

Data assimilation in land surface schemes

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The problem of scale in global models

- The best data on the state of the C cycle come from flask [CO₂]
- The best process data come from eddy flux towers and field sites
- **How can we connect these data across the scale difference?**
- The data assimilation theme attempts to connect global to local data sets, to generate new insights and more powerful models

The benefits of linking models to data

- To guide parameterization
- To determine the uncertainty on predictions
- To test processes understanding
- To link to multiple observation data streams to improve predictions
- To determine what new measurements should be gathered
- To guide construction of observing networks

What is currently funded in JULES DA?

- QUEST/Exeter and Met Office
 - Assimilating flask/satellite CO₂ data
 - Adjoint of JULES, CCDAS
- CTCD/NCEO
 - Assimilating eddy flux, optical remote sensing and inventory data, tall tower/satellite CO₂ data.
 - Ensemble Kalman Filter, observation operators

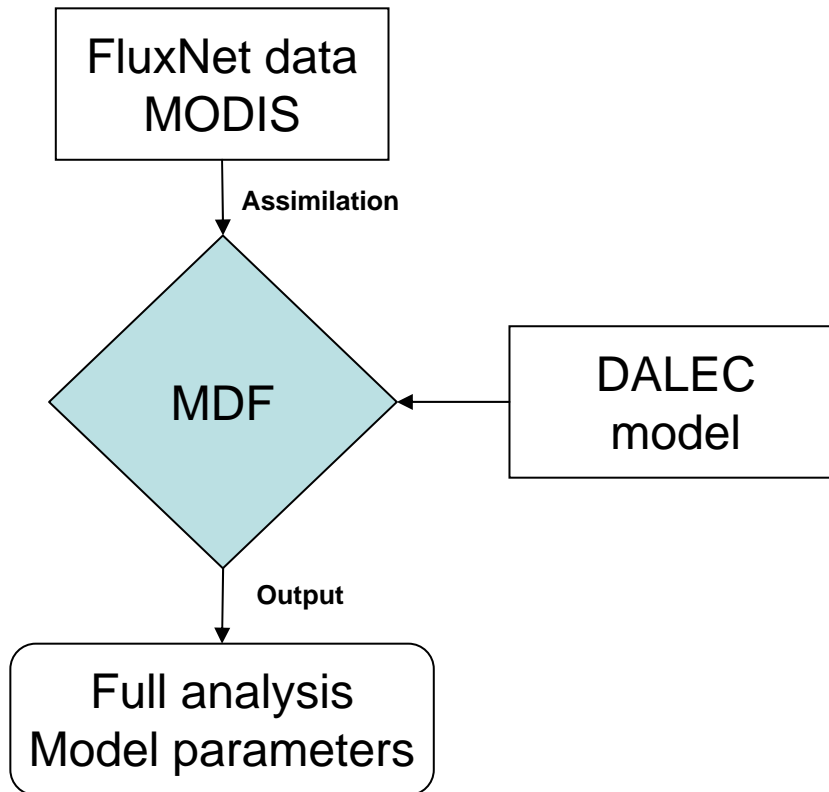
Current activities

- Testing parameterization schemes: Reflex

REgional Flux Estimation eXperiment (REFLEX)

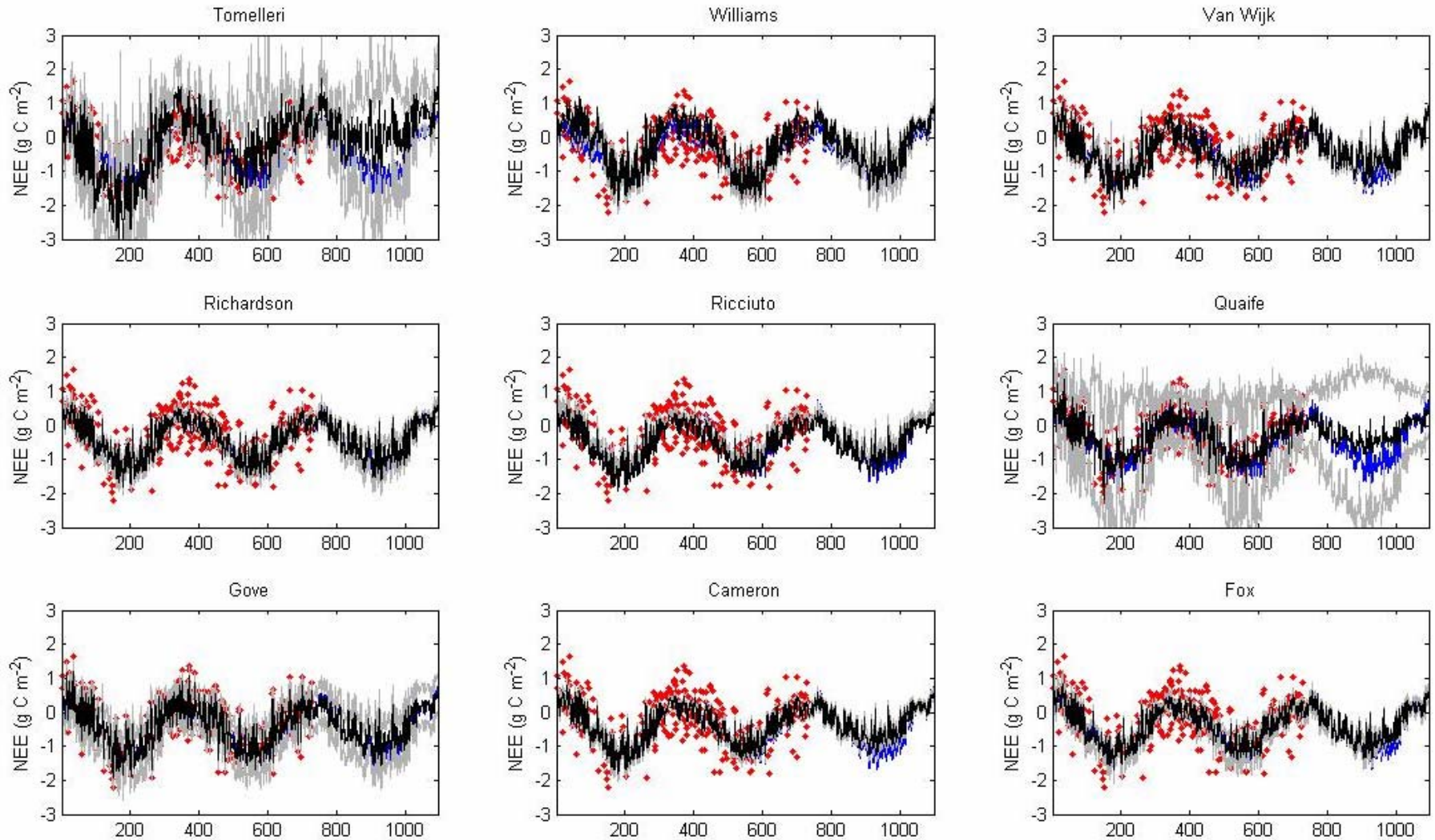
- To compare the strengths and weaknesses of various model-data fusion techniques
- To quantify errors and biases introduced when extrapolating fluxes in space and time
- More details at www.carbonfusion.org

REgional Flux Estimation eXperiment (REFLEX)



Training Runs

Deciduous forest sites
Coniferous forest sites

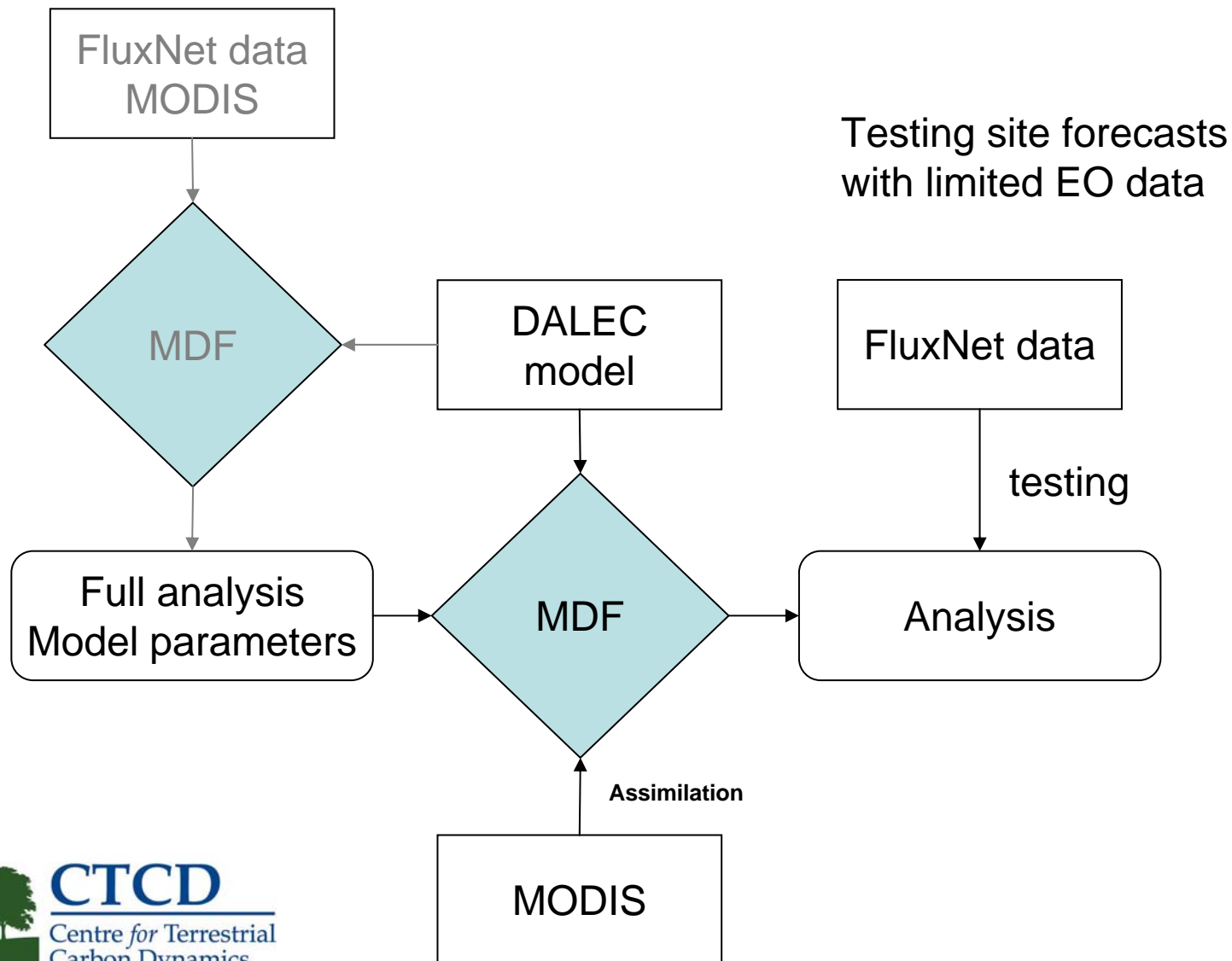


- ◆ observations (with noise)
- truth
- predictions
- | uncertainty

Synthetic evergreen forest
 2 years obs., 1 year prediction



REgional Flux Estimation eXperiment (REFLEX)



A DA strategy for JULES?

- **LOCAL**: DA for local parameter PDFs, process testing, C-water interactions, full state descriptions. *FluxNet, IPSL, NCAR, ACCESS.*
- **REGIONAL**: upscaling, coupling to/inverting atmospheric data/models. *CarboEurope, ABACUS.*
- **GLOBAL**: Global assimilation with optical, CO₂, water, temperature remote sensing, flasks. *NCEO & CCDAS.*

Connecting to other JULES themes

- What parameters are poorly determined in each module?
- What time series data are suitable/available for assimilation?
- What data form the most stringent test of process representation?
- How are state variables related to observations? (EO...)

**Thanks to
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