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Time series of global photosynthetic activity and their recurrence properties

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We investigate the fraction of absorbed photosynthetically active radiation (fapar), an index based on multispectral reflectance properties which relates to the carbon uptake by plants. Fapar is available with global coverage from satellites. We combine observations from two sensors, SeaWifs on board *OrbView-2* and Meris on board *Envisat*, to produce time series with 10 days resolution for a period of 14 years (1998-2011) at a spatial resolution of 0.5° latitude x 0.5° longitude. After careful quality checking and gap-filling, more than 30000 individual time series are obtained covering all terrestrial ecosystems and climates apart from the arctic and major deserts. We augment the fapar dataset with the driving variables air temperature and precipitation at the same spatiotemporal resolution. To characterize the different dynamical behavior as a function of spatial location or distance, we employ *Recurrence Quantification Analysis* (RQA) and *Recurrence Network Analysis* (RNA). They deliver detailed information on the nonlinear dynamics in phase space through embedding. RQA and network variables are calculated either for individual time series using identical recurrence parameters, or bivariate by performing a joint recurrence analysis to quantify the synchronization between fapar and temperature or fapar and precipitation. Taken together, the recurrence analysis might lead to a new partitioning of the terrestrial biosphere which in turn can be compared to existing classifications based on climate and/or vegetation properties.