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Global fAPAR variability on multiple time scales and its relation to meteorological drivers

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Determining the feedbacks between terrestrial biosphere processes and the meteorological drivers (here precipitation and temperature) is crucial to ecosystem research. In this context, the continuous monitoring of the earth surface provides an invaluable basis for investigating the spatiotemporal dynamics in the activity of vegetation in relation to environmental conditions. Here, we seek to identify which patterns of variability in the meteorological drivers dominate the terrestrial photosynthetic activity from monthly to interannual time scales (resp. fluctuation frequencies). We investigate the Fraction of Absorbed Photosynthetically Active Radiation (FAPAR) using SeaWiFS observations from 1998 to 2005 and ancillary meteorological variables. A spectral analysis leads to a global "classification" of the terrestrial biosphere according to prevalent scale dependent dynamics of fAPAR and its relation to the meteorology. A combined subsignal extraction and dimensionality reduction reveals a series of dominant geographical gradients on specific time scales. E.g. we uncover spatially coherent patterns at low frequencies and show where these are induced by precipitation or temperature fluctuations. We also show where high frequency variations (relative to the annual cycle) in fAPAR coincide with corresponding precipitation dynamics. However, we can also identify regions where the variability of fAPAR on specific time scales cannot be traced back to climate and is apparently shaped by other geoecological or anthropogenic drivers.