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Regional CO_2 balance modeling and results

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Land ecosystem CO_2 balance

Ecosystem processes such as

- Photosynthesis
- Autotrophic respiration and
- Heterotrophic respiration

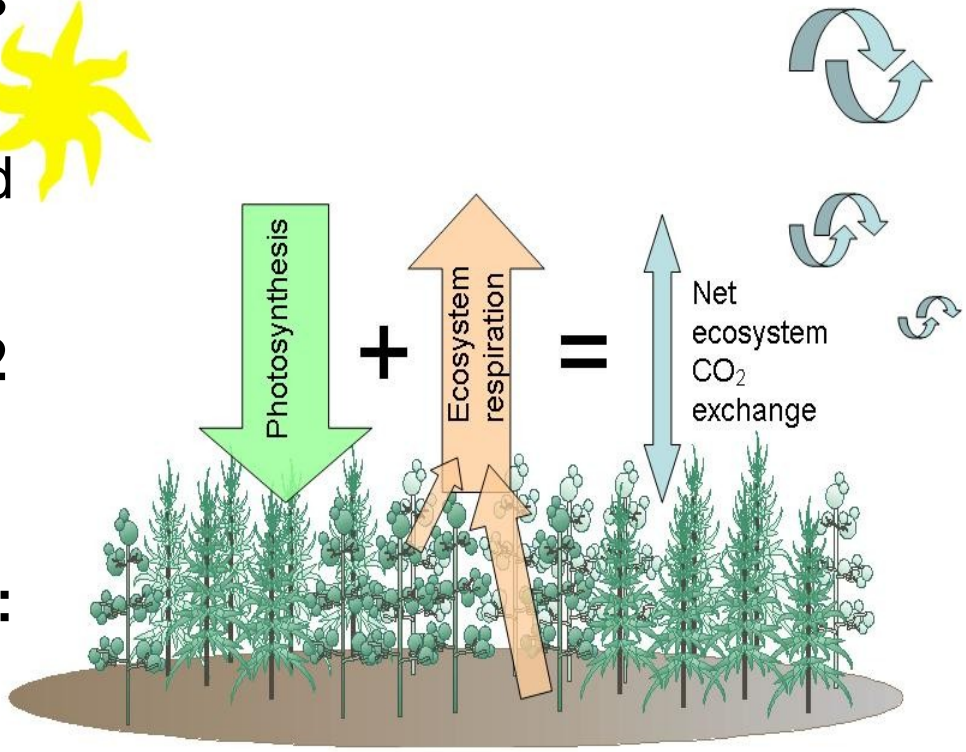
Release and assimilate CO2

Are controlled by climatic variables

Net ecosystem CO2 exchange:

NEE = - sinks + sources

= - GPP+total ecosystem respiration



Modelling framework in Snowcarbo

REgional climate MOdel of CSC, Hamburg REMO

Produce regional climatic forcing

Land surface scheme (LSS) of GCM ECHAM JSBACH

Produce regional CO2 balance consisting of assimilation and emissions in ecosystems

Domain: Scandinavia, Baltic countries and surroundings

Spatial resolution ~18km

High time resolution 1 hour

Target years 2001-2009

REMO: boundary data

Atmospheric conditions:

Wind speeds, Temperature, Humidity etc from

- ECMWF ERA-Interim

Surface parameter fields related to land cover:

Surface background albedo, roughness length, vegetation ratio, leaf area index, forest fraction, soil field capacity

- Land cover based on Finnish National Corine, European Corine Land Cover and GlobCover

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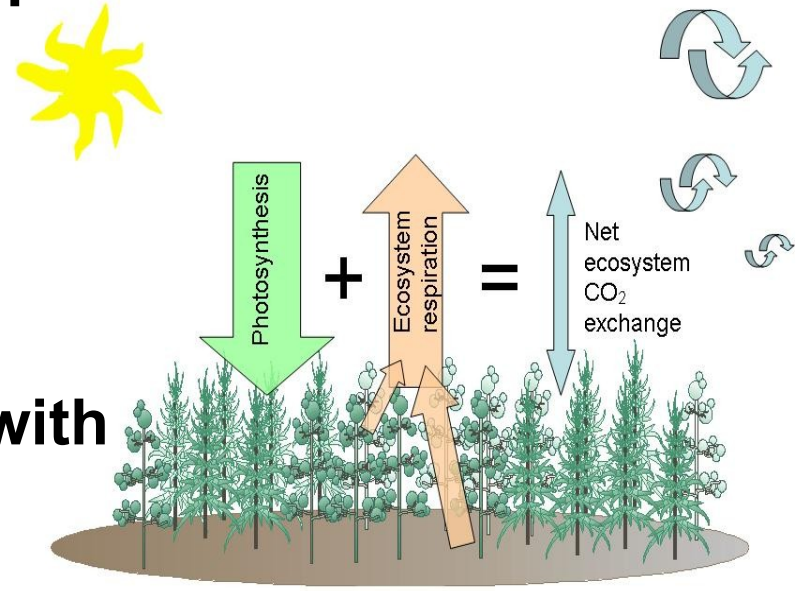
JSBACH: characteristics

Process model with

- **4 plant functional types for each grid cell**
- **Photosynthesis of C3 and C4 plants**
- **Carbon storages in soil and vegetation**
- **LAI (leaf area index) dynamics with phenology module**

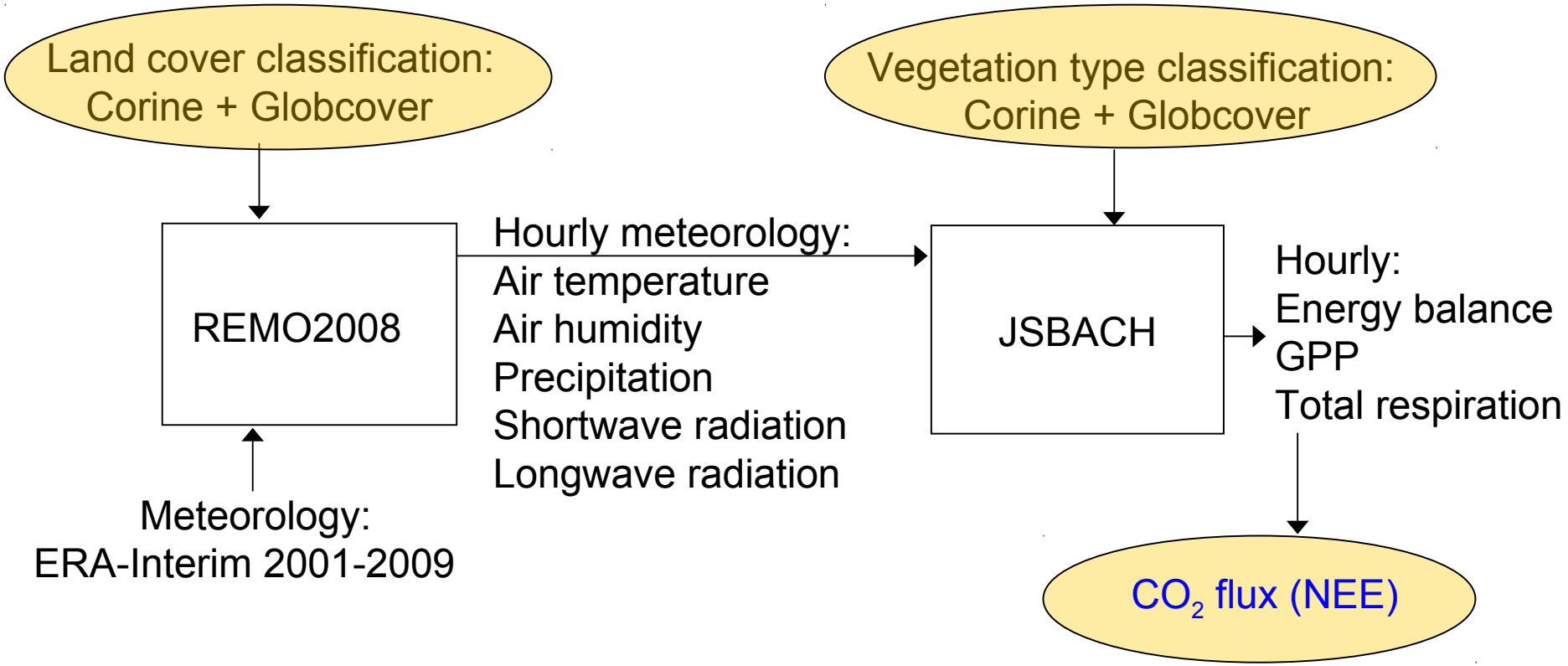


Surface radiation balance

Surface energy balance (Le, H, Rn)

CO2 balance (GPP, respiration terms)

REMO – JSBACH coupling



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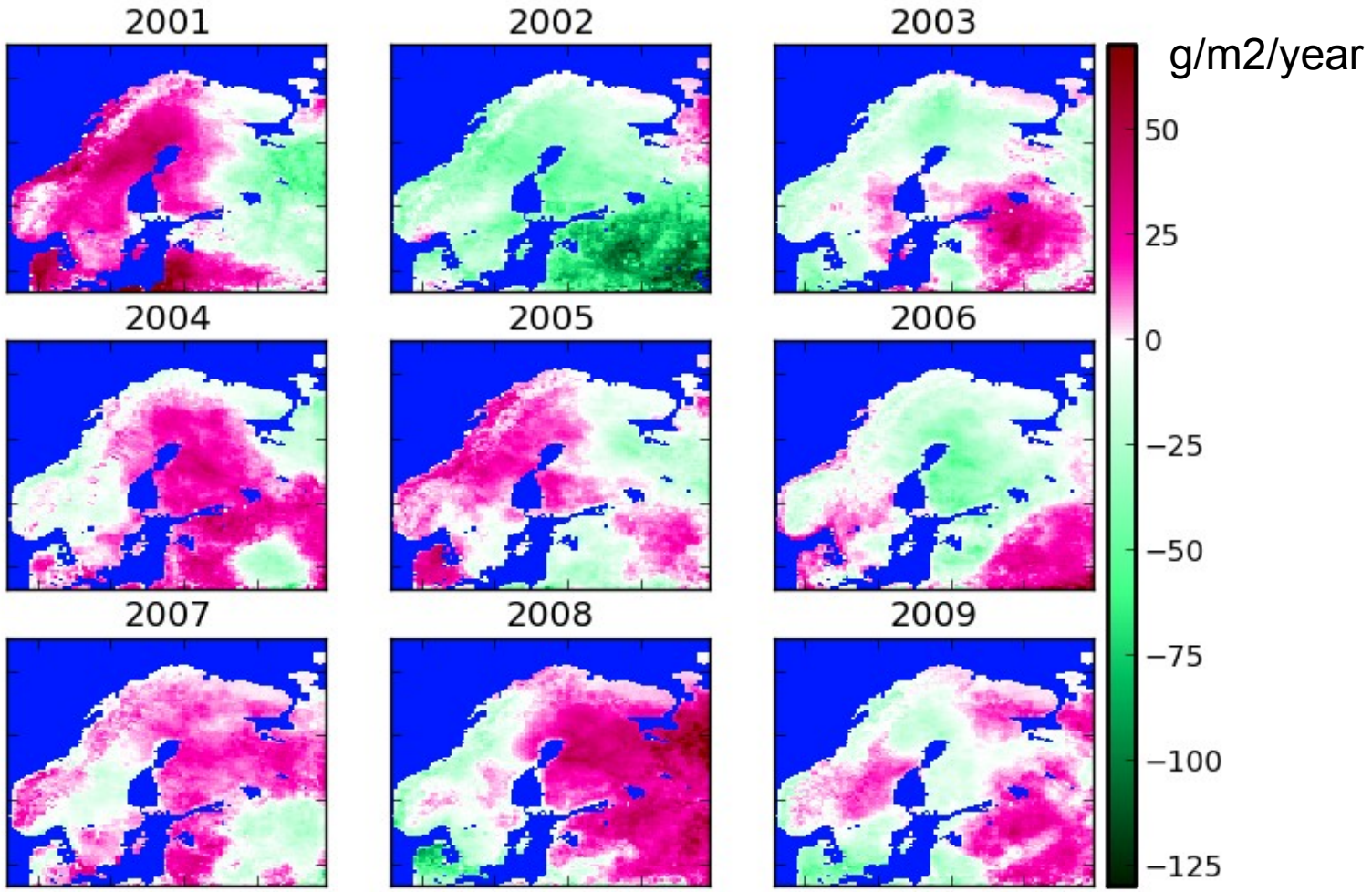
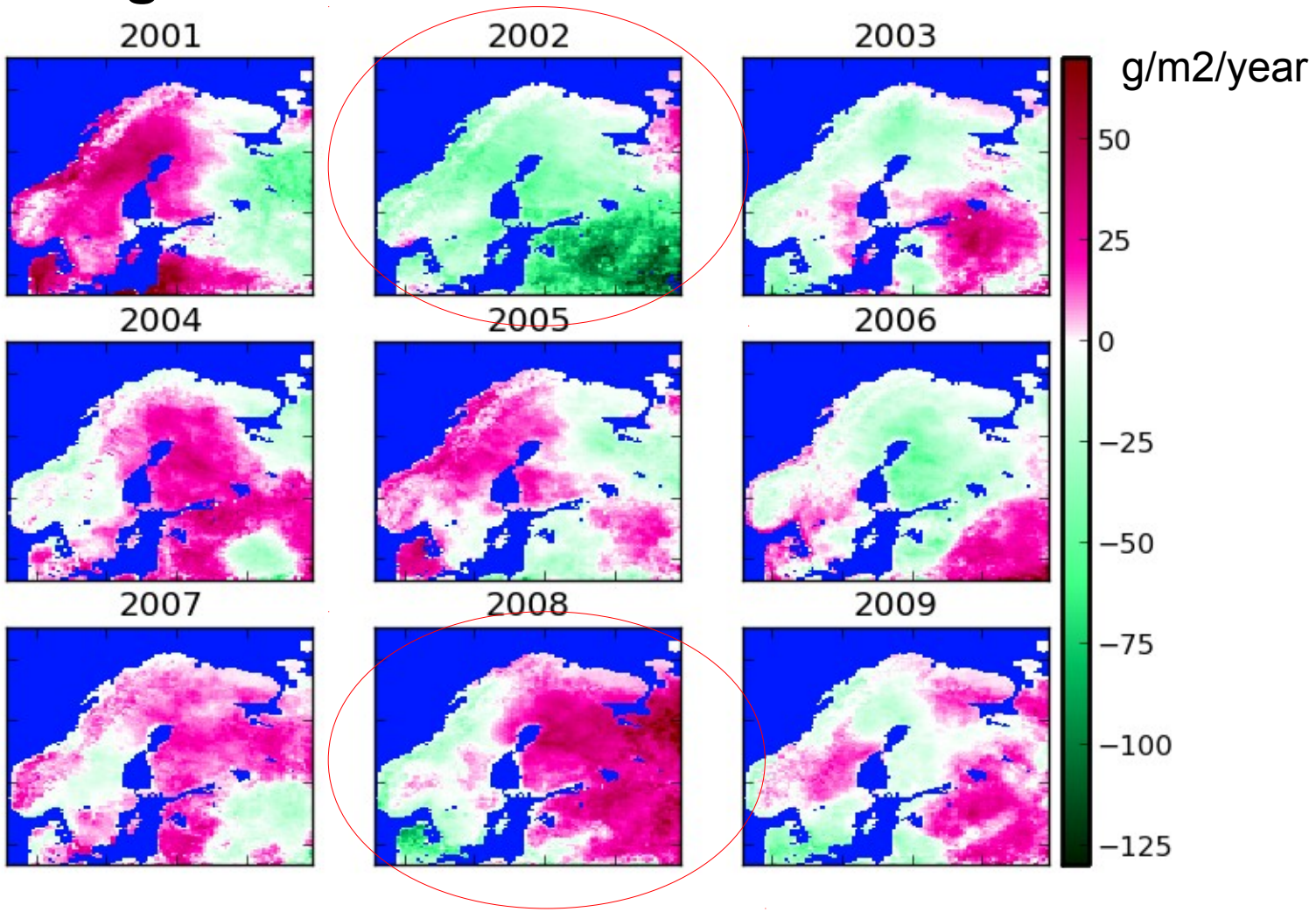
Regional CO2 balance 2001 - 2009

Regional CO2 balance 2001 - 2009



Regional CO2 balance 2001 - 2009



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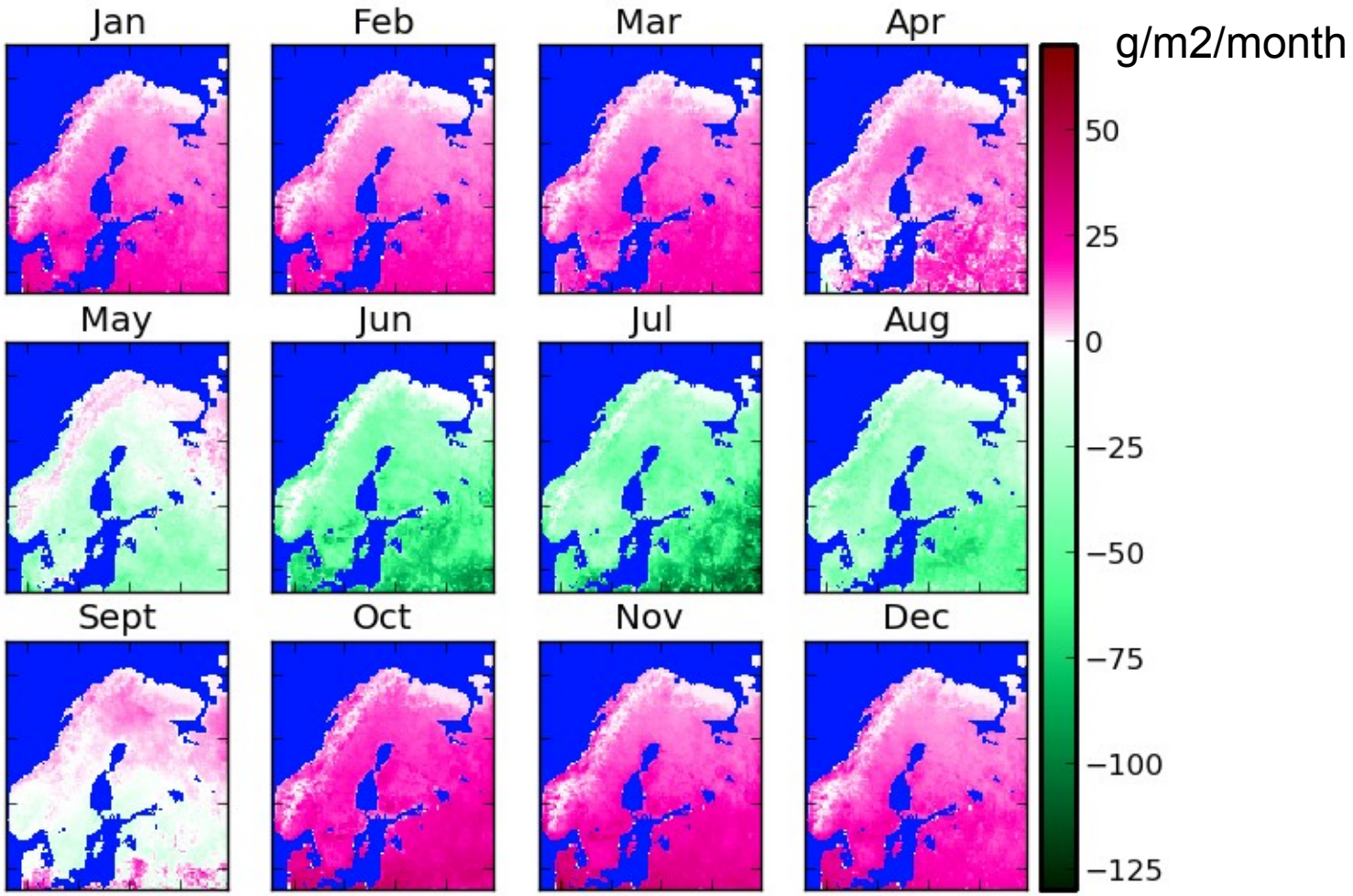
Monthly regional CO2 balance in 2002



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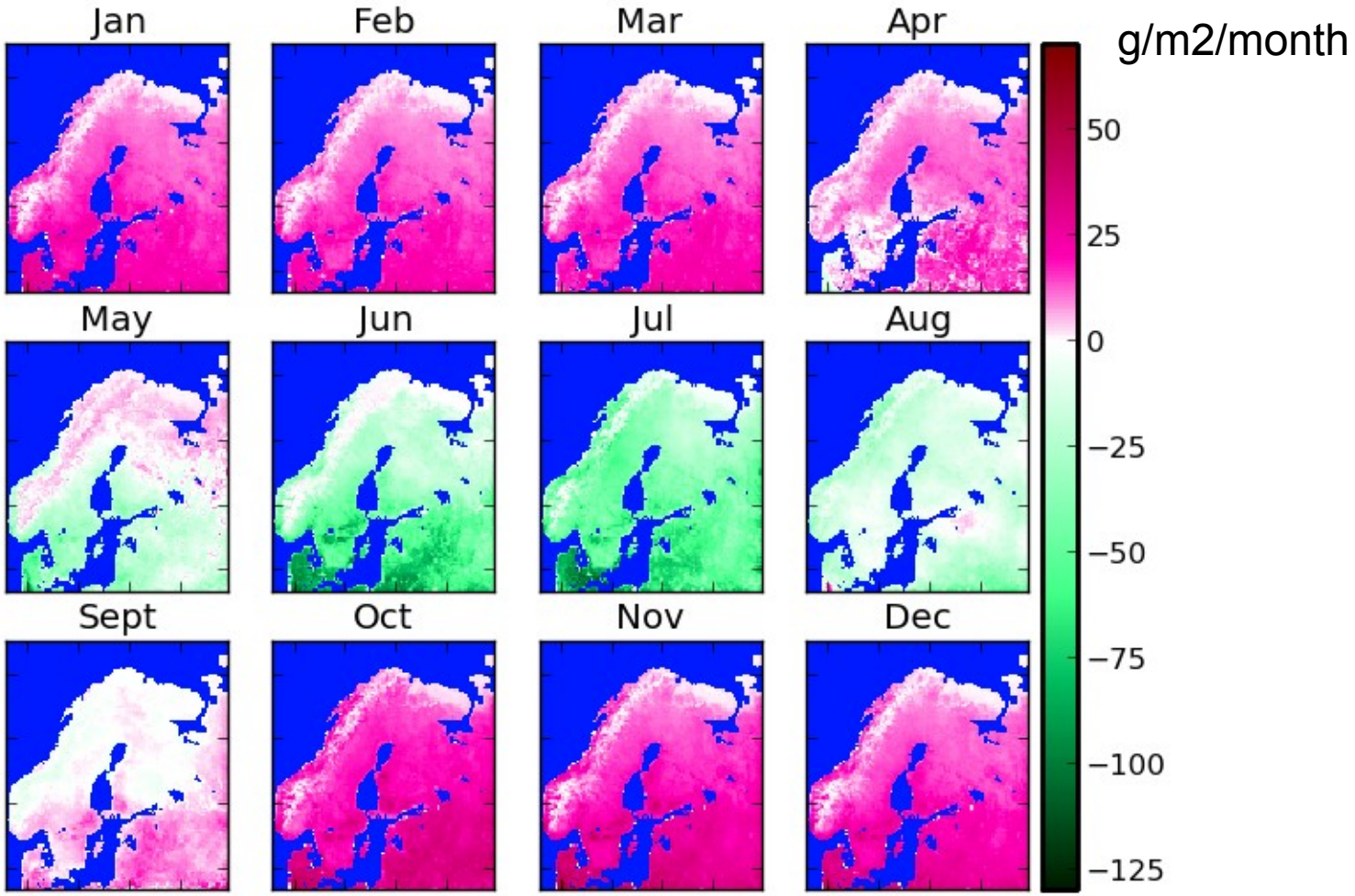
Monthly regional CO2 balance 2008



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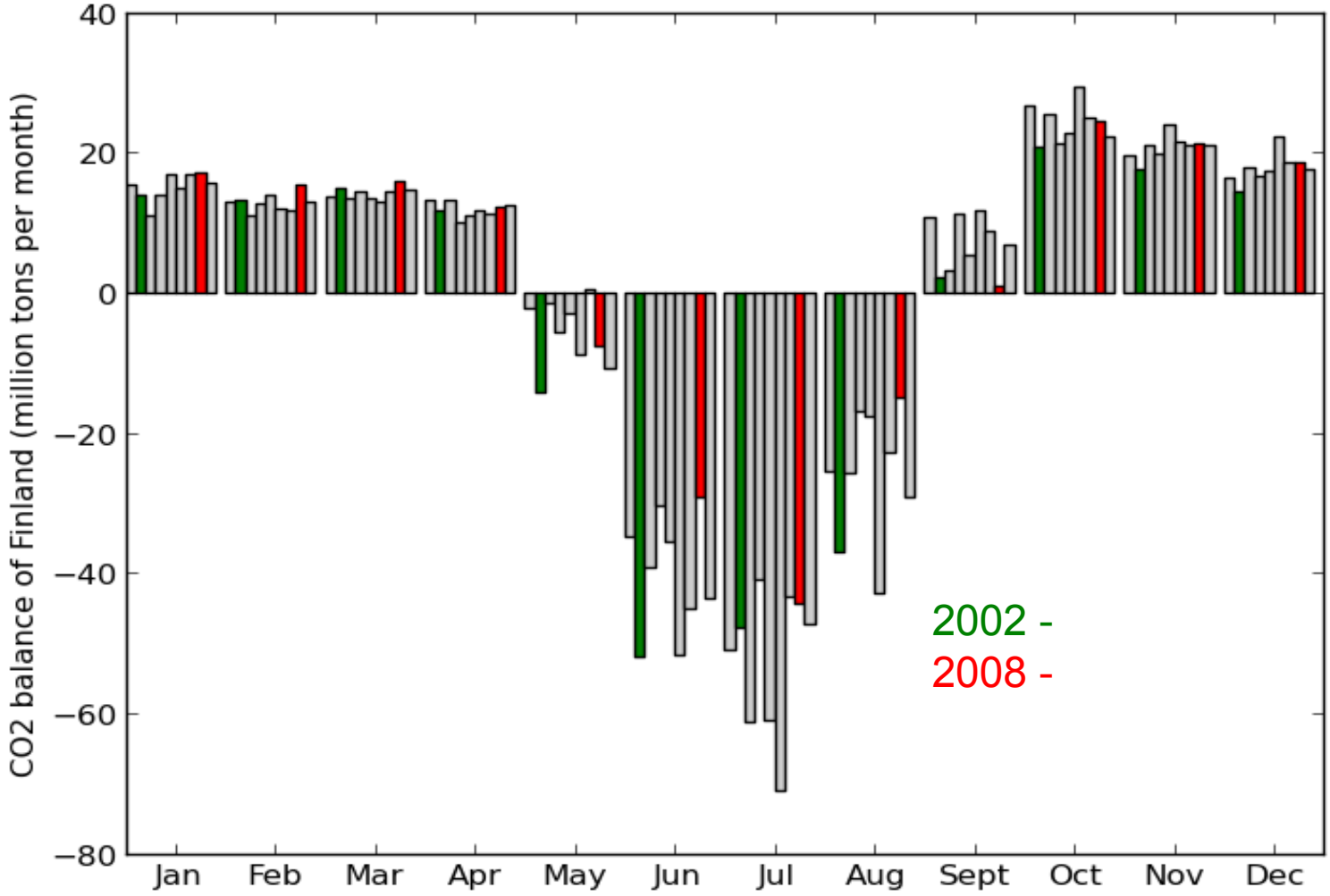
Monthly CO2 balance of Finland 2001-2009



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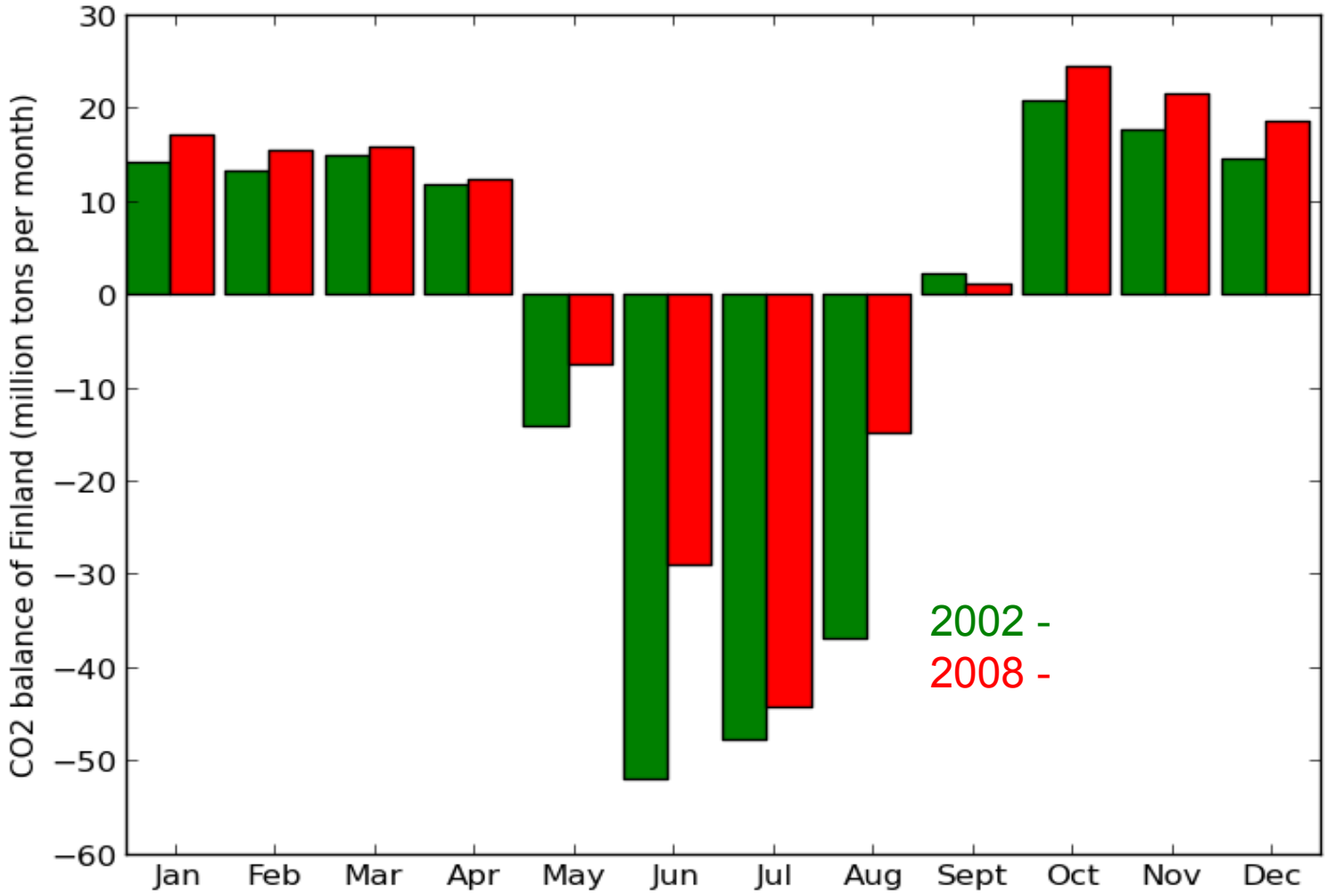
Monthly CO2 balance of Finland 2001-2009



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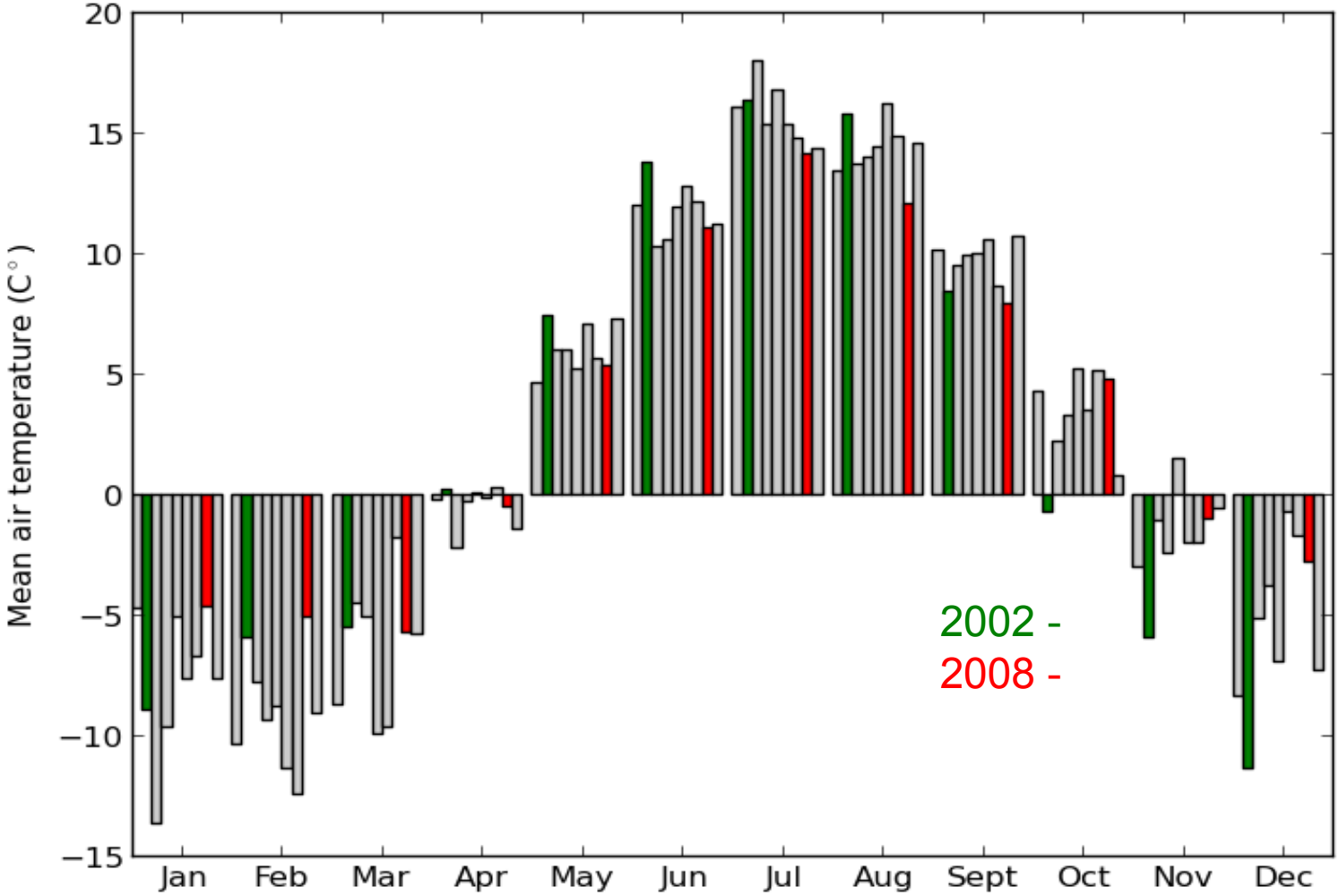
Monthly mean air temperature in Finland 2001-2009



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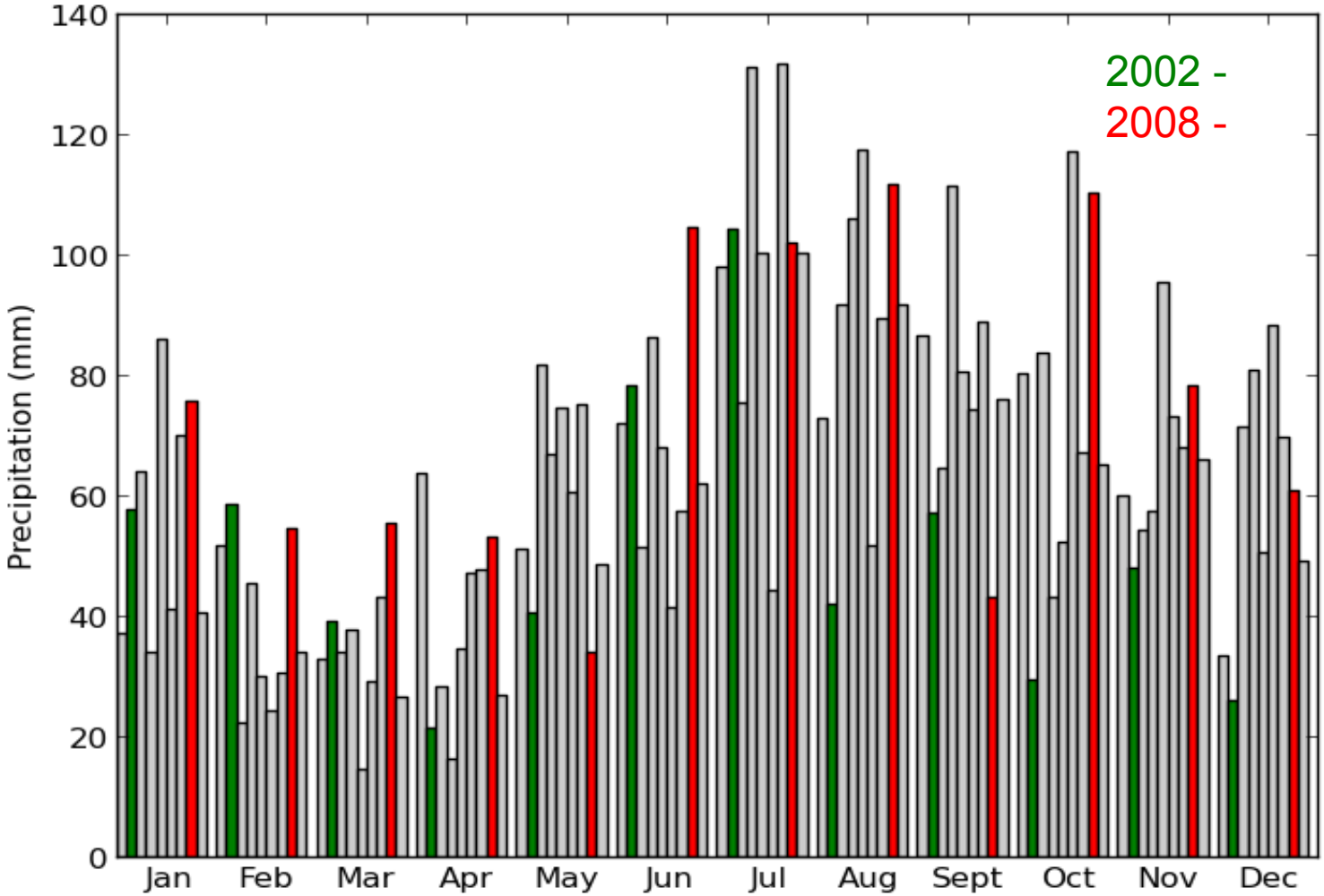
Monthly precipitation in Finland 2001-2009



Conclusions and future perspectives

Offline coupled regional climate model, land ecosystem model framework was used to estimate regional CO2 balances

Up-to-date land cover data was used in both models

NEE shows year to year variation that correlates with summer time monthly temperatures

Correlation with other driving variables, such as precipitation is not so straightforward

Conclusions and future perspectives

In the future

- The importance of climatic drivers will be further studied
- The model will be calibrated against data (see the poster)
- Trends can be assessed with runs extending longer into the past
- Regional CO2 balance projections will be produced
- Source strengths can be used as a priori data for atmospheric inversions

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Thank you.