Estimating carbon balance of terrestrial ecosystems

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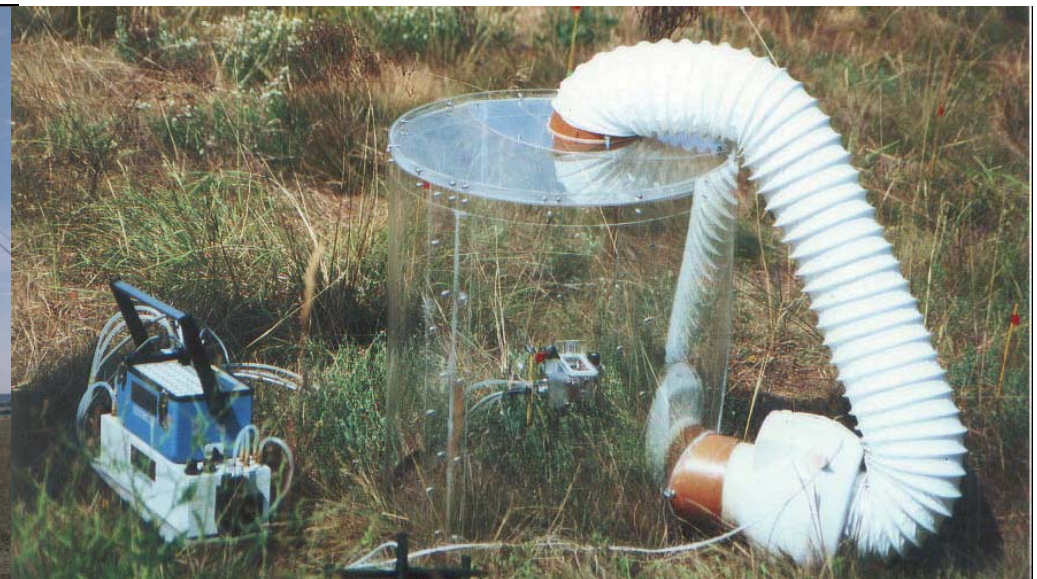
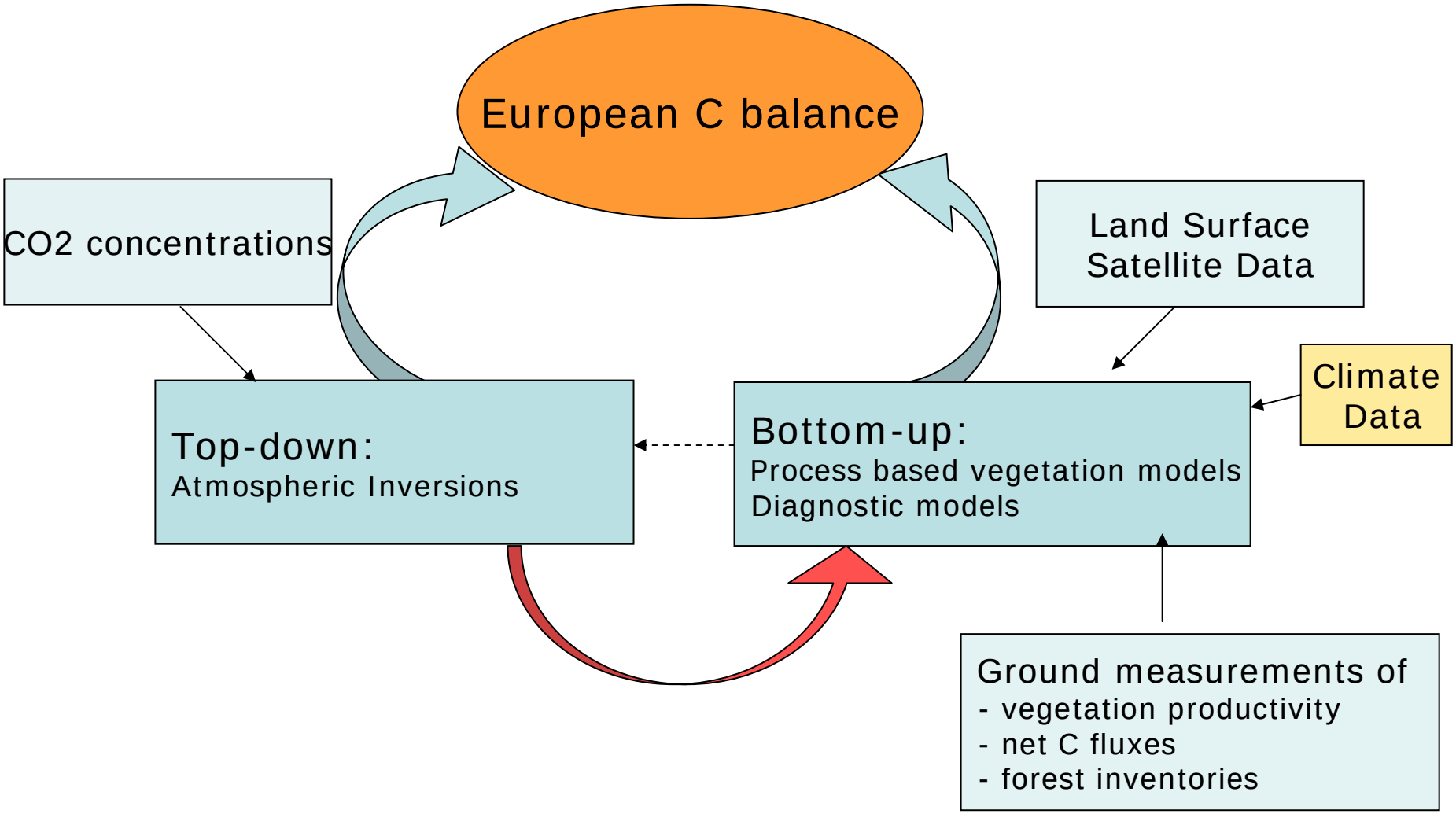
What is the role of the European continent in the global carbon cycle?

- CarboEurope Integrated Project is EU-funded research project
- Participants: more than 60 research centres from more than 15 countries
- Timeframe: 5-year, starting January 2004





Integrating top-down with bottom-up approaches



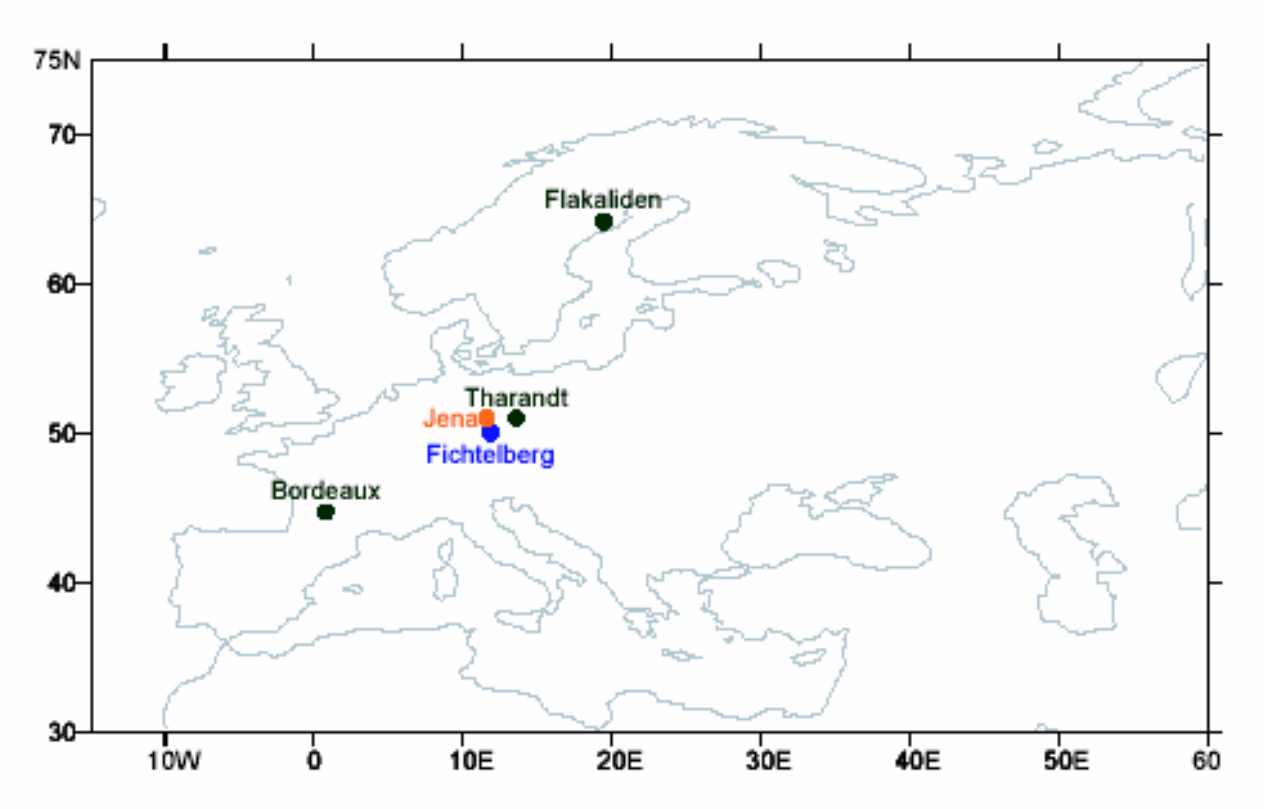
Climate Drivers

- Requirements:
  - Spatial resolution: 0.25/0.25 lat/lon
  - Temporal resolution: daily (hourly)
  - Timeframe 1950(1960)-2004(2005)
  - Variables:
    - precipitation
    - max and min air temperatures
    - downward solar radiation
    - vapor pressure deficit
- Possible candidates considered: NCEP, PIK-CRU, ECMWF, and REMO

Applications of REMO variables

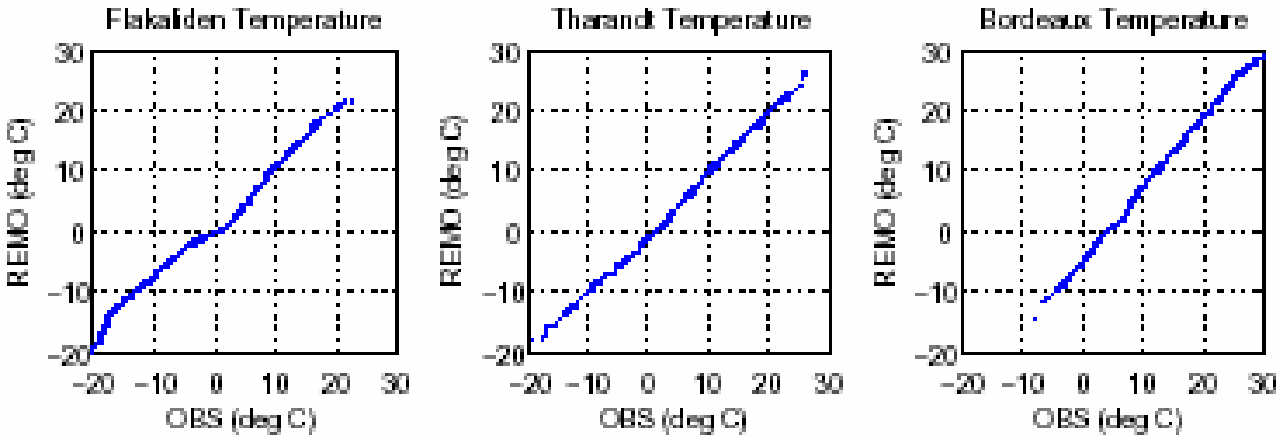
- Testing REMO data quality for EUROPE (Y. Chen et al. MPI report)
  - Comparison between variables from REMO and from other climate datasets (NCEP, CRU, ECMWF)
  - Comparison of REMO variables with observations
- Estimation of uncertainties in modeled vegetation gross primary productivity (GPP) (M. Jung et al. paper in preparation)
- Simulation of 2003 summer drought effect on European carbon balance (M. Vetter et al. in preparation)

Comparison of REMO variables with site level observations

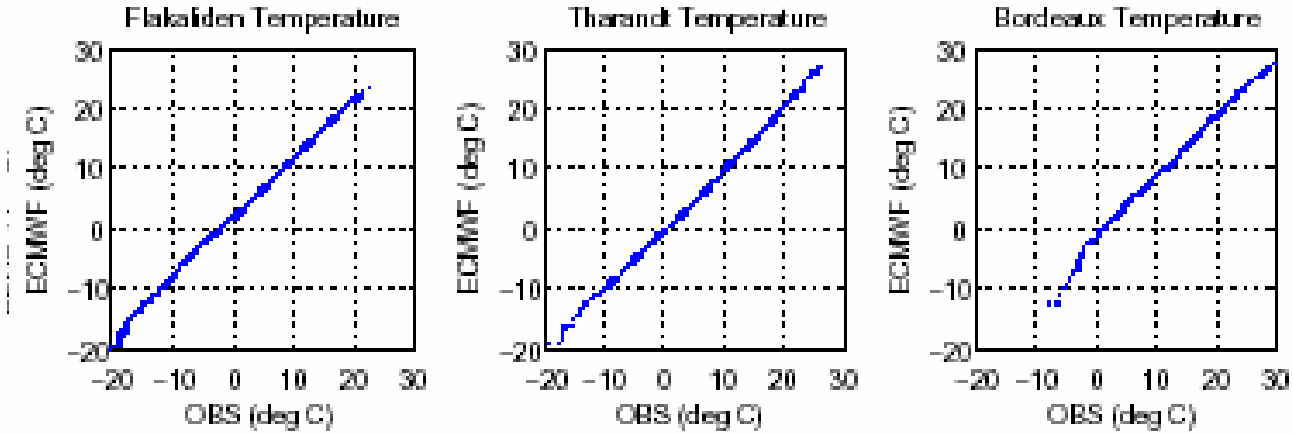


Air temperature: comparison with observations

REMO



ECMWF

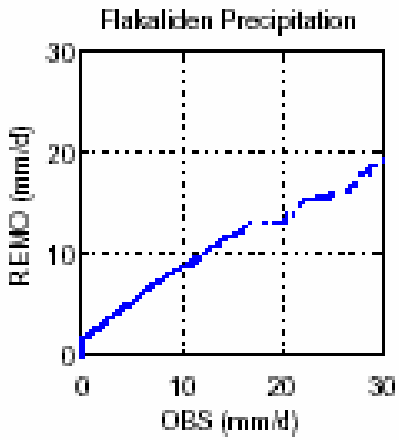


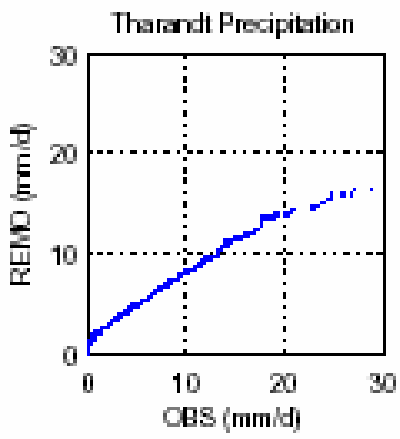
Based on 10-year (1980-1989) daily data

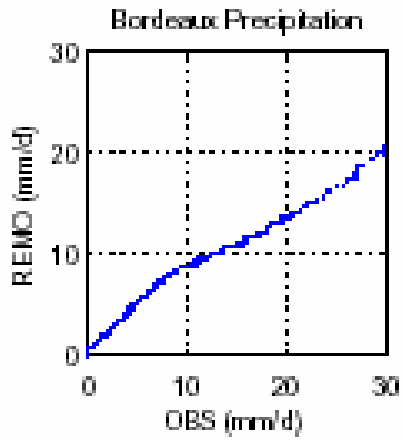
Y. Chen et al, report

Precipitation: comparison with observations

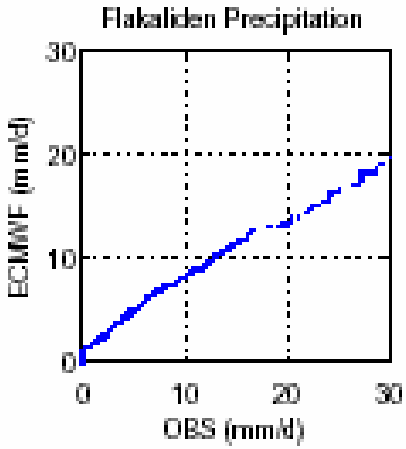
REMO

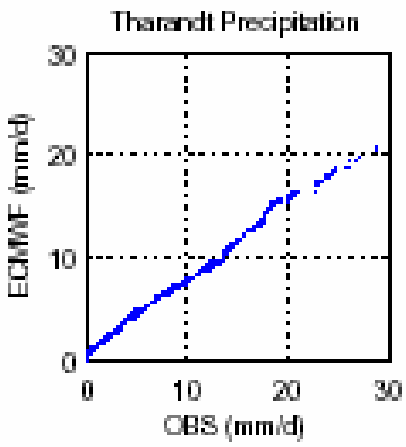


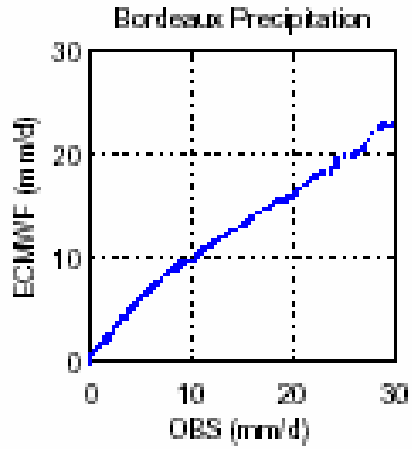




ECMWF





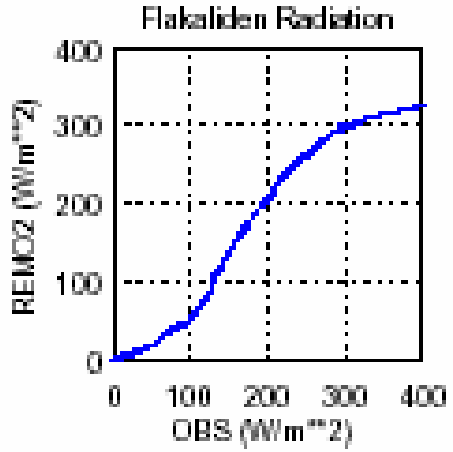


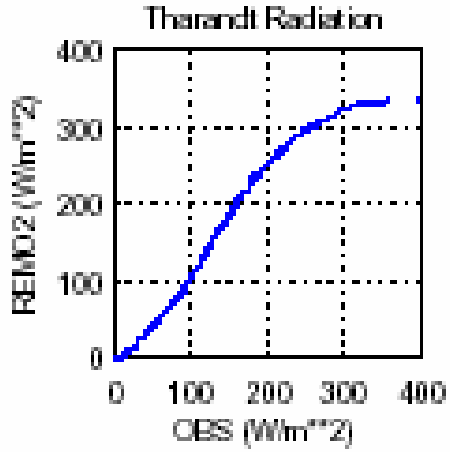
Based on 10-year (1980-1989) daily data

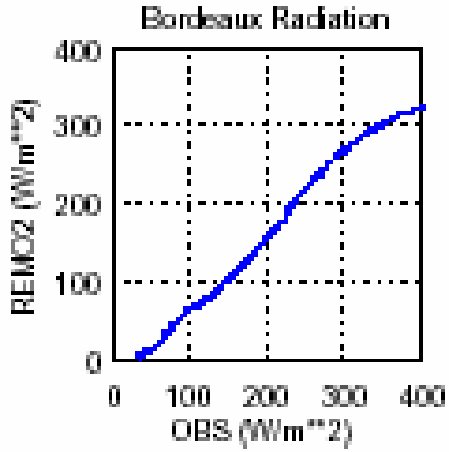
Y. Chen et al, report

Radiation: comparison with observations

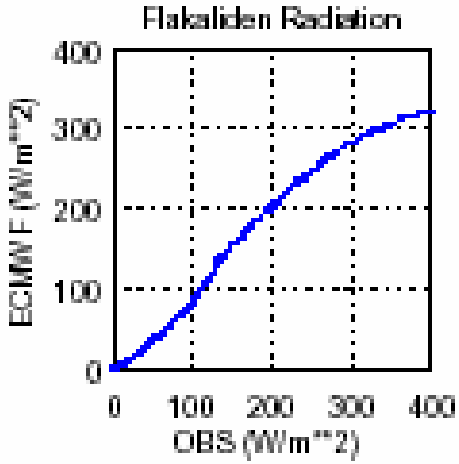
REMO

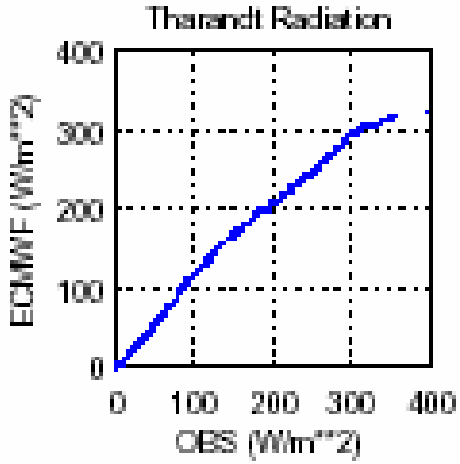


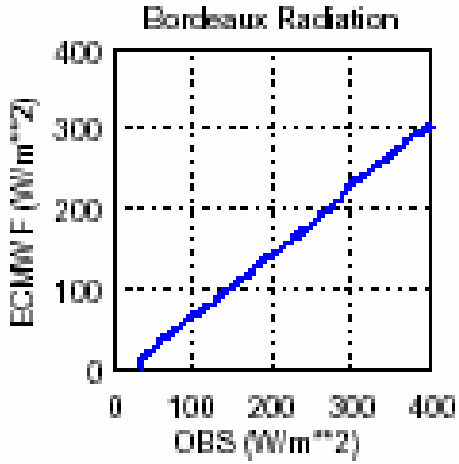




ECMWF



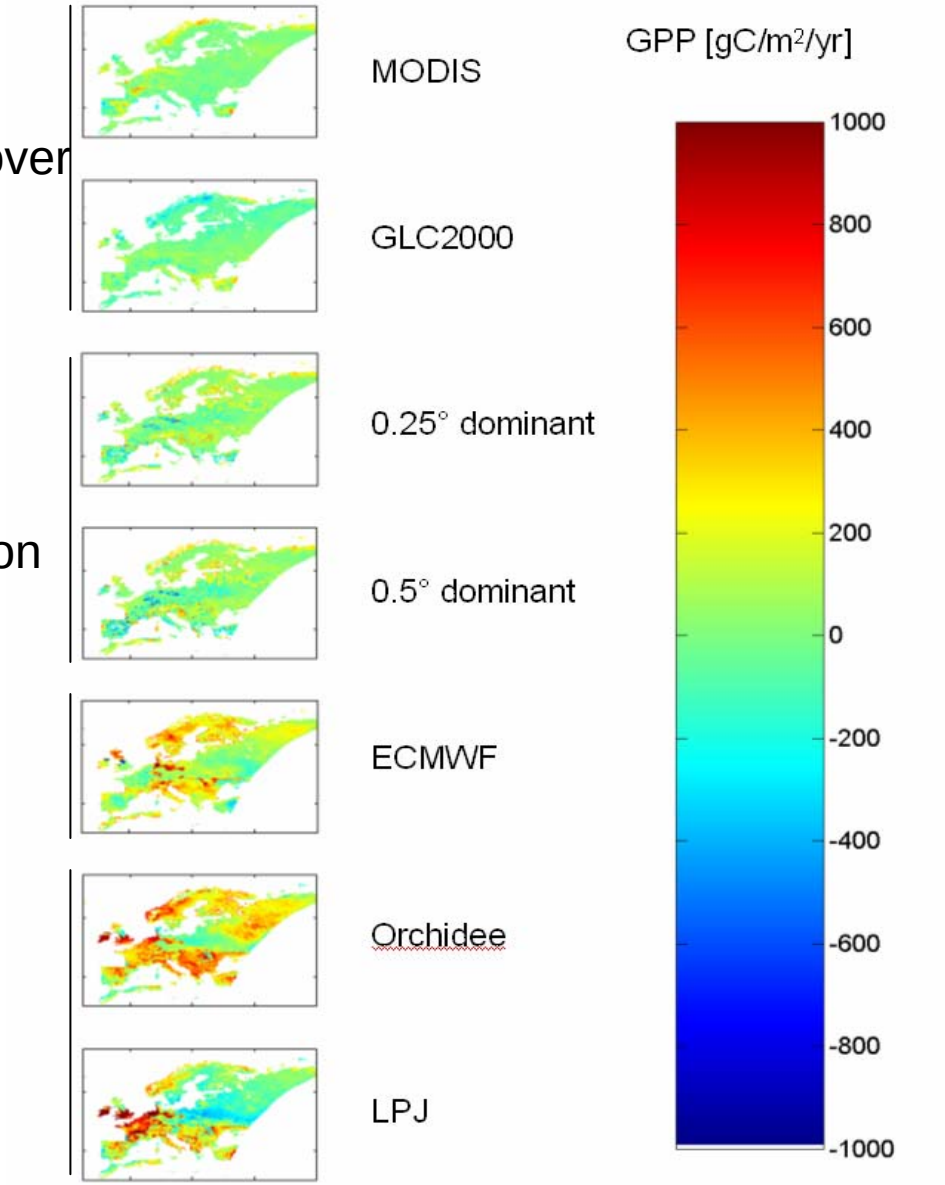




Based on 10-year (1980-1989) daily data

Y. Chen et al, report

Climate drivers as source of uncertainties in carbon uptake



GPP simulated with alternative realizations

minus

benchmark GPP

(mean for 1981-2000)

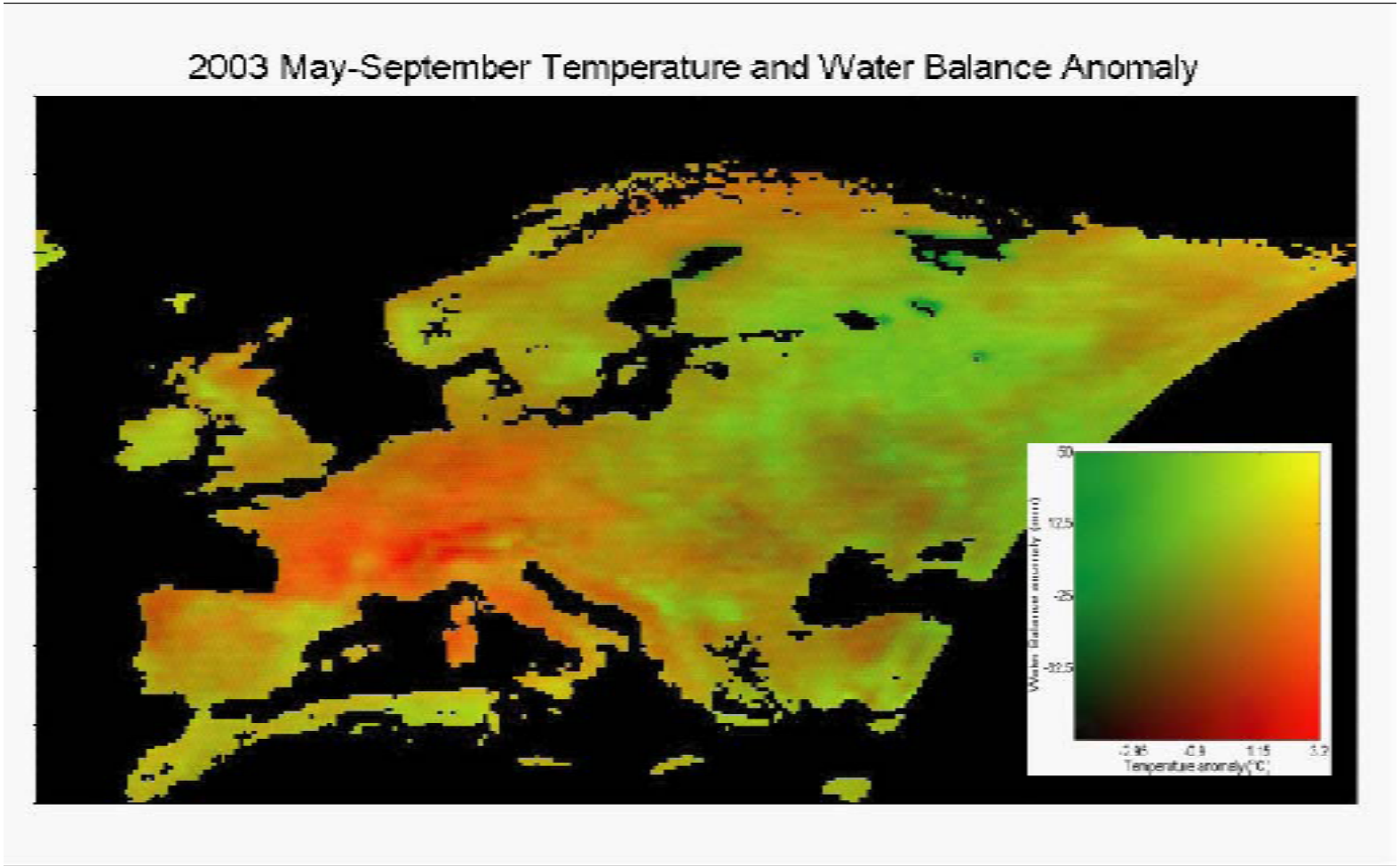
Benchmark GPP was simulated with BIOME-BGC model using fractional SYNMAP landcover at 0.25° and REMO climate

M. Jung et al. in preparation

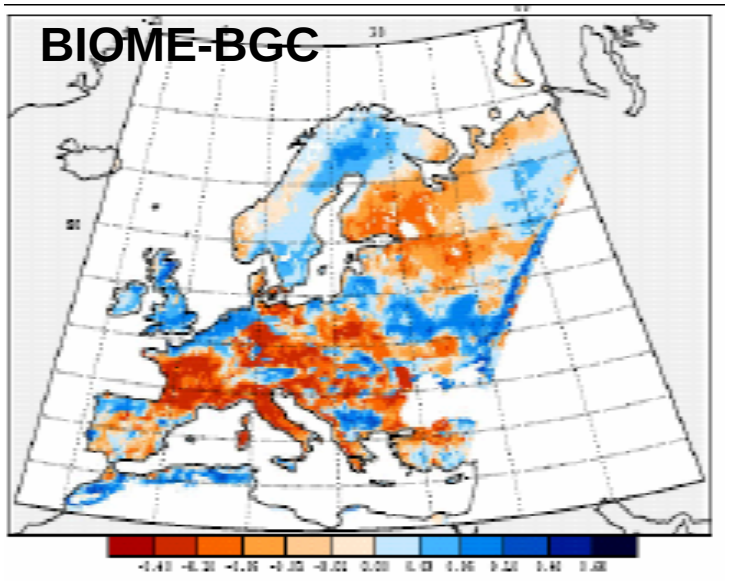
Hierarchy of uncertainties in modeled carbon uptake

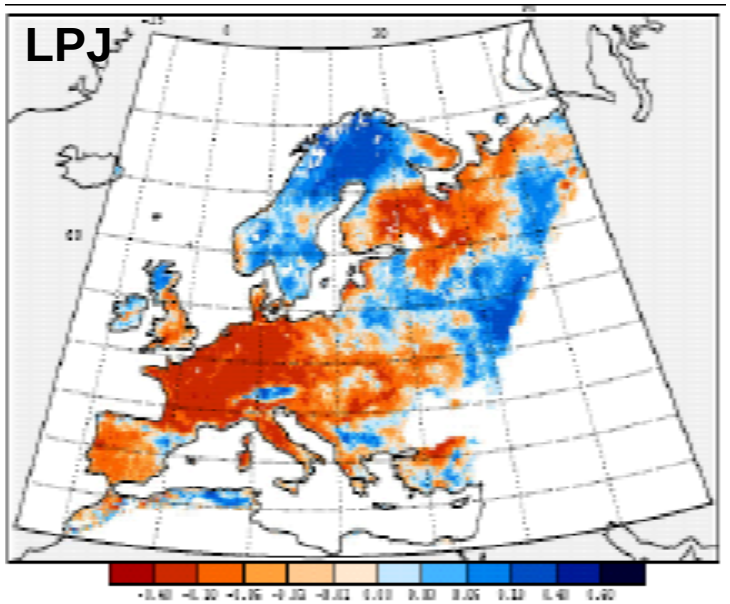
- General:
  - Land cover maps → small
  - Land cover resolutions → relatively small
  - Meteorological data sets → large
  - Carbon cycle models → very large
- Climatology:
  - Issues of interannual variation: primarily radiation & precipitation
  - Issues of spatial pattern: primarily precipitation

Climate Anomalies in 2003



Climate and carbon anomalies in 2003





Spatial anomaly = NEP in 2003 – NEP average 1998-2002

Vetter at al. in preparation

Summary/Future plans

- High quality climate drivers are critical for accurate carbon balance estimation
- Improvement of REMO’s precipitation and solar radiation would be desirable
- Within CARBOEUROPE project REMO will be used as benchmark climate drivers (data for 2006, 2007)