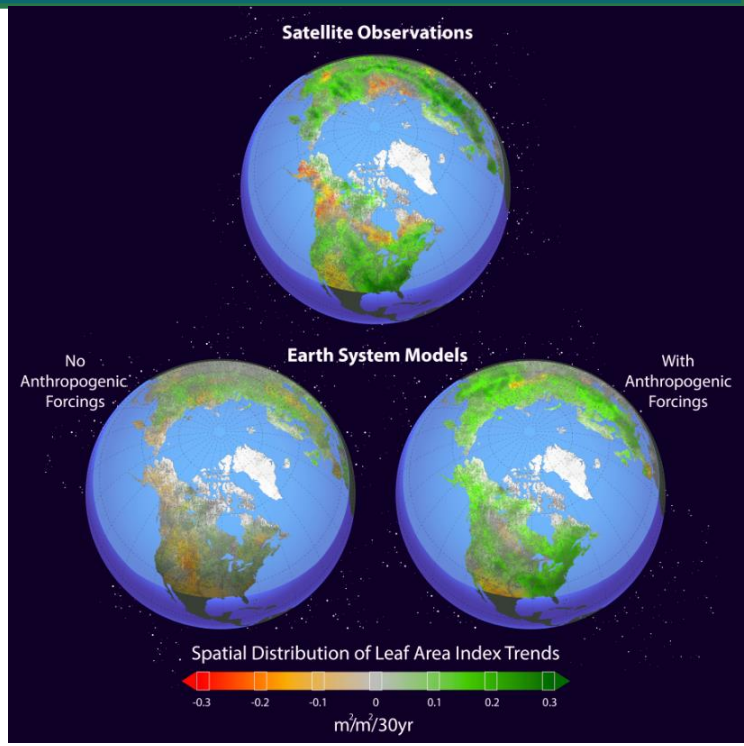
Human-induced greening of the northern extratropical land surface

Objective:

Two long-term satellite leaf area index (LAI) datasets, 19 coupled Earth system models (ESMs) and a formal detection and attribution algorithm were used to attribute changes of vegetation activity in the northern-extratropical latitudes (NELs) for the period 1982–2011.

Approach:

- Significant land greening in NELs was captured by satellite observations and ESM simulations with historical anthropogenic and natural forcings.
- The trend of strengthened northern vegetation greening is clearly distinguishable from both internal climate variability and the response to natural forcings alone.
- The observed greening record can be rigorously attributed to anthropogenic forcings, particularly to rising atmospheric concentrations of greenhouse gases.



Spatial distribution of LAI trends observed by satellite and simulated by CMIP5 models over the period 1982–2011.

Results/Impacts:

- We clarified mechanisms driving NEL vegetation dynamics for the past 3 decades.
- We demonstrated the first clear evidence of a discernible human fingerprint on physiological vegetation changes other than phenology and range shifts.
- We proposed new areas for detecting and attributing terrestrial ecosystem dynamics across scales.

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