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Remote sensing of leaf N to improve carbon assimilation prediction

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Predicting and understanding carbon assimilation by terrestrial vegetation remains fundamental in the context of climate change. Carbon and nitrogen cycles are linked as nitrogen is an essential nutrient for plant growth. In this respect the N cycle is integrated into vegetation models predicting vegetation carbon uptake. However plant traits within the N cycle, such as leaf nitrogen, are lacking at large scales, which complicates the calibration and optimization of the N cycling modelling modules. Remote sensing techniques could offer the possibility to detect leaf N concentration at continental scales. In fact, it has already been used to sense leaf N at local, e.g. in agricultural oriented applications, as well as at regional scales. The objective of this study is to enhance the availability of leaf N estimates in forested ecosystems at European scale using remote sensing products. European forest leaf N data were obtained from the TRY database. The MERIS Terrestrial chlorophyll Index (MTCI) Level 3 product as well as two reflectance bands in the NIR region (band centers at 865 and 885nm) both from MERIS aboard ENVISAT (ESA) were used to study statistical relationship with leaf N data. In a first step, we analyzed 1892 Catalonian (NE Spain) forest plots using a linear regression method. The regressions results between leaf N and either MTCI or NIR bands were significant ($p< 0.001$). The R-square for the regression between leaf N and MTCI was equal to 0.13. The method performed better for broadleaves deciduous plots (R-square = 0.11) than for needleleaves or broadleaves evergreen plots. The relationship between leaf N and MTCI was also higher for the plots sampled during summer (R-square = 0.28 in July) than for the plots sampled during the rest of the year. In a second step the method will be applied on and will include more diverse forest types at the European level.