Carbon & Biogeochemical cycles

ECVs:

Greenhouse Gases

Soil Moisture

Fire

Land Cover

CEOS – Carbon strategy

GHG

Climate Science question addressed:

- contribute to the understanding **of land carbon sink** with the usage of CO2/CH4 time series

  - CO2 atmospheric growth rate / compare this to CarbonTracker
  - using CCI GHG in inversion methods → Europe is a stronger carbon sink than derived in other studies (CarboEurope)
  - CH4 applied in inversion methods → decreasing wet land emissions before 2007

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Soil Moisture

Climate Science questions addressed:

- how important are previous moisture conditions for climate extremes?
    - precipitation / temperature coupling
    - soil moisture / temperature coupling

    → both lead to similar spatial pattern but the soil moisture temperature coupling is weaker then the precipitation temperature coupling

    CCI - soil moisture shows lower seasonal variability → maybe this explains the weaker coupling

Fire

Climate Science question addressed:

How does the fire cci burned area relate to fire carbon emissions?

- Bottom up approach:

    - Prescribing CCI Fire burned area in a vegetation model (ORCHIDEE)
    - compared to other fire emission products
    - compared to atmospheric CO concentrations (applying an atmospheric transport model)

→ Fire carbon emissions using fire CCI are higher than previous estimates and lead to too high CO concentrations
→ has to be checked again with the new Fire CCI algorithm (v3)

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Land Cover

Climate Science question addressed:

- contribute to the understanding **of land carbon sink** with improved Land Cover data

    - Usage of CCI Land Cover data as boundary conditions in global vegetation models

        - CCI Land Cover classes conversion into model PFT classes automated
        - various relevant simulated quantities have been compared to independent estimates (LAI, GPP, NPP, albedo) and showed in general an improvement of the models applying the CCI Land Cover dataset against their reference dataset

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CEOS – Carbon Strategy

- CEOS: **Strategy for Carbon Earth Observations from Space**

- similar activity as GCOS, but specifically framed around carbon related topics that aims for an improved understanding of the global carbon cycle

- goes beyond CCI:
    - need to put observations in carbon units
    - cross-domain fluxes
    - Integrated observing system including other than EO data

- CEOS report (currently under review) could be a a framework as a successor to CCI phase 2 for carbon related ECVs?

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What climate science questions can be addressed?

- Intercomparison / Validation

Common climate science questions among the ECVs:

- Contribute to the understanding of the land carbon sink

- Extreme events (e.g. Europe 2003, Siberia 2010-11, Amazon 2004-5) & Biogeochemical Cycles – common data periods/regional focus

- Cross-domain interfaces between energy-water-carbon

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What climate science questions can be addressed?

How do the single ECVs advance together?

→ identify a framework for collaboration

- ECVs share partly similar climate modeling tools in the CRG
- CRGs are already busy in dealing with one ECV → here CMUG should help in cross ECV assessments

- CCI 2 structure should be framed around science questions and not around single products

- technical themed specific workshops around CCI/CMUG meetings

→ Bring in new/other data streams/ECVs (Evapotranspiration, LST, Fapar, biomass, albedo)

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What data is missing to address these questions?

- Fluorescence data

- Biomass data

- root zone soil moisture

- fire energy to derive combustion completeness

- soil carbon

- ….

- EO products have to be put into carbon units

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How to promote an ECV?

- How does an ECV become a sustainable product, that will be used beyond phase 2?

    - engage users at an early stage (institutional users are slow to change)

        - Climate research groups very useful
        - CMUG
        - User requirement document

    - publications
        - Special issue on ECVs related to carbon & biogeochemcial cycles

    - Big CCI promotion event/conference
    - build a data portal that is easy to access, to handle and is visible

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