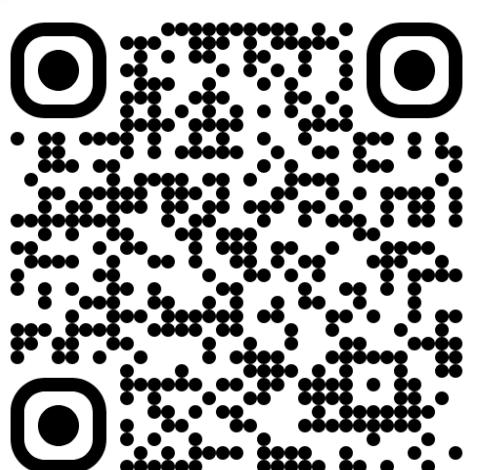


Global Above Ground Biomass changes over the last 30 years



Samuel Favrichon¹, M. Santoro¹, O. Cartus¹, C. Prigent^{2,3}, C.Jimenez^{3,2}

¹ Gamma Remote sensing AG, ² Observatoire de Paris, LIRA ³ Estellus

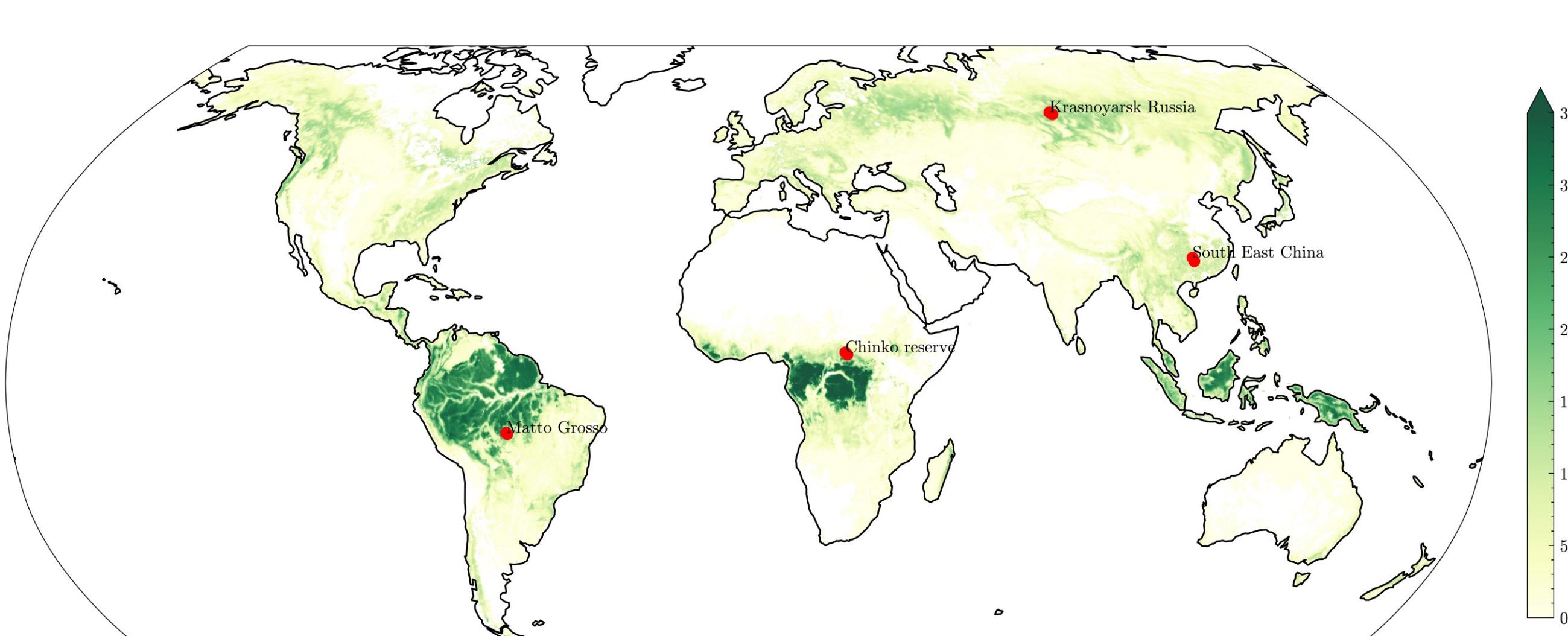
Retrieval of AGB from satellite microwave observations at 12.5 km² from 1992 to 2022:

Data sources

- Passive Microwave Radiometers:
Special Sensor Microwave Imager, (SSMI/SSMIS) at 18 and 36 GHz monthly values,
- Active Microwave Scatterometers:
CScat [1] using ERS, ASCAT and Qscat (5.3 and 13.4 GHz) monthly values,
- Reference AGB: CCI v5 [2], (2019/2020 during training)

Using a neural network we model the global AGB values per grid cell from each month observations. Performance depends on the input variable combination:

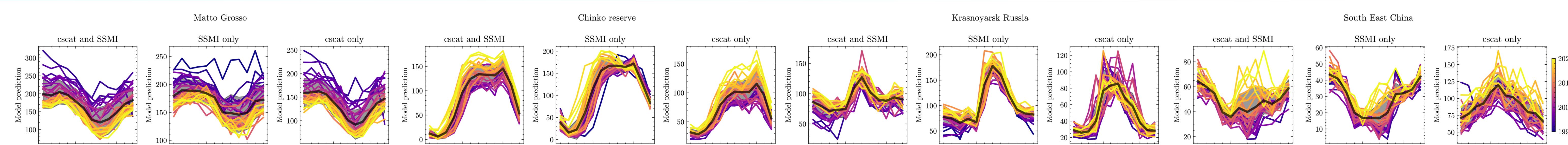
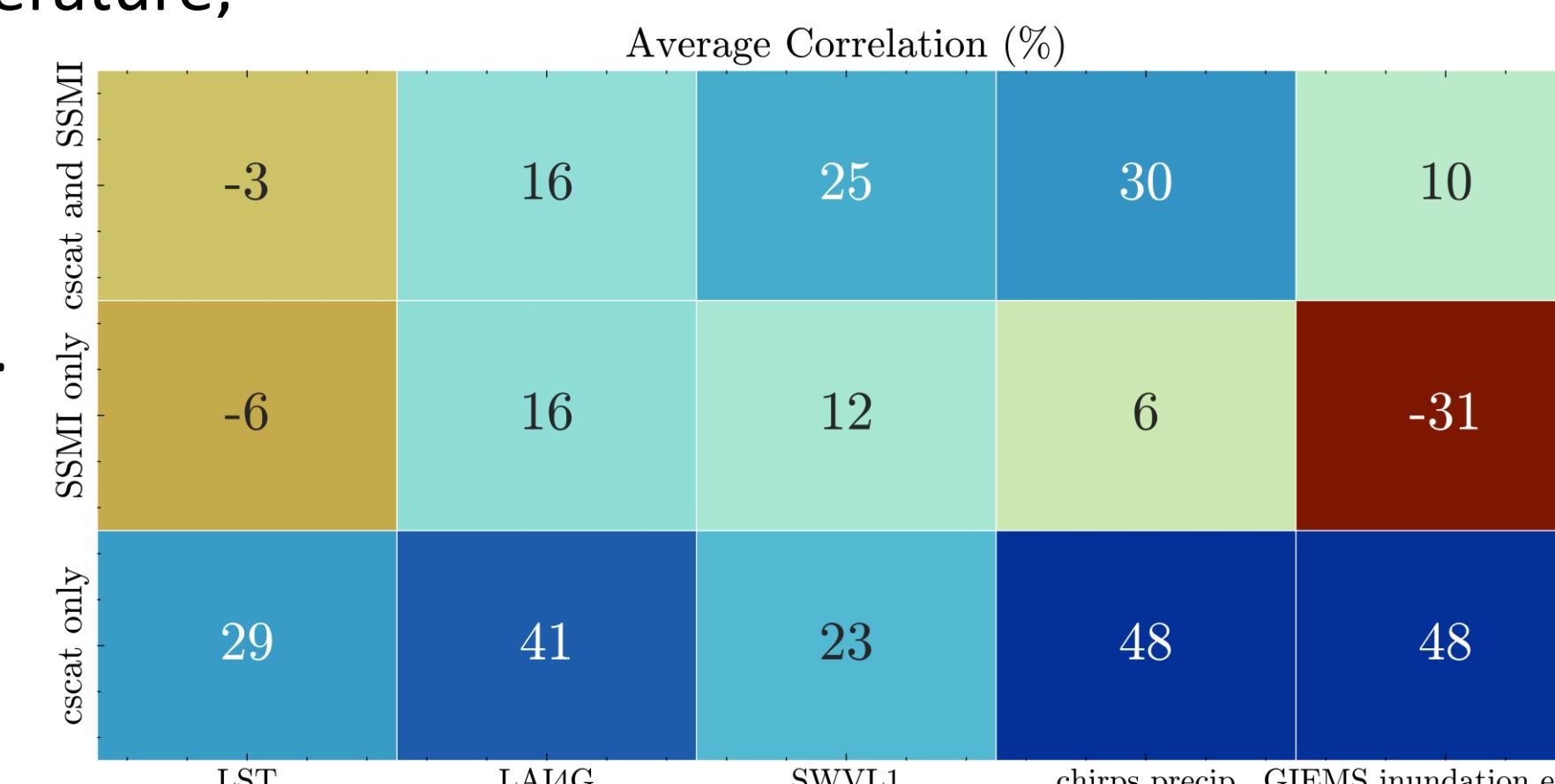
Input	R ²	RMSE (Mg/ha)
CScat	0.51	56.8
SSMI 18&36	0.64	48.3
All	0.75	40.6



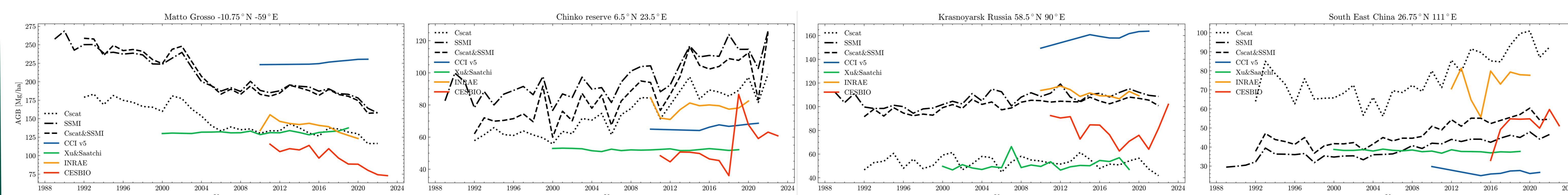
Spatial distribution of the above ground biomass predicted for 2020 from the CScat and SSMI observations.

Strong seasonality in predicted values at monthly timescales, with spatial variations in the correlation with other environmental variables:

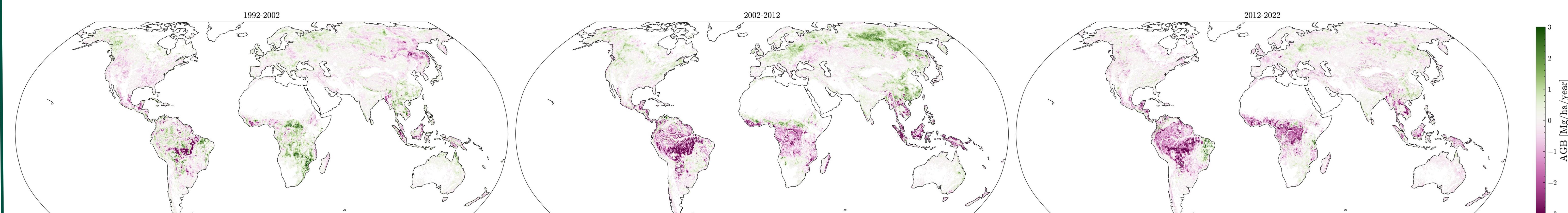
- Land Surface Temperature,
- Leaf Area Index,
- Soil Moisture,
- Precipitations,
- Inundation extents.



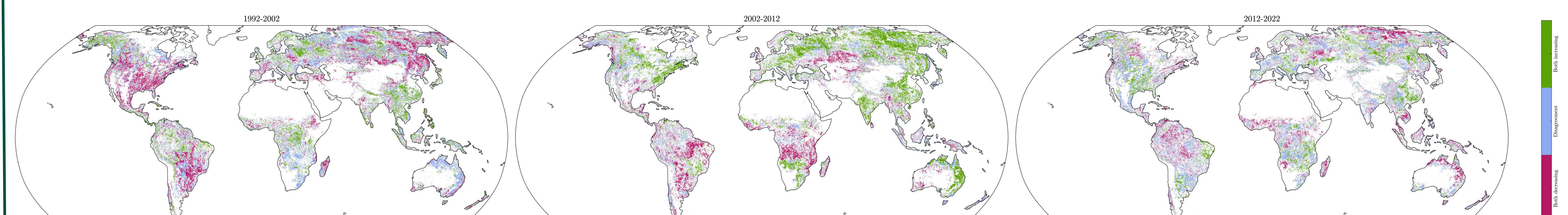
Yearly annual cycles of the predicted values for selected locations, using active and passive, only passive (SSMI) or only active (CScat) observations.



Aggregate of monthly estimates from multiple platforms and sensors to create yearly values of AGB. Other time series of remote sensing derived AGB from different input observations (L-band radiometers, radar data, optical and radar) are displayed.



Decadal linear slopes from the combined CScat & SSMI time series. Known large scale patterns: Amazon arc of deforestation, Borneo coastline, large scale fires (Eastern Siberia), woody encroachment in northern Congo Basin clearly apparent. Low linear trends in most regions, few long term consistent dynamics.



Agreement between MEaSUREs Forest Vegetation cover fraction [3] slopes and CScat & SSMI derived AGB slopes over the same time periods.

- ✓ Combining active and passive sensors improves the robustness of the long term variations
- ✓ Longest monitoring (>30 years) achieved with the passive microwave time series
- ✓ Yearly variations show diverse dynamics, with similar patterns to the L-band microwave variations
- ✓ Challenges remain in estimating absolute AGB levels (e.g. Pacific North West, dense tropical forests)
- ✓ Sensitivity to confounding factors (e.g. Soil moisture) may lead to non-AGB-related variations
- ✓ Trends in partial agreement with optical sensor-derived vegetation data.