Global gross primary productivity (GPP) based on plant functional types

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Aims

- To describe the in-situ NDVI (NDVI) seasonal variability (Fourier time-series analysis)
- To evaluate the performance of NDVI, multi-temporal time series derived from radiation measurements and MODIS NDVI (NDVI) computed at different spatial scales and across different PFTs
- To analyse the site heterogeneity (SHI: Spatial Heterogeneity Indicator)
- To model GPP seasonal variability

Seasonality of NDVI, time-series analysis: Fourier fitting

- CRO, DBF and OSH show the highest amplitude values of the first derivative of NDVI, time-series eliciting a large seasonality in NDVI time-series (Left panel: a) for DBF; and (b) for CRO)
- GRA also present quite high amplitude but show a high variability across sites
- Evergreen forest and woody savanna represent the lowest amplitude values of the first derivative of NDVI, time-series and therefore a low seasonality in terms of NDVI time-series (Left panel: c-d)

Performance of in-situ and MODIS NDVI

- NDVI presents the best CORR values for deciduous broadleaf forest at a 1x1 km spatial resolution (DBF, CORR = 0.70 and RMSE = 0.10);
- The performances of the evaluation of NDVI, vs. NDVI09 at 1x1 km spatial resolution are very comparable for all DBF sites;
- The goodness of the statistical performance slightly decreases with increasing pixel size, i.e. for a 7x7 km spatial resolution the CORR value is 0.62 and RMSE 0.11)

Spatial Heterogeneity Indicator (SHI)

- Homogenous site: all 144 pixels are classified in the same class by DT classification, SHI = 0.00 & Kappa = 0.00
- For all deciduous and evergreen needleleaf forests SHI = 0.00; these sites are located in a homogenous area
- A very high SHI value (e.g. US-Ne1 and US-Ne2) → a large spatial variability in the proximity of the eddy covariance tower → more than two classes close to the site location
- A low SHI value → a reduced spatial variability

Conclusions

- The performance between in situ and MODIS NDVI depends on the MODIS pixel aggregation
- The site heterogeneity varies between the different PFTs
- NDVI performs best when applied as an estimator for GPP but only with the boundary condition that all PFTs are pooled
- A specific correlation can be applied to improve the estimation of GPP starting growing season for each PFT

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