4th Carbon from Space Workshop

Comparing global aboveground biomass data products from satellite observations: Evidences and needs

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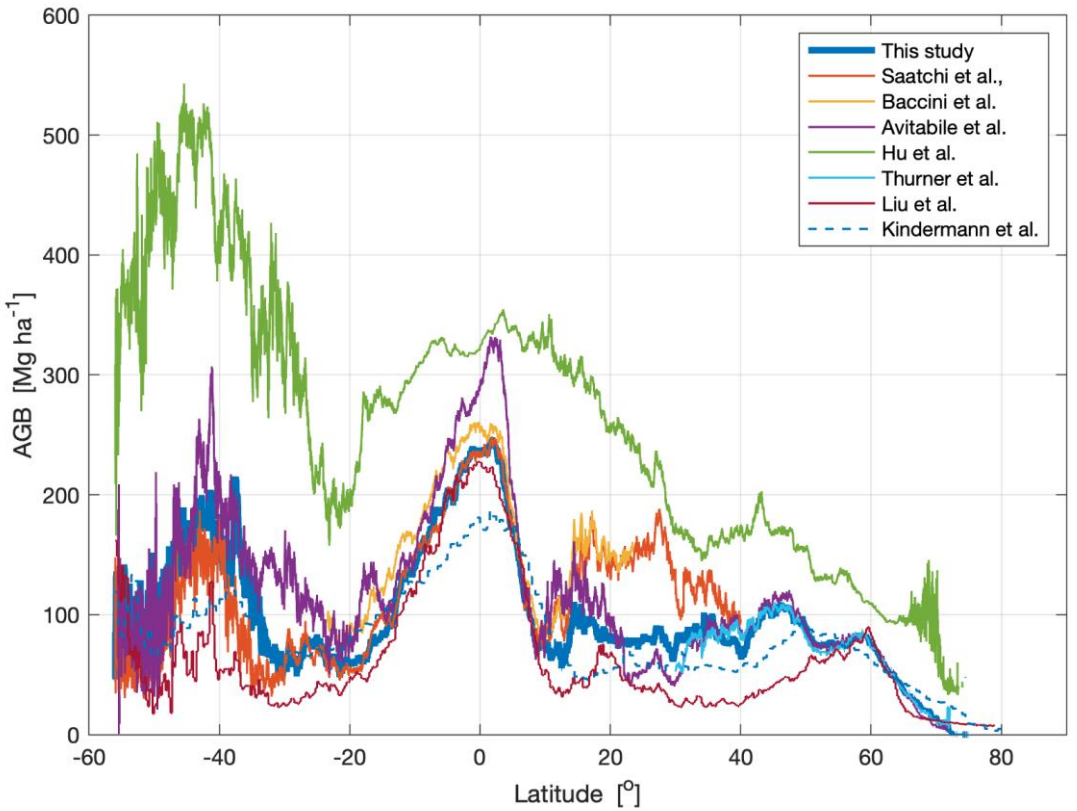
SETTING THE STAGE

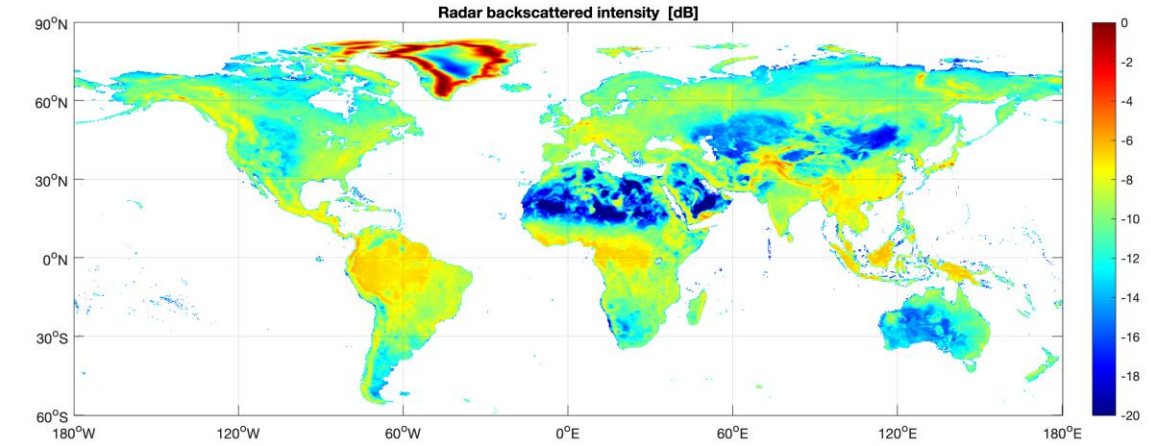


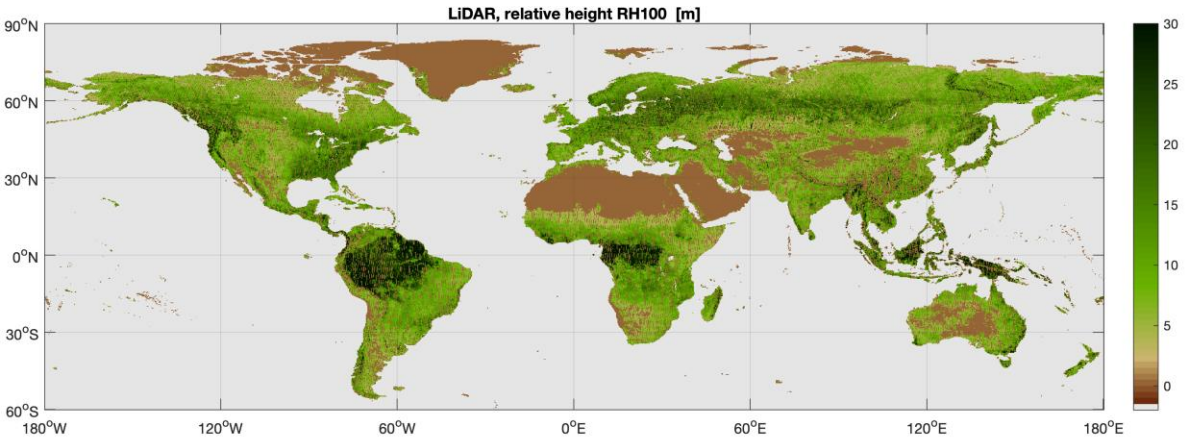
(Santoro et al., ESSD, 2021)

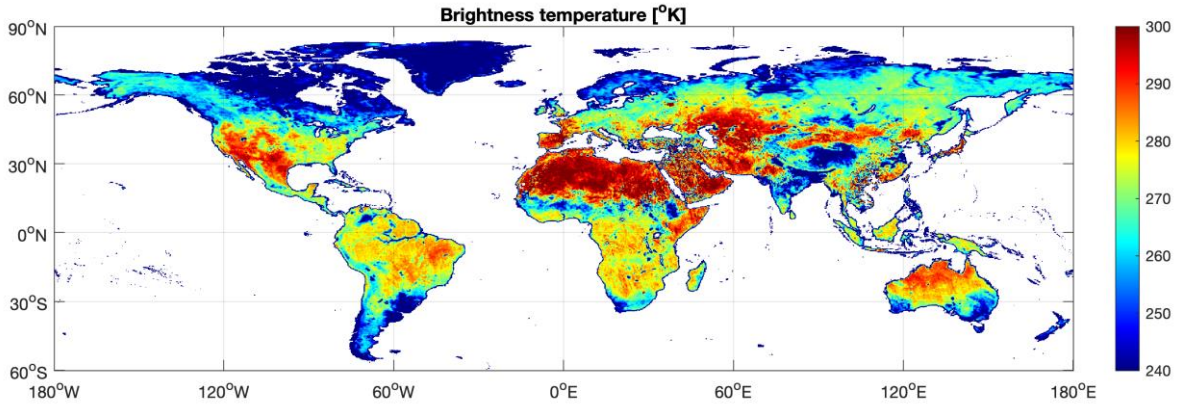
- AGB (aboveground biomass) maps derived from satellite observations are uncertain
- As satellites do not measure the amount of organic mass, a biomass map is the result of (i) a combination of observations more or less related to biomass and (ii) mathematical models selected by the map producer

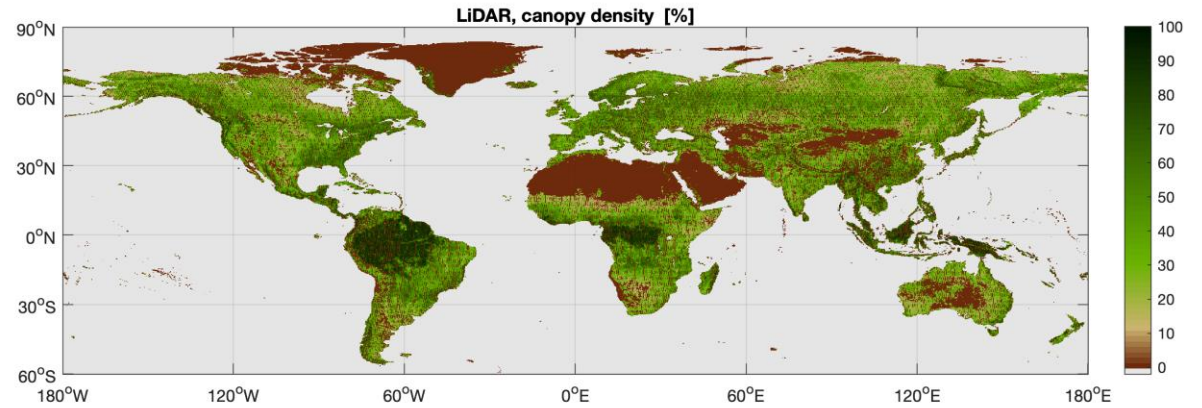
BIOMASS AND SATELLITE OBSERVATIONS

- EO does not measure biomass but each band and instrument senses specific properties of vegetation









STATUS QUO ON AGB ESTIMATION FROM SPACE

- Estimation of biomass from EO data has evolved in recent years thanks to a much wider range of observations from space, open data policies and distributed computing capabilities → multiple observational evidences lead to larger confidence in what we estimate
- Question is: how reliable are biomass and biomass dynamics derived from satellite data at present?

- Here, we compare two recent AGB time series

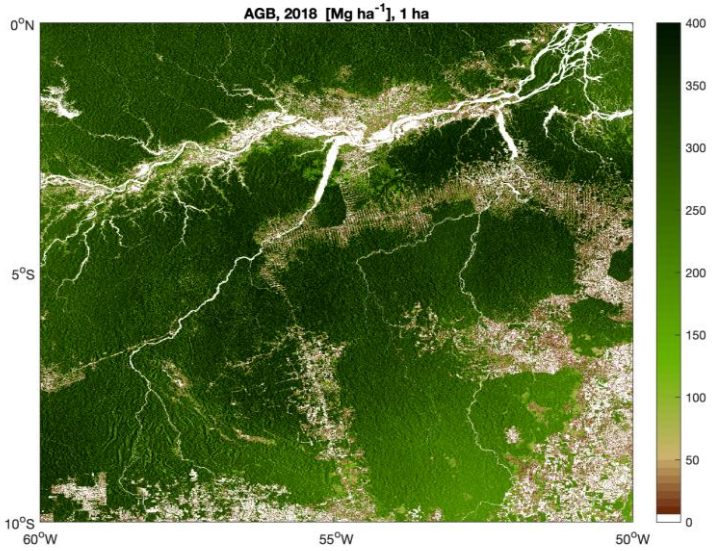
(1) HIGH-RES & TEMPORALLY SPARSE SAMPLING

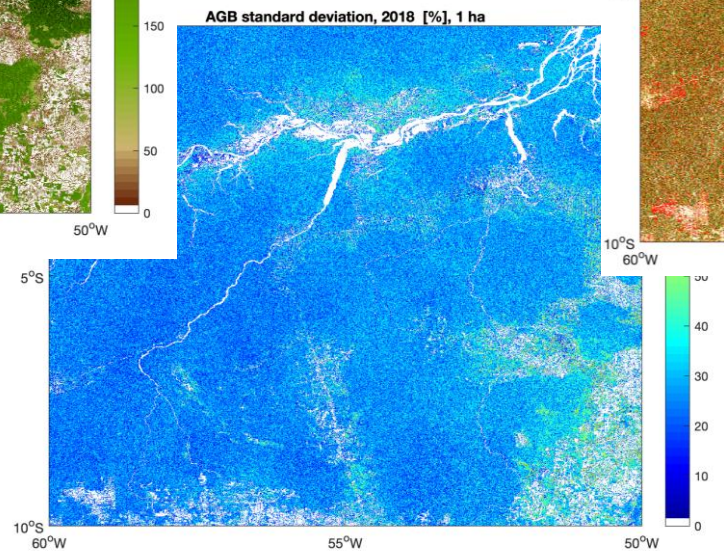
VS.

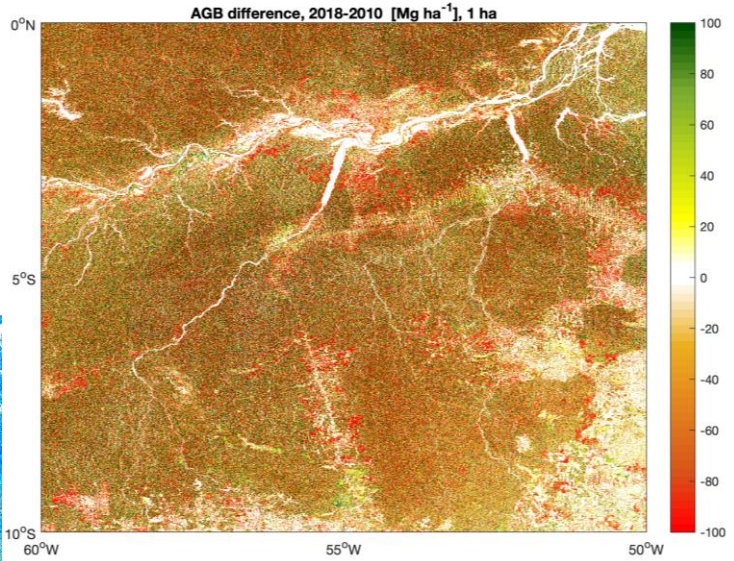
(2) LOW-RES & HIGH TEMPORAL SAMPLING

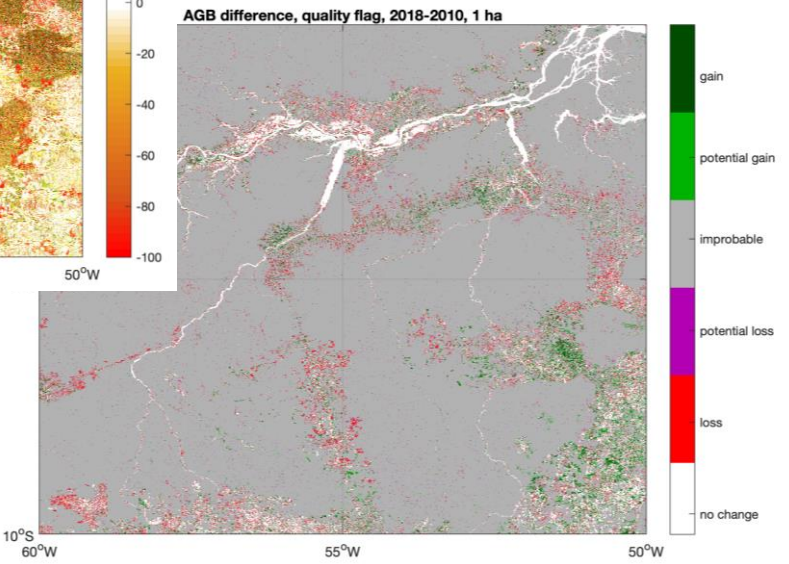
Climate Change Initiative (CCI) Biomass

- Global maps of forest AGB and related standard deviation, spatial resolution: 100 m, years: 2010, 2017, 2018 (version 3) + AGB Change maps for 2018-2010 and 2018-2017, including a quality layer
- Predictor: SAR observations. Auxiliary data: spaceborne LiDAR metrics and optical canopy density



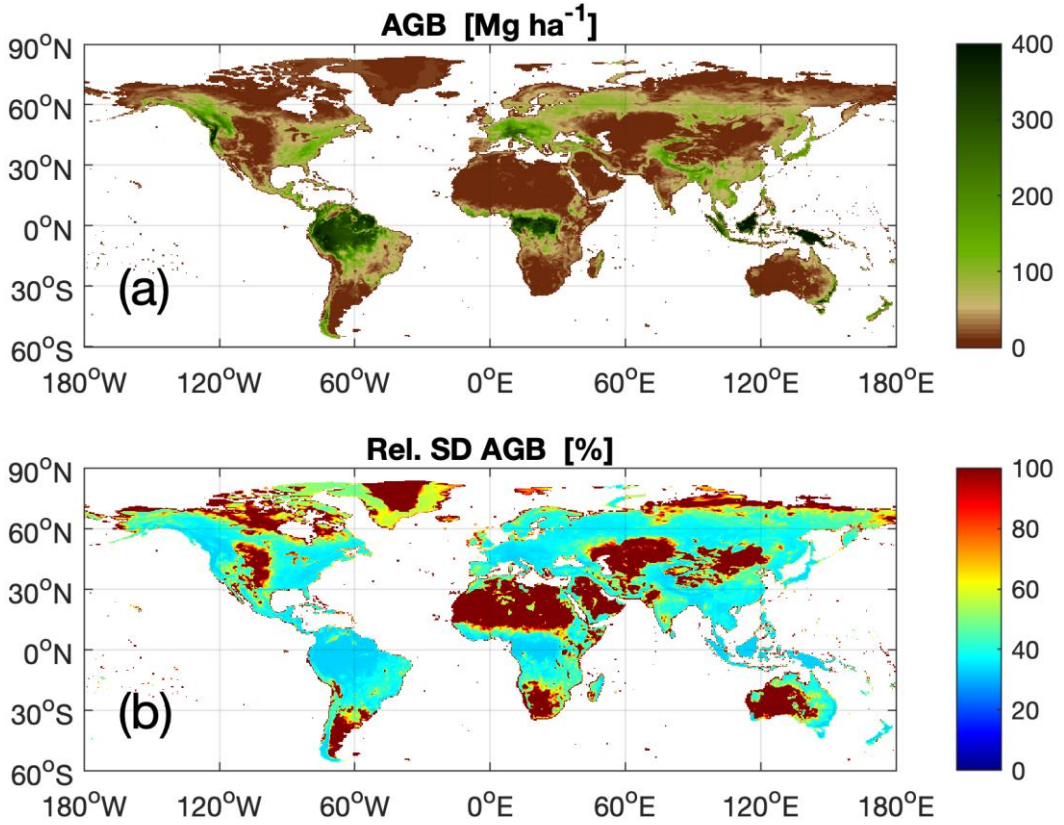


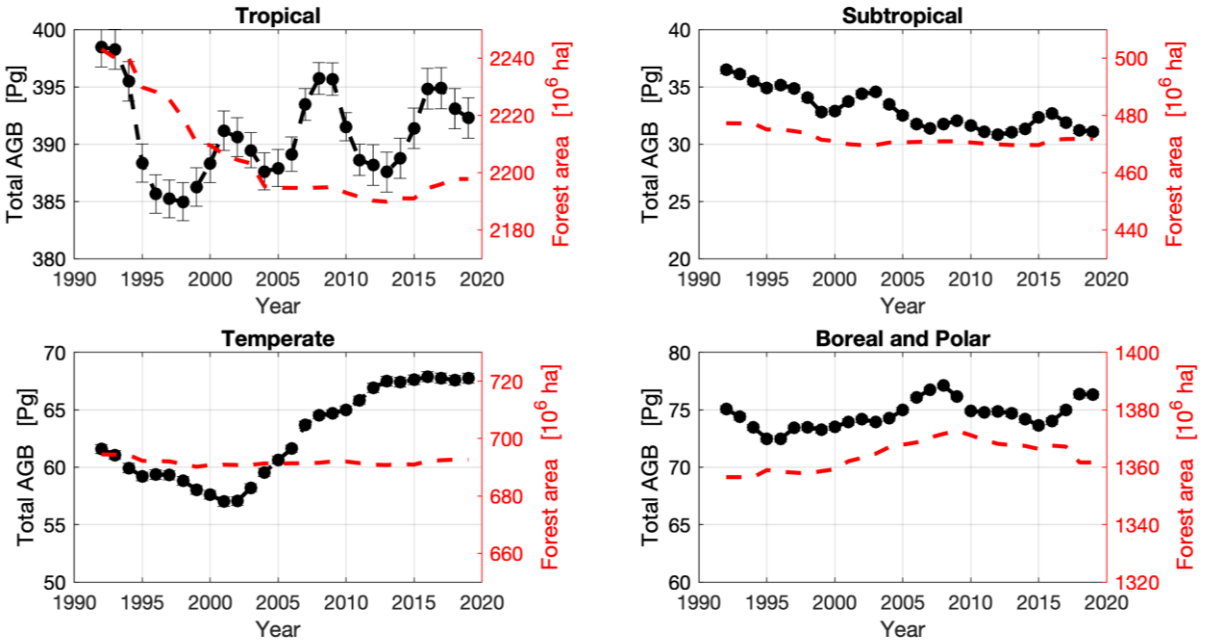




BIOMASCAT

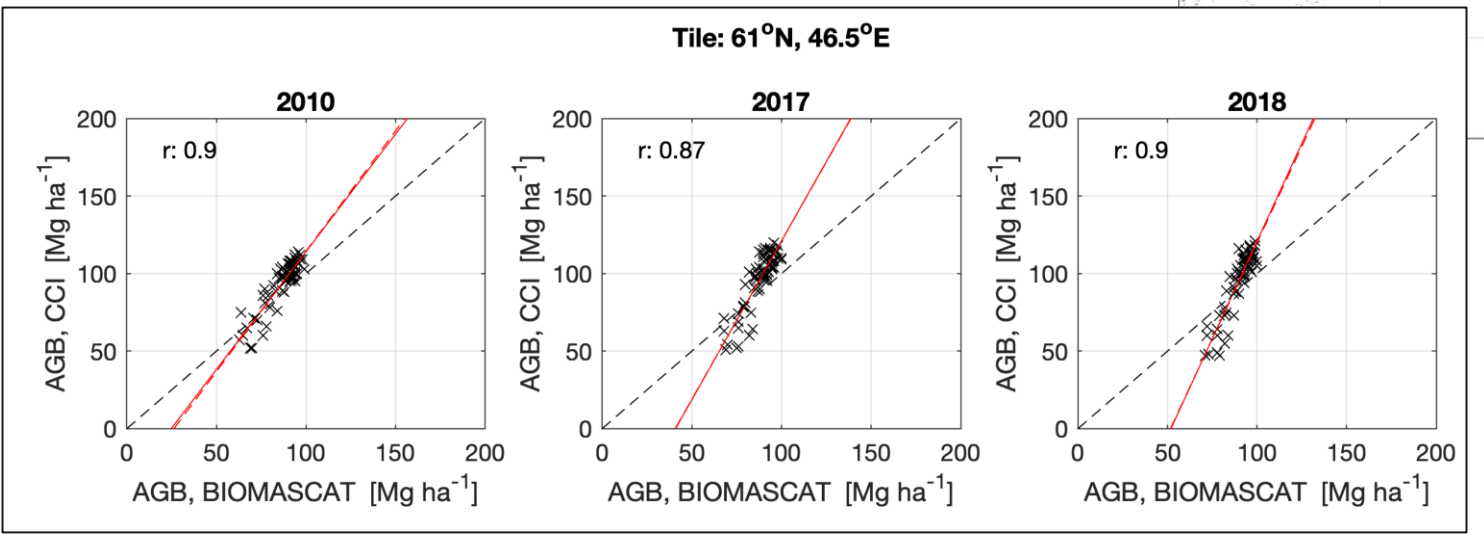
- Global maps of forest AGB and related standard deviation, spatial resolution: 25 km, years: 1992-2019 (version 1)
- Predictor: Scatterometer observations (C-band). Auxiliary data: spaceborne LiDAR metrics and optical canopy density

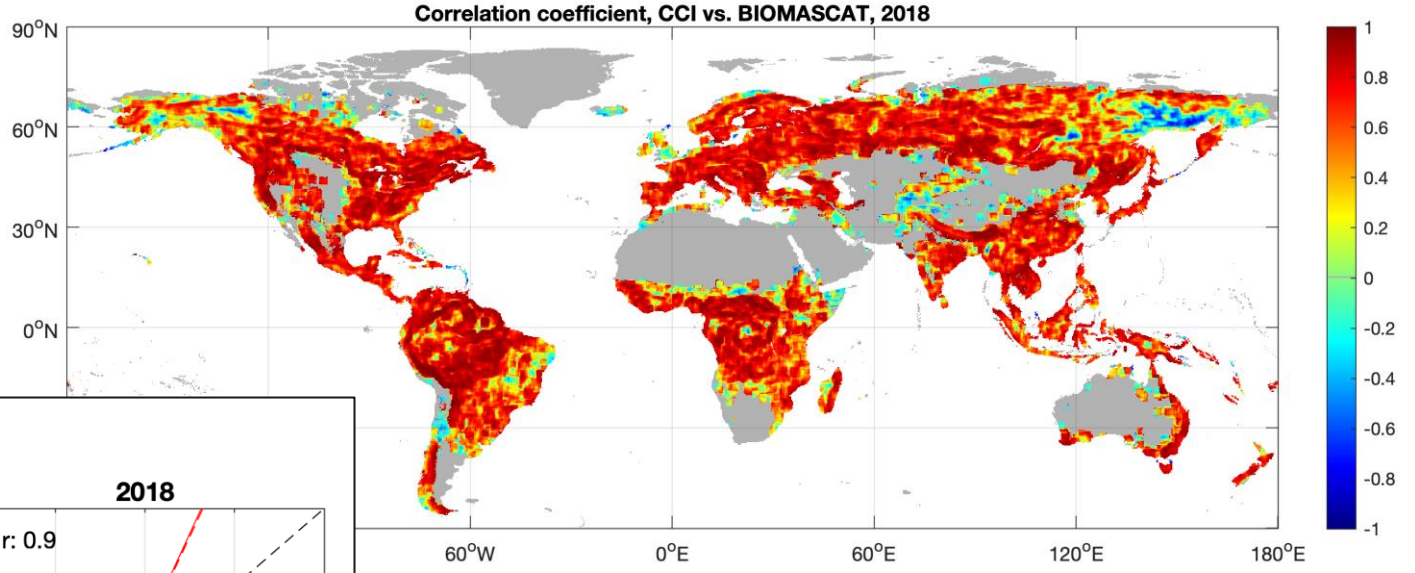




COMPARING CCI and BIOMASCAT

- Both maps capture the spatial distribution of AGB, with some exceptions in sparse forests
- The levels, however, may be different, which ultimately depends on the sensitivity of the EO data used to estimate AGB





KNOWLEDGE GAPS AND WAY AHEAD

- Current maps of AGB capture the spatial distribution of AGB. They are still uncertain in terms of levels but cross-comparisons allow to identify caveats (e.g. ESA/NASA biomass harmonization activities).
- The quantification of biomass dynamics is in its infancy. Often, we rely on a single-sensor approach. On top of that, data that may provide indications on biomass dynamics are not acquired consistently over long periods of time, with the exception of missions operating coarse resolution sensors (e.g., MetOp, SMOS, AMSR)

- We need to
    - understand how to better use EO data in synergy (e.g. plug in high res. data into low res. trends)
    - understand how to reduce uncertainties (e.g., through communication between producers and users)
    - have space agencies to observe land continuously and over decades with the same mode
- Integrate satellite data with extended set of observations from ground surveys (research networks and national forest inventories) → join forces and convince each community that cooperation is a win-win situation