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On the use of integrating FLUXNET eddy covariance and remote sensing data for model evaluation

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The current FLUXNET database (www.fluxdata.org) of CO2, water and energy exchange between the terrestrial biosphere and the atmosphere contains almost 1000 site-years with data from more than 250 sites, encompassing all major biomes of the world and being processed in a standardized way (1-3). In this presentation we show that the information in the data is sufficient to derive generalized empirical relationships between vegetation/respective remote sensing information, climate and the biosphere-atmosphere exchanges across global biomes. These empirical patterns are used to generate global grids of the respective fluxes and derived properties (e.g. radiation and water-use efficiencies or climate sensitivities in general, bowen-ratio, AET/PET ratio). For example we revisit global "text-book" numbers such as global Gross Primary Productivity (GPP) estimated since the 70's as ca. 120PgC (4), or global evapotranspiration (ET) estimated at 65km3/yr-1 (5) - for the first time with a more solid and direct empirical basis. Evaluation against independent data at regional to global scale (e.g. atmospheric CO2 inversions, runoff data) lends support to the validity of our almost purely empirical up-scaling approaches. Moreover climate factors such as radiation, temperature and water balance are identified as driving factors for variations and trends of carbon and water fluxes, with distinctly different sensitivities between different vegetation types. Hence, these global fields of biosphere-atmosphere exchange and the inferred relations between climate, vegetation type and fluxes should be used for evaluation or benchmarking of climate models or their land-surface components, while overcoming scale-issues with classical point-to-grid-cell comparisons.

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