Greenhouse gas management in European land use systems

FP7 Project GHG-Europe
Grant agreement No 244122

Deliverable D5.4			
Title	Complete generic and data oriented model evaluation using data collected from previous projects		
Delivery date from Annex I (project month)	12		
Planned delivery date	Month 24		
Lead participant	WP	Nature	Dissemination level
CEA (2)	5	R	RE

Deliverable description

While data oriented model evaluation has been completed the complete model evaluation (including generic models) is still in progress. Complete data evaluation using previous data is under way using new data available from the GHG-Europe project. It has therefore been decided to postpone the completion of D5.4 to month 24.

Data oriented model evaluation

For the evaluation of data-driven models a cross-validation approach was selected as the proper method. The performance of the MTE data-driven model (Jung et al. 2009) to predict the carbon balance at eddy covariance sites of CarboEurope and further international sites was evaluated based on 5-fold cross-validations. A 5-fold cross-validation implies that the dataset is stratified into 5 parts with approximately equal number of samples. The target values for each of these 5 parts are predicted based on the training using the remaining 4 parts. We conducted 2 experiments where (1) entire sites were removed from the training (~20 %), and (2) consecutive parts of the time series of the sites were removed. Hence, the first cross-validation experiment corresponds to the uncertainty of predicting the flux time series for unknown sites, while the second experiment assesses the uncertainty of filling long gaps in the time series based on the information from all flux sites. The evaluation was performed along 3 categories of temporal variability: (1) among-site variability, (2) seasonal variation, and (3) anomalies. We first calculated the mean seasonal cycle (FMSC) per site, i.e. averaging the values for a month across all available years. We prescribed that at least 2 values (i.e. years) for a month must be available. To assess the among-site variability, we calculated a mean value for each site (FSITE) given as the mean of FMSC if at least 6 out of 12 values of FMSC were present. We calculated the seasonal variation FSEAS by removing FSITE from FMSC. Anomalies were calculated as the deviation of a flux value from FMSC. Then the evaluation was based on a series of performance measures: Pearson's correlation (Cor), Nash-Sutcliff's modelling efficiency (MEf, [Nash and Sutcliffe, 1970]), root mean squared error (RMS), median absolute deviation (MAD), and ratio of variances

(RoV) which is the variance of the predicted values divided by the variance of the observed values. If present, extreme outliers were removed from the computation of performance measures to avoid biased statistics. We identified outliers when data points were outside the range defined by the median of the residuals ± 7 times the inter-quartile range of the residuals.

Cross-validation analyses revealed good performance of MTE in predicting among-site flux variability with modelling efficiencies (MEf) between 0.64 and 0.84, except for NEE (MEf = 0.32) (Fig. 1). Performance was also good for predicting seasonal patterns (MEf between 0.84 and 0.89, except for NEE (0.64)). By comparison, predictions of monthly anomalies were not as strong (MEf between 0.29 and 0.52). Improved accounting of disturbance and lagged environmental effects, along with improved characterisation of errors in the training dataset, would contribute most to further reduce uncertainties. Further details can be found in Jung et al. (2011), JGR-Biogeosciences, in press).

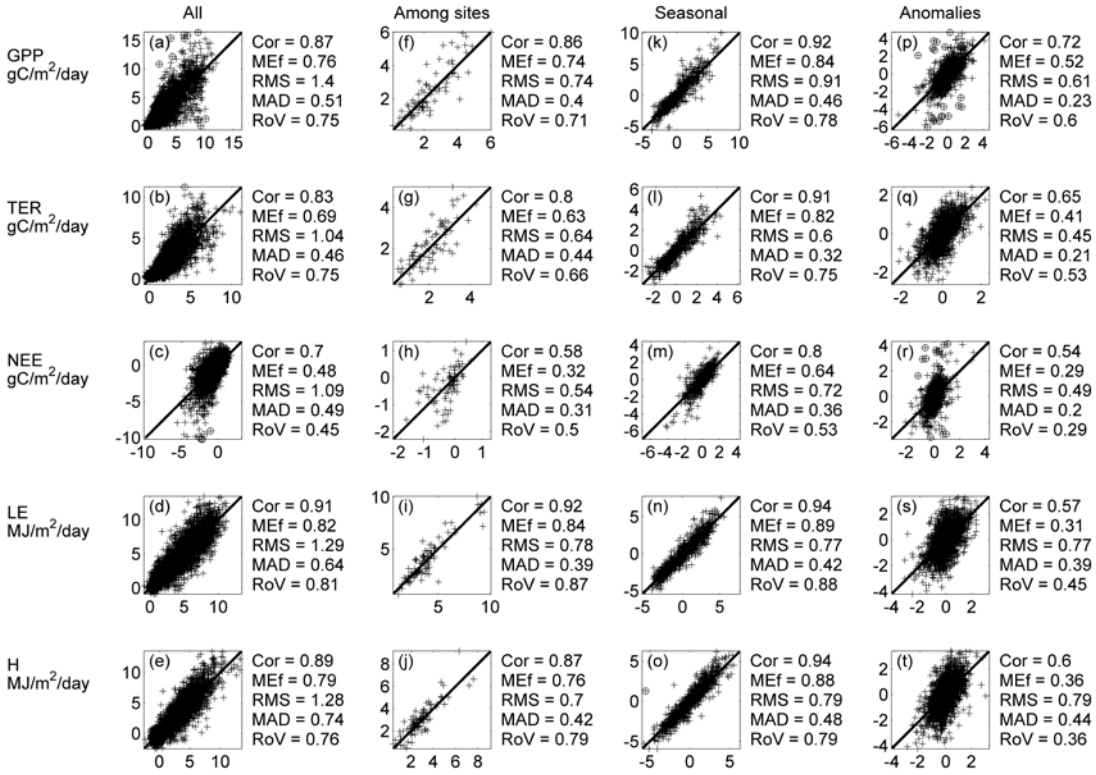

Figure 1: Cross-validation results for the data-driven MTE model at eddy covariance sites from previous projects.