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Forest structure and vegetation dynamics as a driver of global carbon uptake

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The drivers for terrestrial carbon uptake remain unclear despite a clear signal that the land removes the equivalent of up to 25-30% of fossil fuel CO2 emissions each year. Recent work has confirmed sustained carbon uptake by the land that is proportional to anthropogenic emissions, meaning that the land 'sink' has strengthened over the past five decades, and with interannual variability driven by climate. Drivers responsible for sustained uptake include hypotheses related to lengthening growing season length, increasing nitrogen deposition, changes in the ratio of diffuse to direct radiation, and land-use and land cover change. More recently, land-use and land-cover change has been investigated as a driver of land carbon uptake owing to an emergence of global-scale datasets related to canopy disturbance, land use, and forest age. At the same time, land-surface models have increased their realism in terms of moving beyond 'big-leaf' model representation of ecosystems to including vertical structure and horizontal heteorogeneity via size-and-age structured approaches. This presentation will address recent work identified forest structure and vegetation dynamics as a driver for global carbon uptake and provide examples of how remote sensing observations have led to new datasets for initialization land-surface models. Compared to inventory-based approaches, land-surface models initialized with forest age show a lessor role in explaining net terrestrial carbon uptake at global scales, but at regional scales, vegetation structure is a key determinant of carbon exchange. New satellite missions improving forest structure observations are expected to reduce uncertainties and contribute substantially to ongoing land-surface model development.