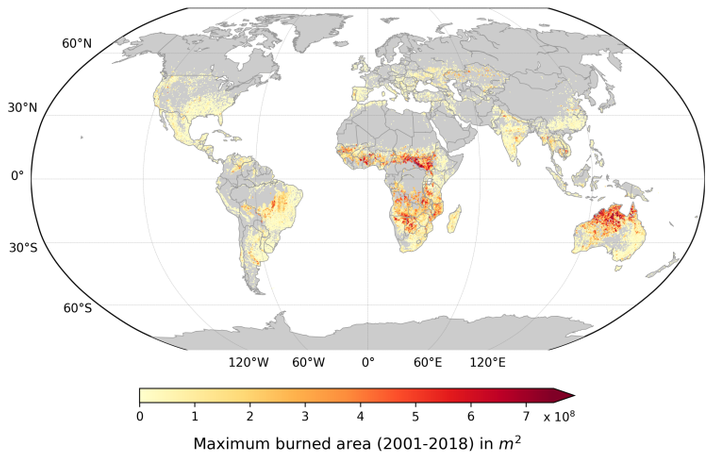
3. Method and Data

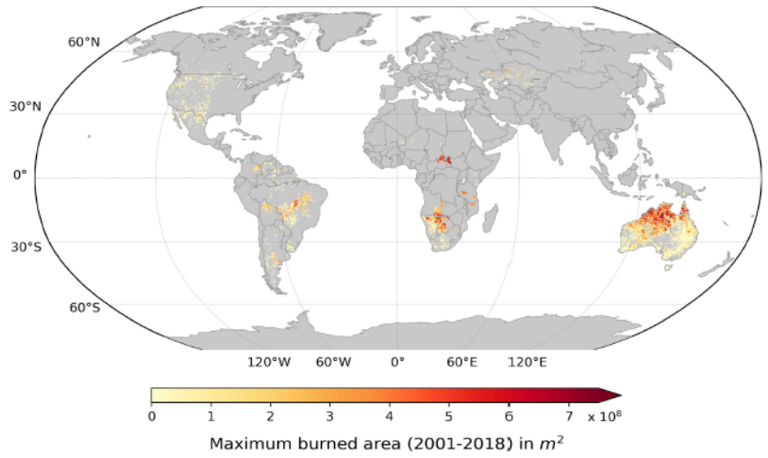
1. Selected largest burned area during the last 18 years (2001-2018) for each grid box.

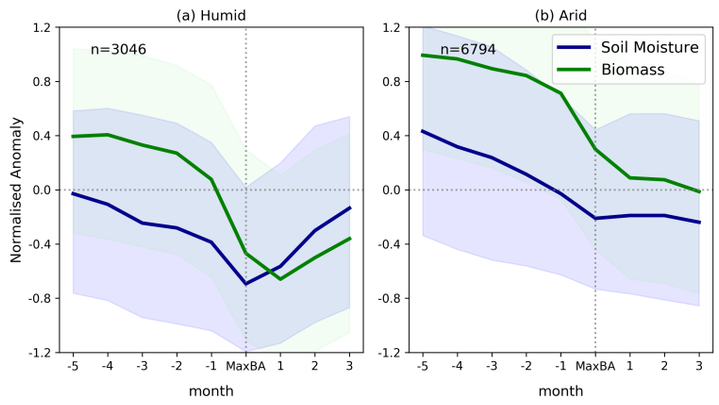
2. Filter out grid boxes with missing soil moisture data and select low population areas.

3. Compute temporal evolutions of normalised anomalies* of soil moisture and biomass

* Monthly anomalies divided by monthly standard deviation







Datasets

- Burned area: ESA CCI Fire v5.1
- Soil moisture: ESA CCI v04.4
- Population density: GPWv4.11
- Temperature: ERA5 reanalysis
- Biomass: Vegetation optical depth (Moesinger et al., 2020)

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