Effects of land use and climate change on biosphere-atmosphere exchange of GHG in terrestrial ecosystems

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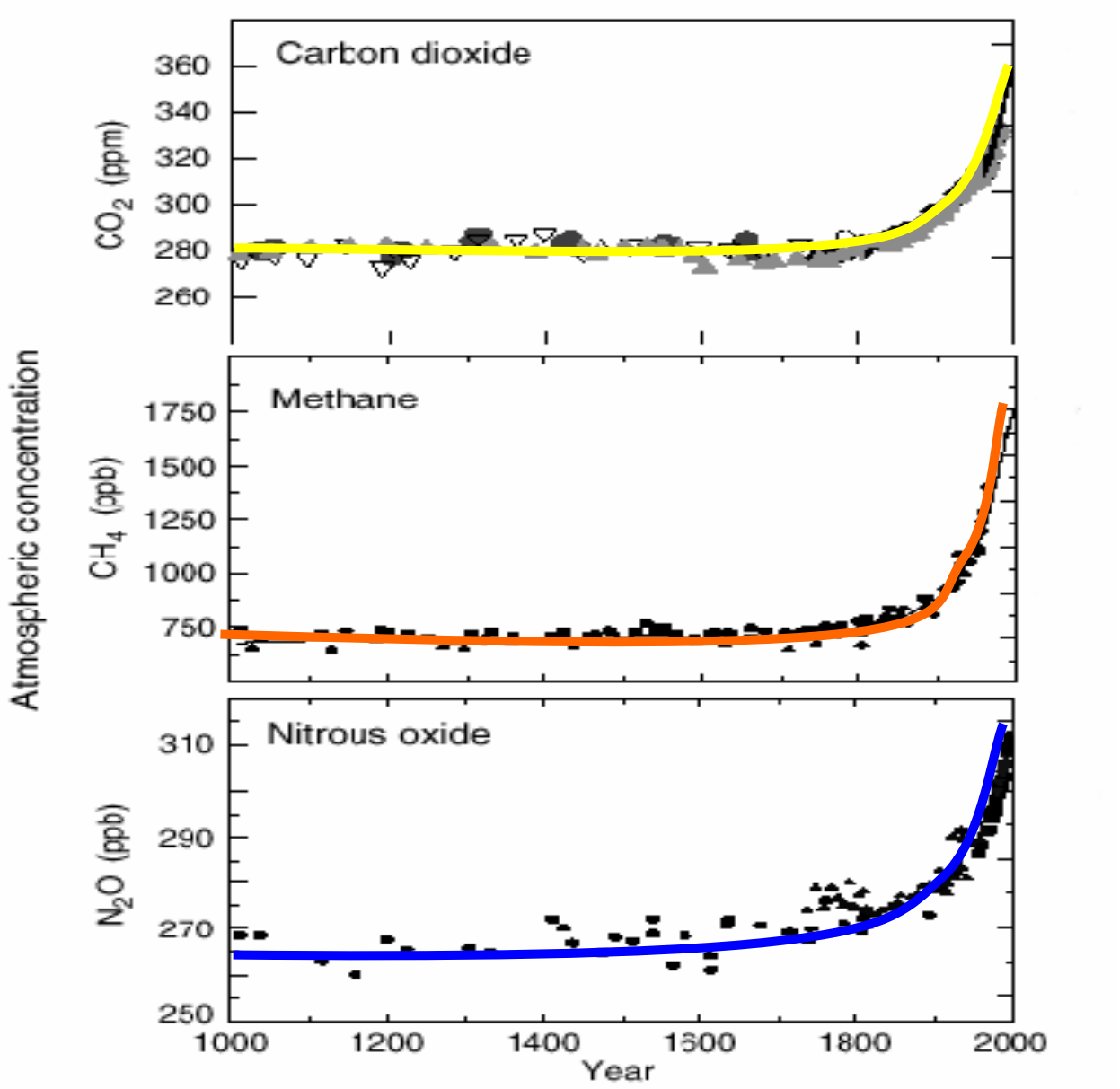
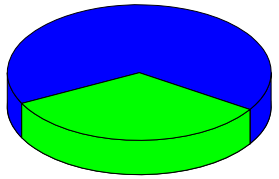
Increase of atmospheric GHGs

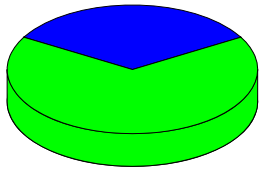


anthropogenic

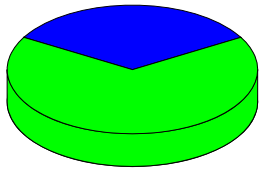


biogenic

Land use change

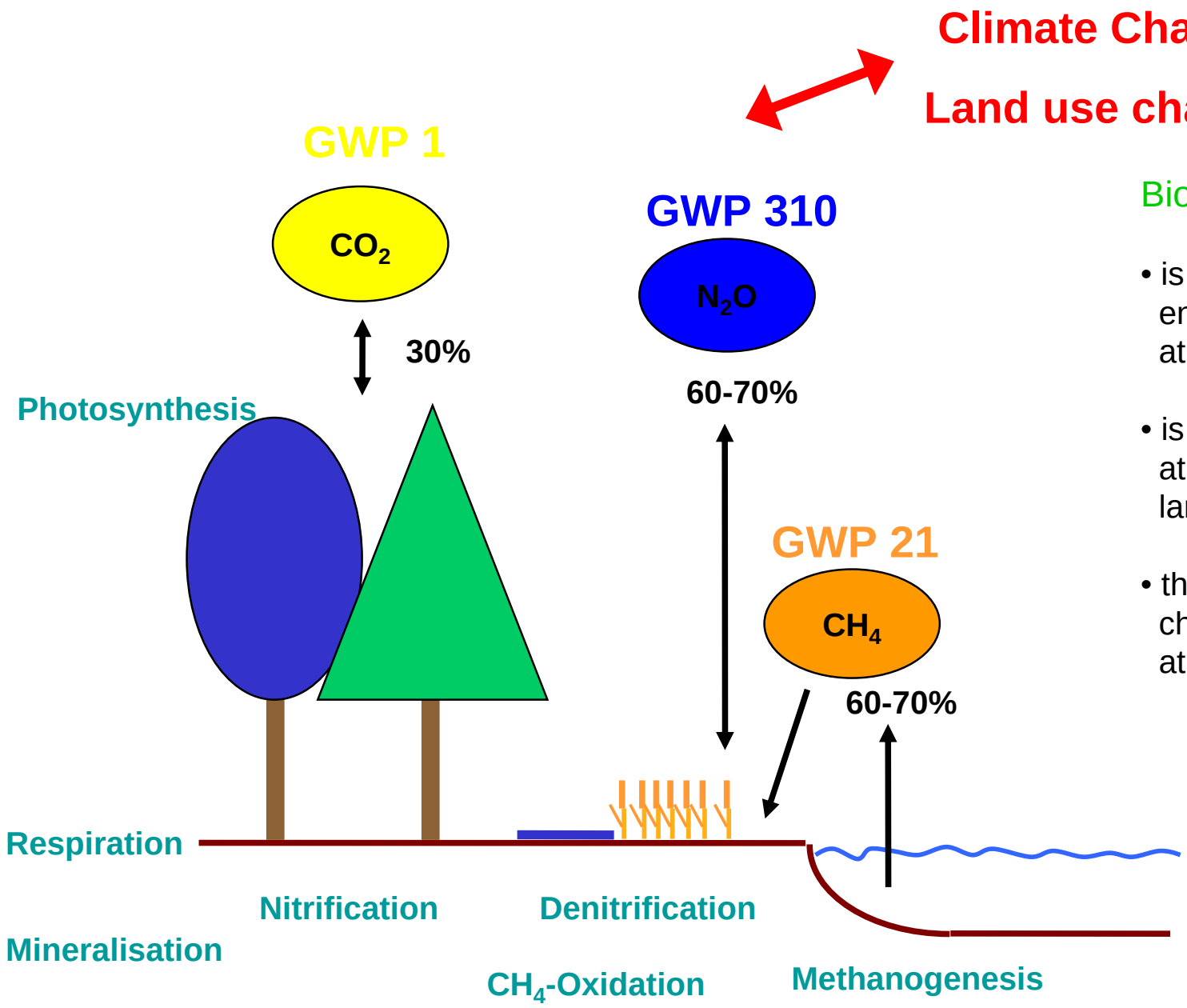


Rice paddies, wetlands, ruminants



arable, grassland- and forest soils

Biosphere as sink and source for atmospheric GHGs



Biosphere

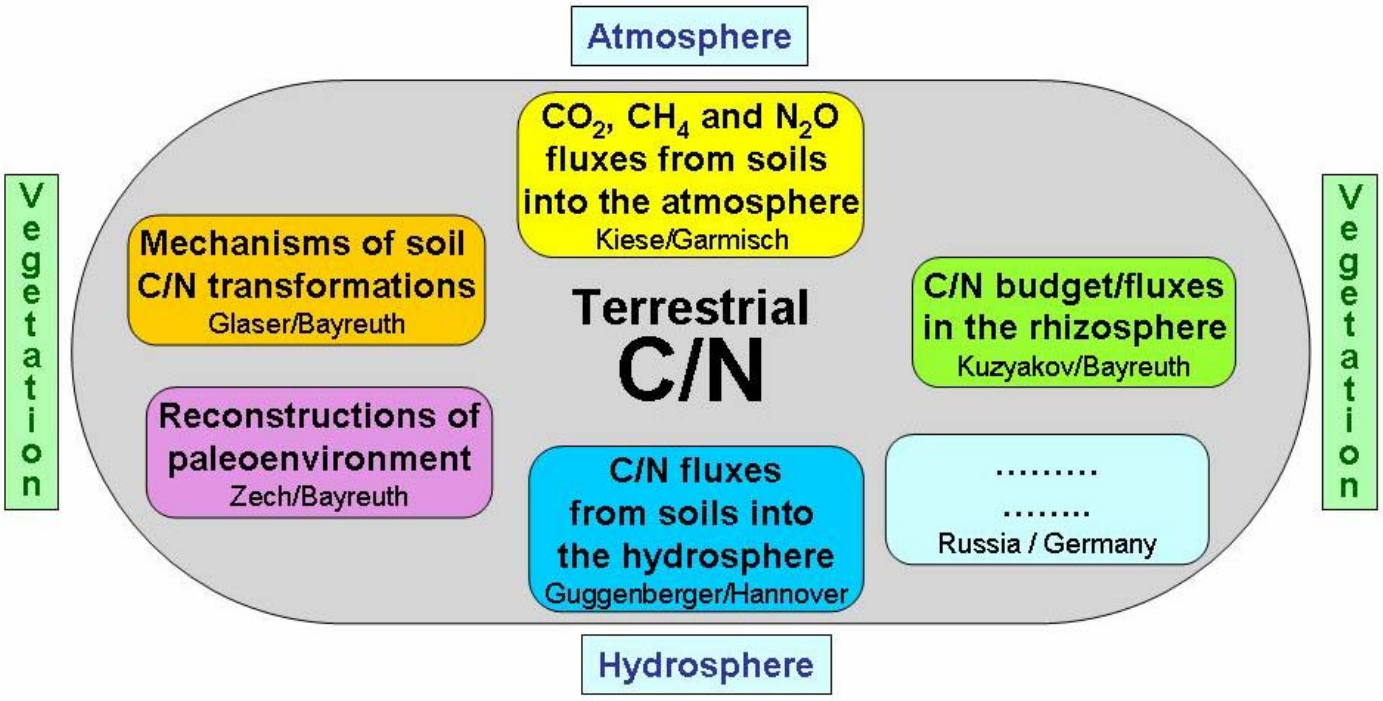
- is a significant source and sink for environmentally important atmospheric trace gases
- is in continuous exchange with the atmosphere; altered by climate and land use change
- thus, has an important effect on the chemical composition of the atmosphere

Impacts of climate and landuse change on C/N in terrestrial ecosystems of Baikal Area

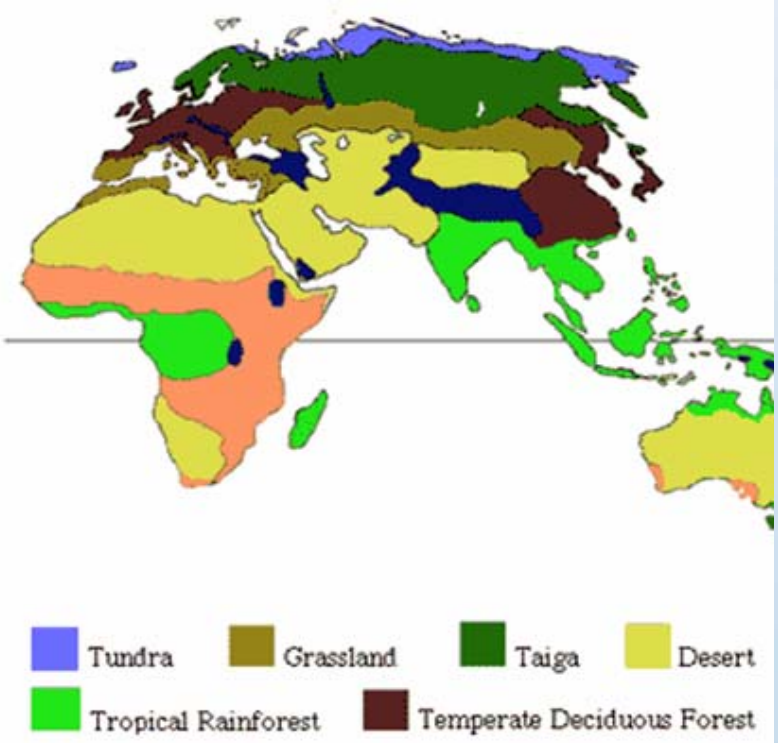
Preliminary ideas….

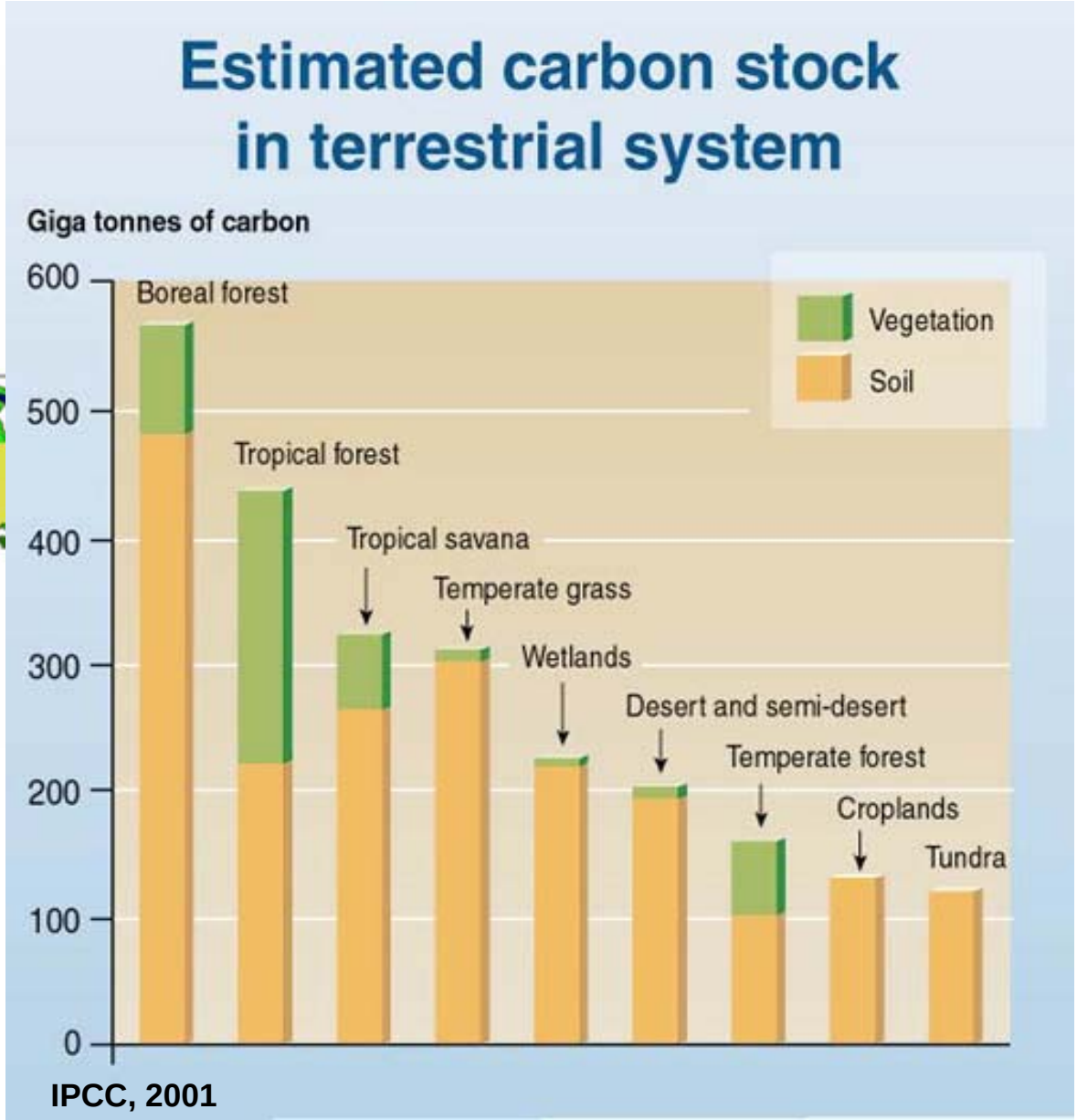
- **ecosystems at increasing elevations using natural temperature gradient for climate change study and/or manipulation experiments with effects on permafrost and active layer**
- **ecosystems with contrasting land uses**
- **…….**

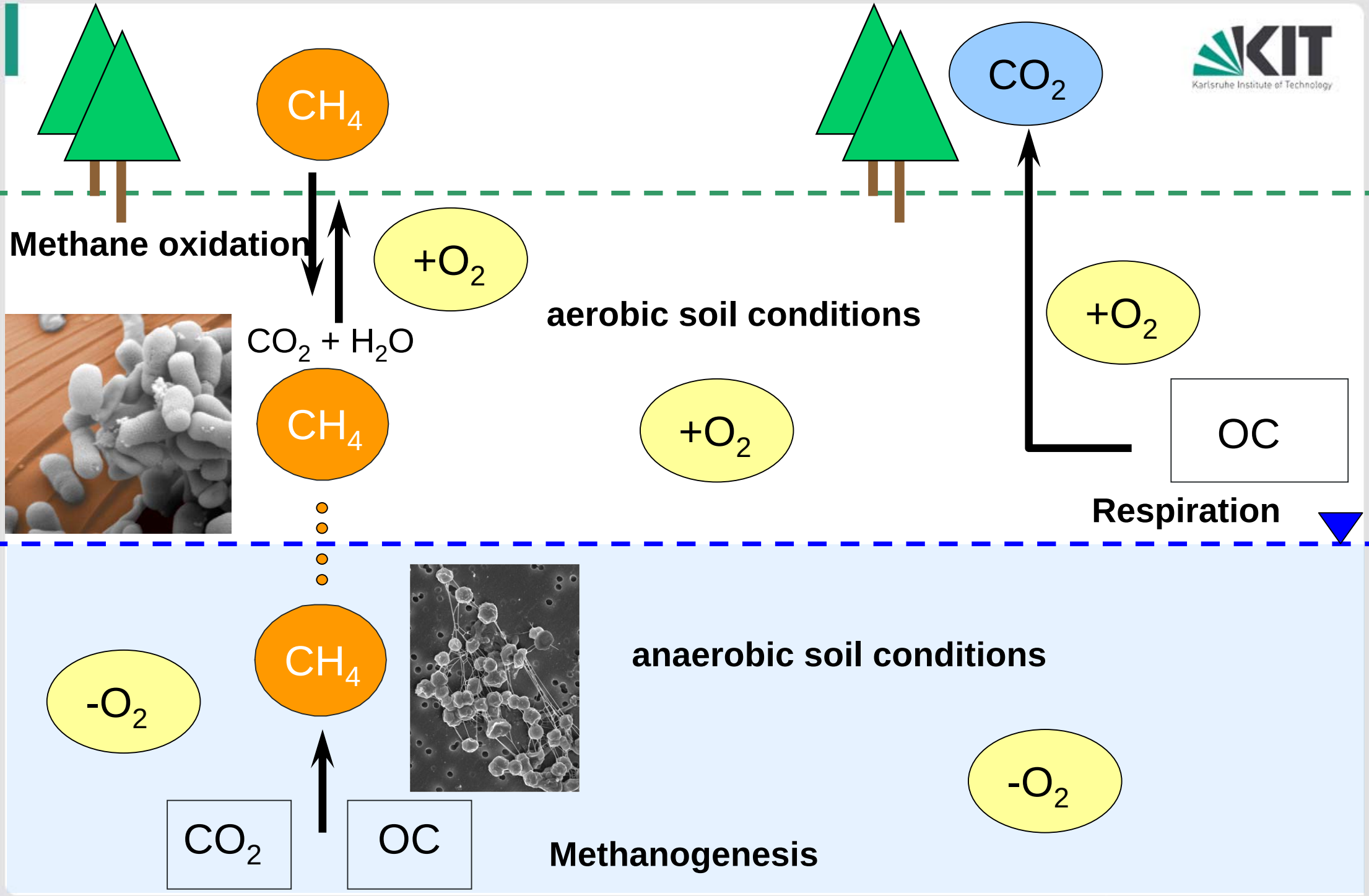
Why Baikal region ?

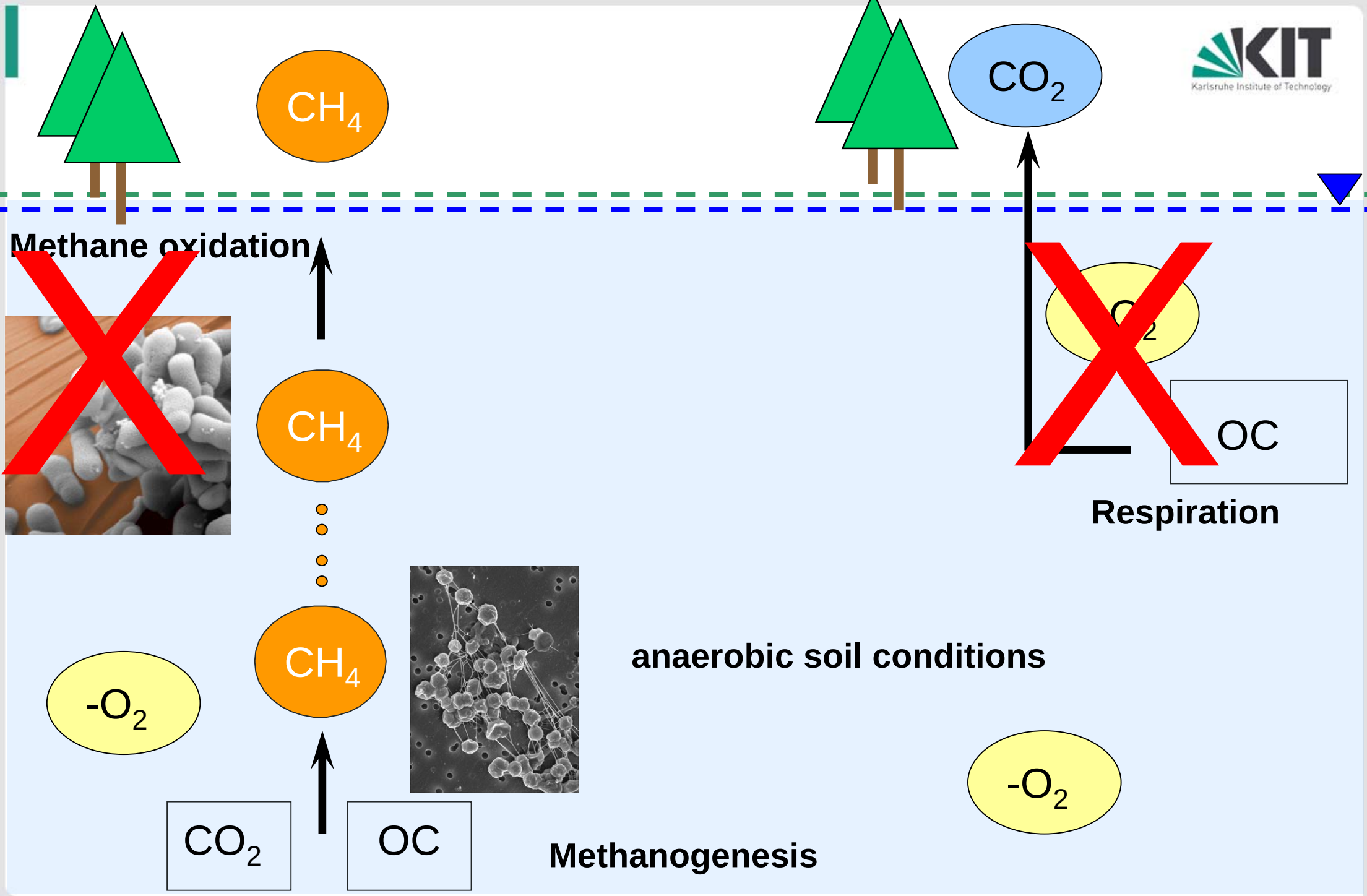


Global importance of the biome type Taiga



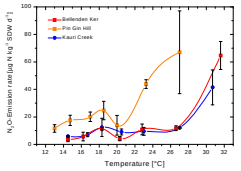



CH4
CO2
Methane oxidation
+O2
aerobic soil conditions
CO2 + H2O
CH4
+O2
+O2
OC
Respiration
CH4
-O2
anaerobic soil conditions
-O2
CO2
OC
Methanogenesis


CH_4
CO_2
Methane oxidation
CH_4
CH_4
$-O_2$
CO_2
OC
anaerobic soil conditions
$-O_2$
Methanogenesis
OC
Respiration

Integrated interdisciplinary research concept at IMK-IFU

process scale

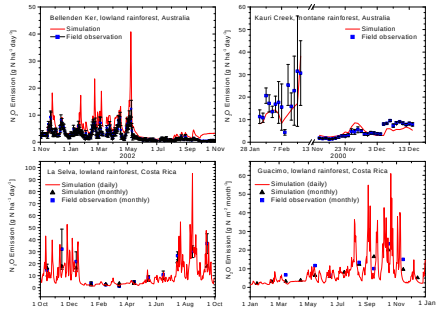


$$fact\_moist[l] = 1 - \frac{1}{1 + e^{\frac{water[l] - W\_CRIT}{W\_DELTA}}}$$

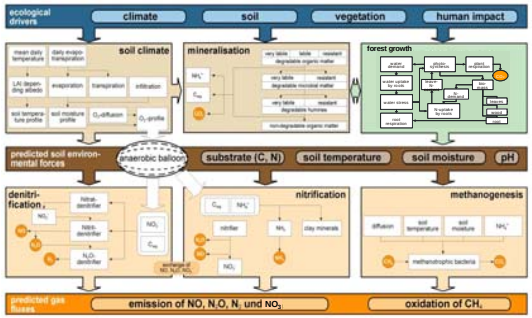
$$fact\_temp[l] = \left(\frac{T\_MAX - temp[l]}{T\_MAX - T\_OPT}\right)^{T\_A} * e^{T\_A * \frac{temp[l] - T\_OPT}{T\_MAX - T\_OPT}}$$

$$\frac{d\ nitr\_akt[l]}{d\ t} = MUEMAX * \left(\frac{temp\_moist\_fact}{\frac{KM\_DOC + DOC[l]}{DOC[l]} + \frac{KM\_N + n[l]}{n[l]}} - nitr\_akt[l]\right)$$

plot scale

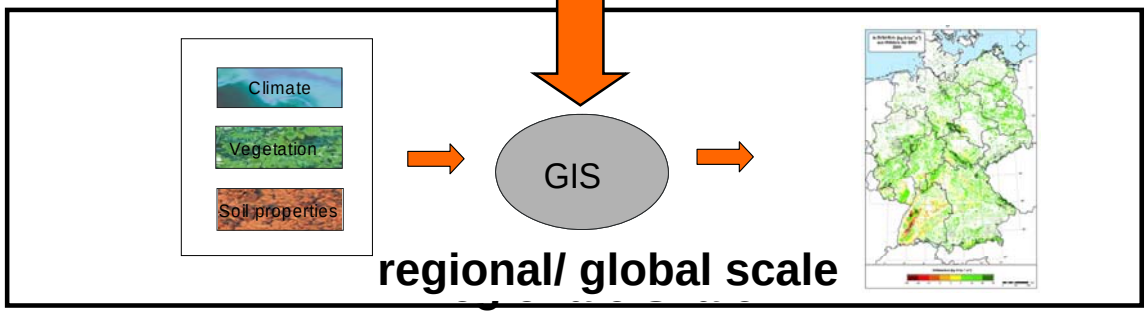


process based model



parameterisation

calibration/ testing

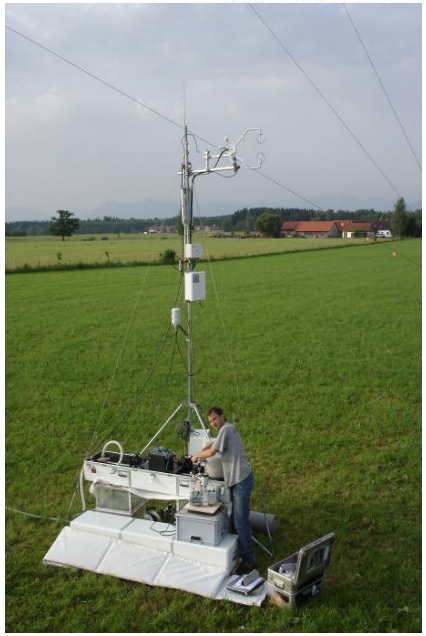


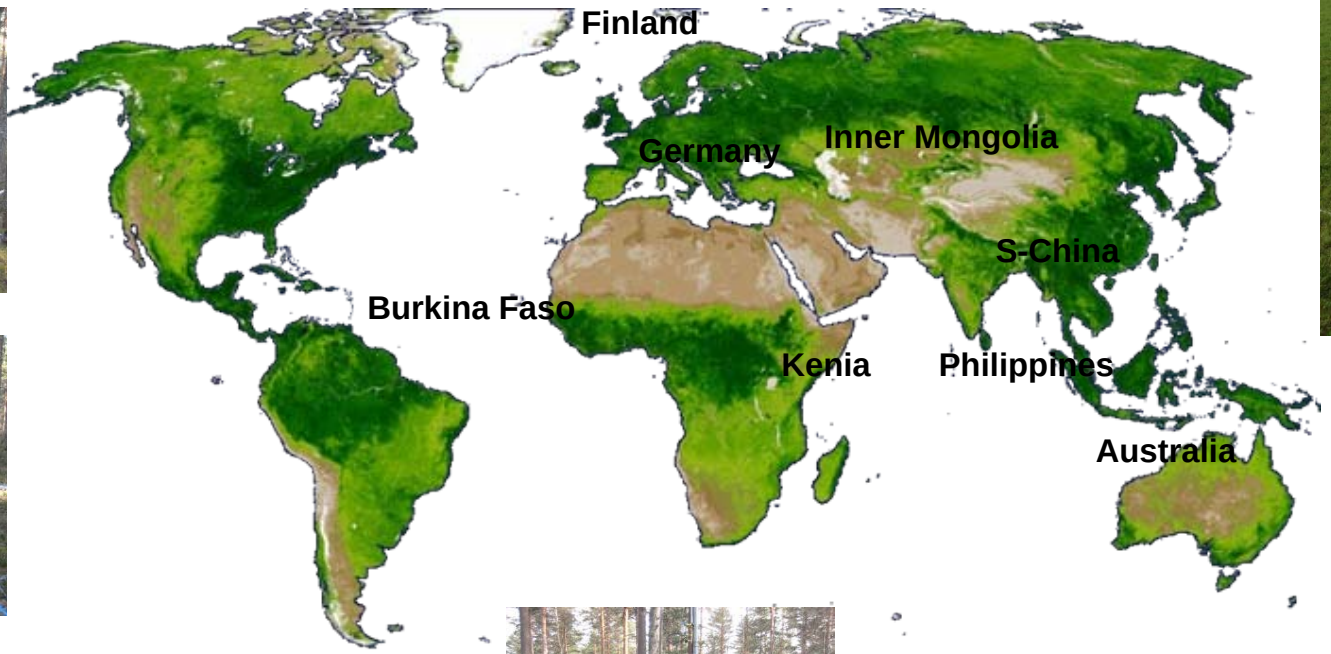
regional/ global scale

IMK-IFU research sites / measuring techniques for GHG exchange







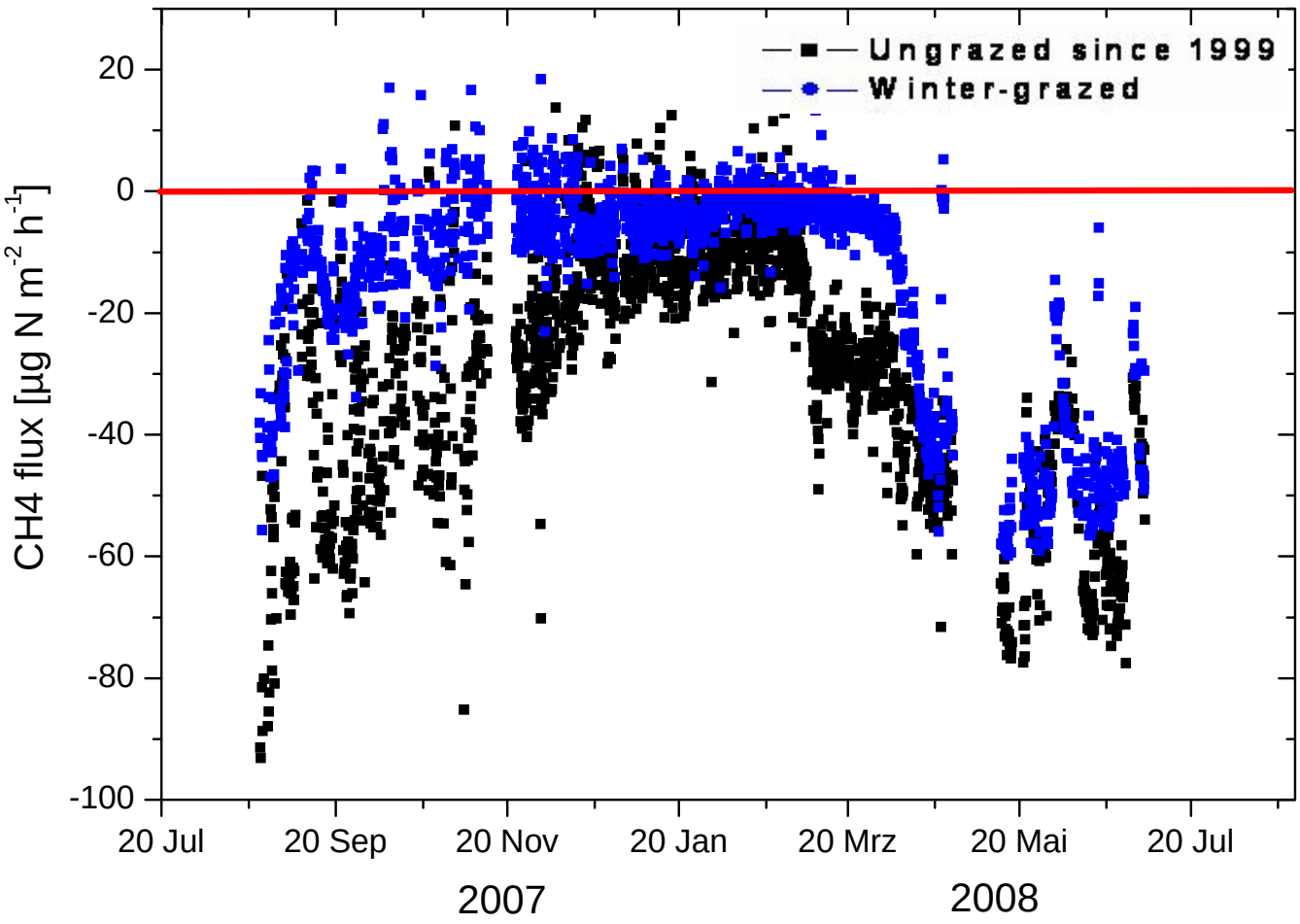


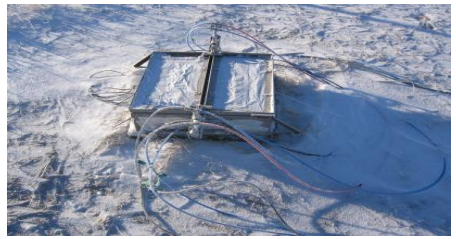


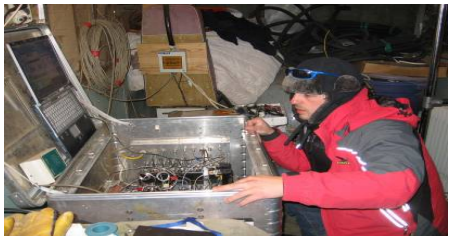




CH_4 fluxes in a steppe ecosystem in Inner Mongolia / China

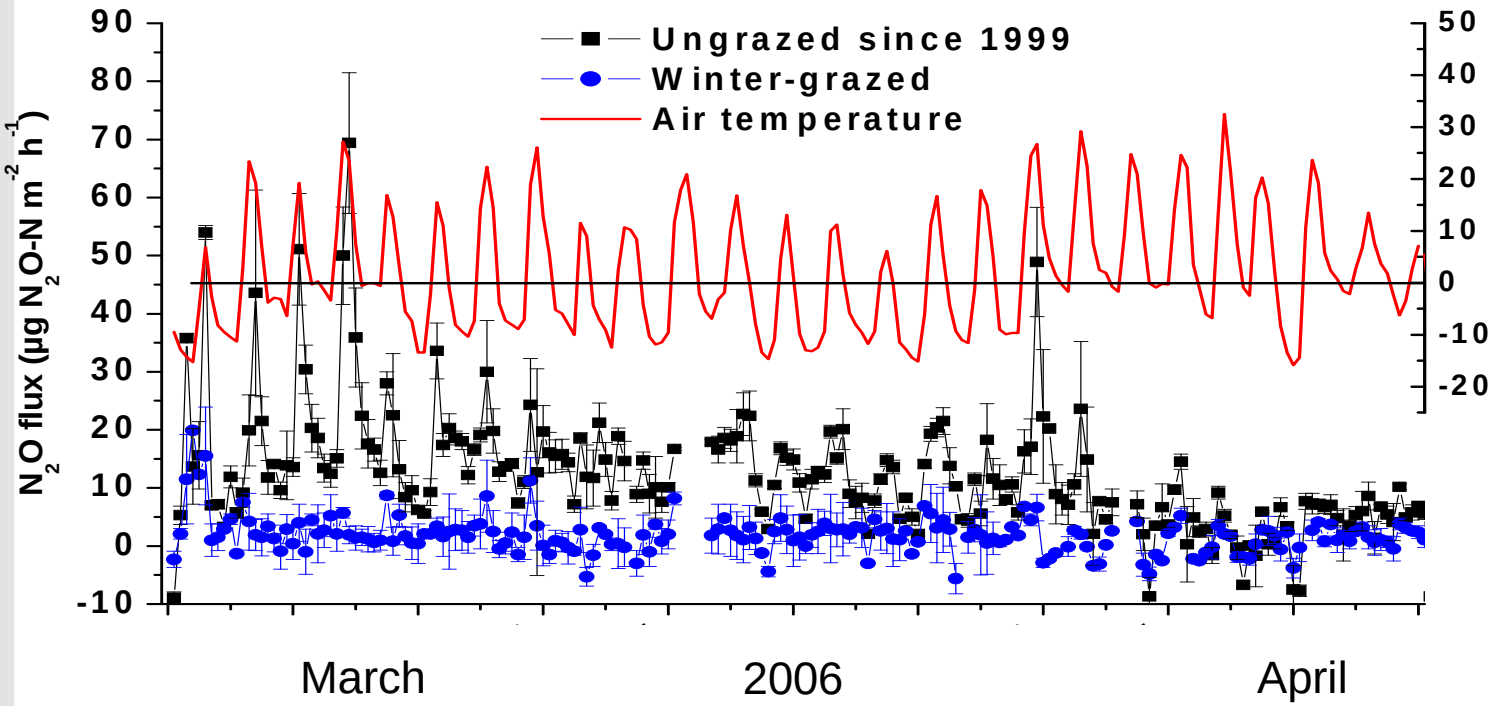


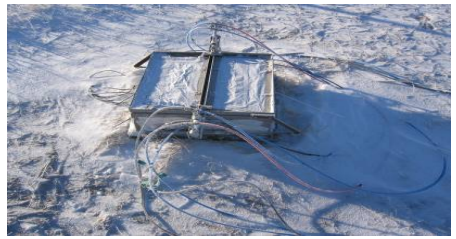


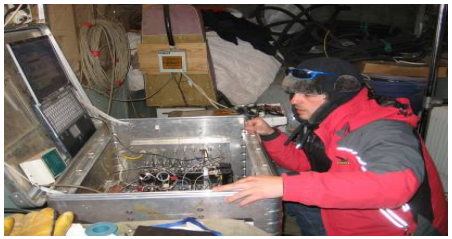


still significant uptake in wintertime with temperatures as low as -20°C

N_2O fluxes in a steppe ecosystem in Inner Mongolia / China

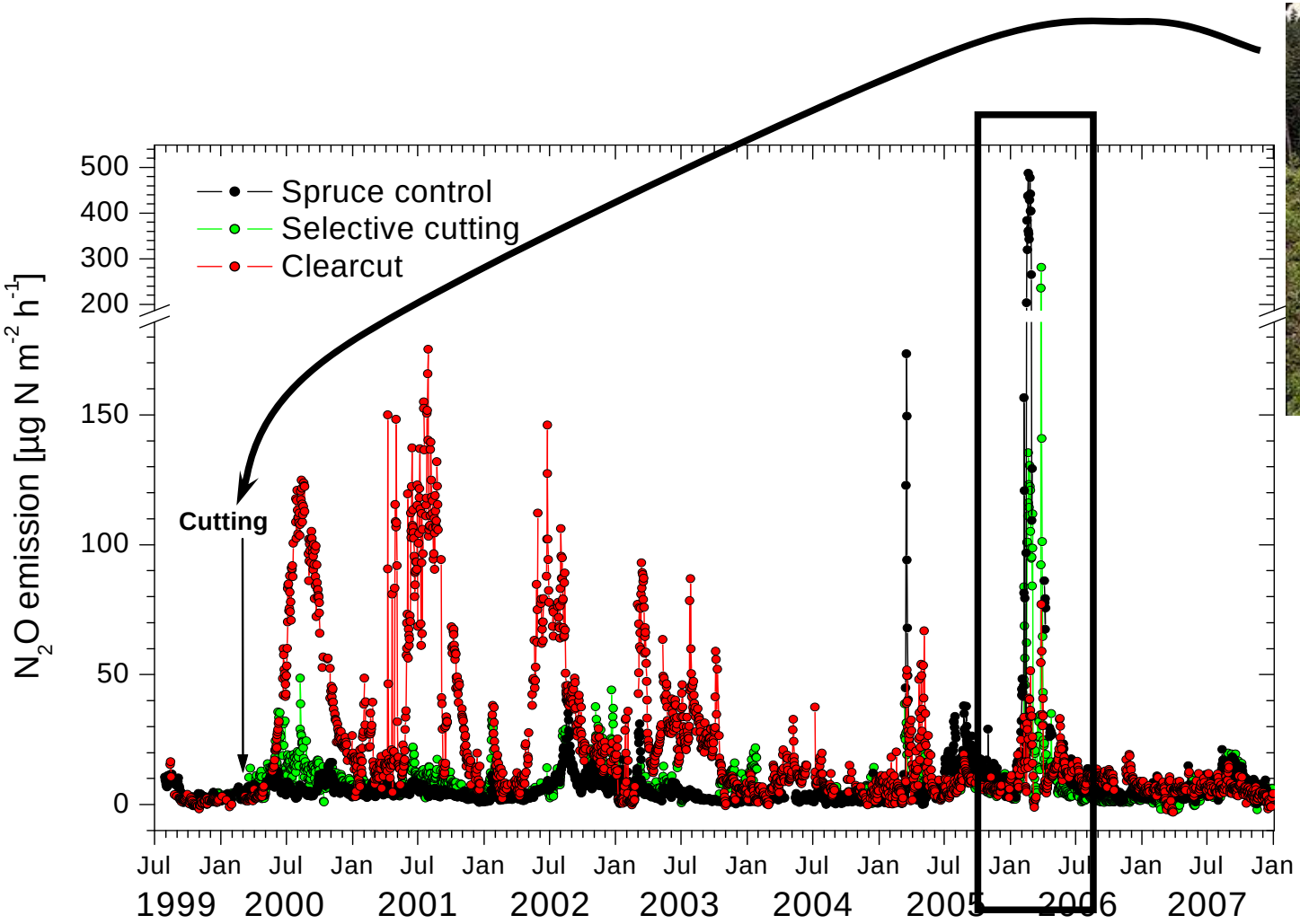




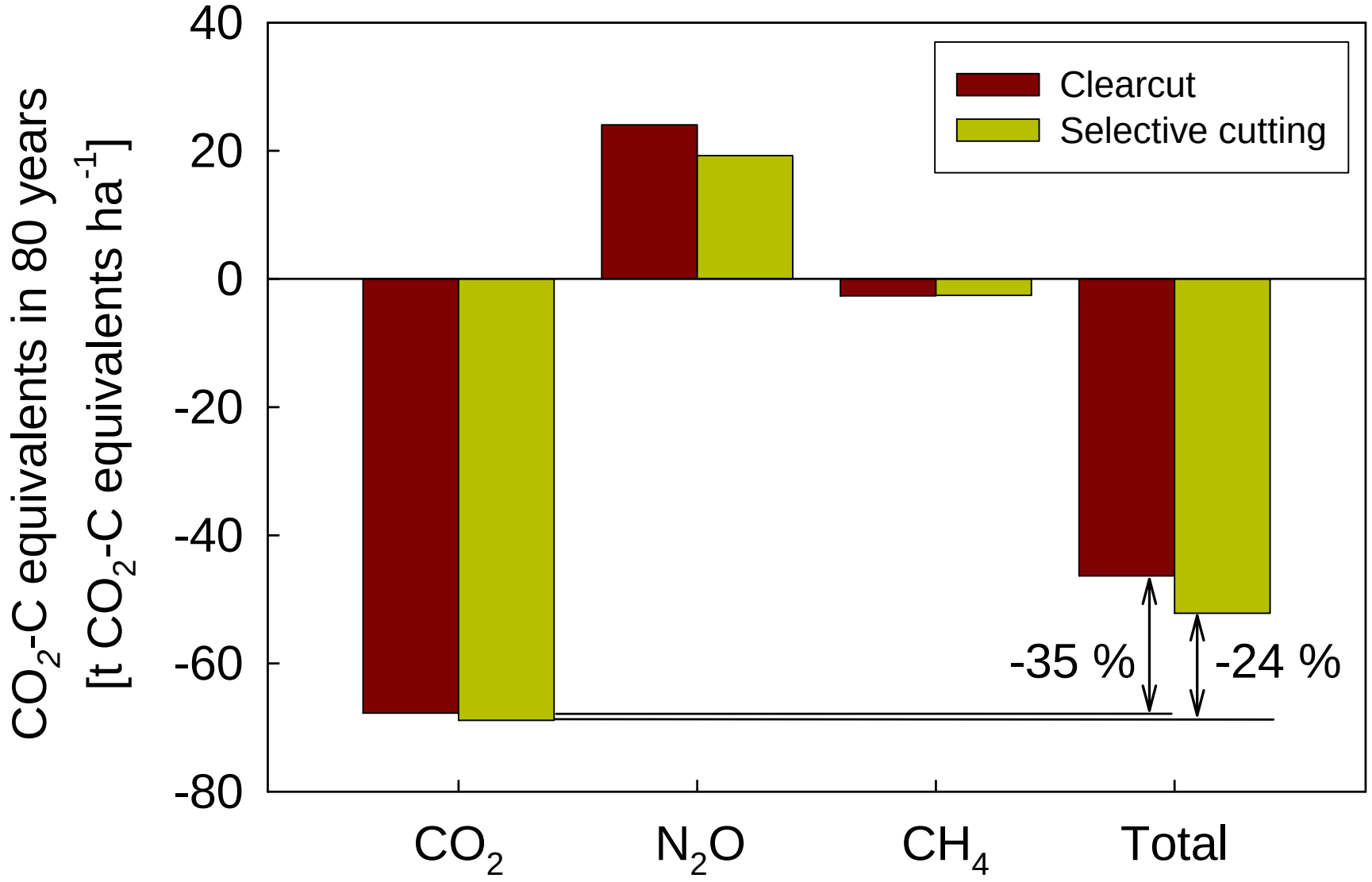


wintertime N_2O fluxes driven by frost thaw cycles dominate annual N_2O emissions

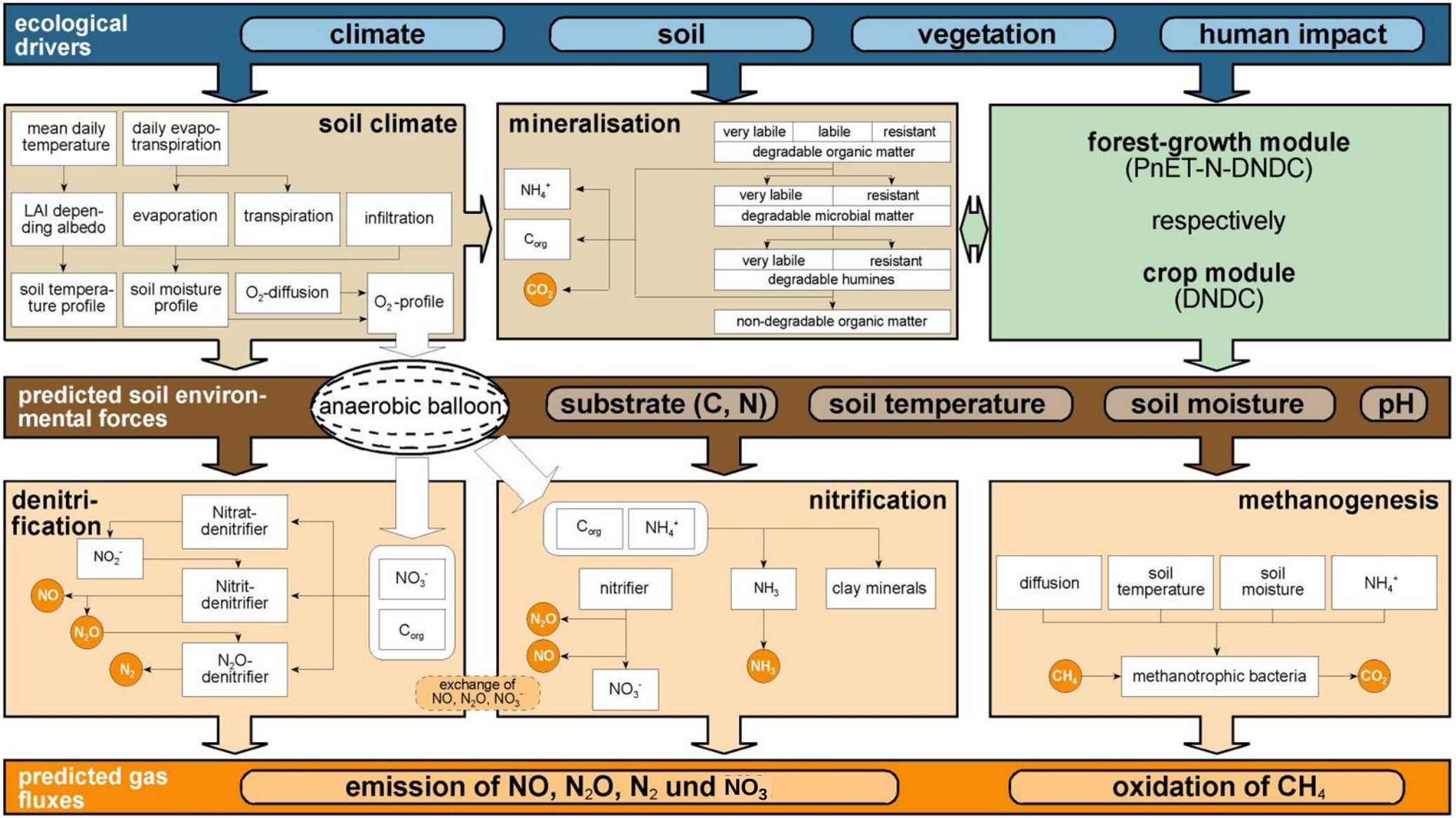
Long term measurements at a German temperate spruce forest



Full GHG balance over a 80 years rotation periode

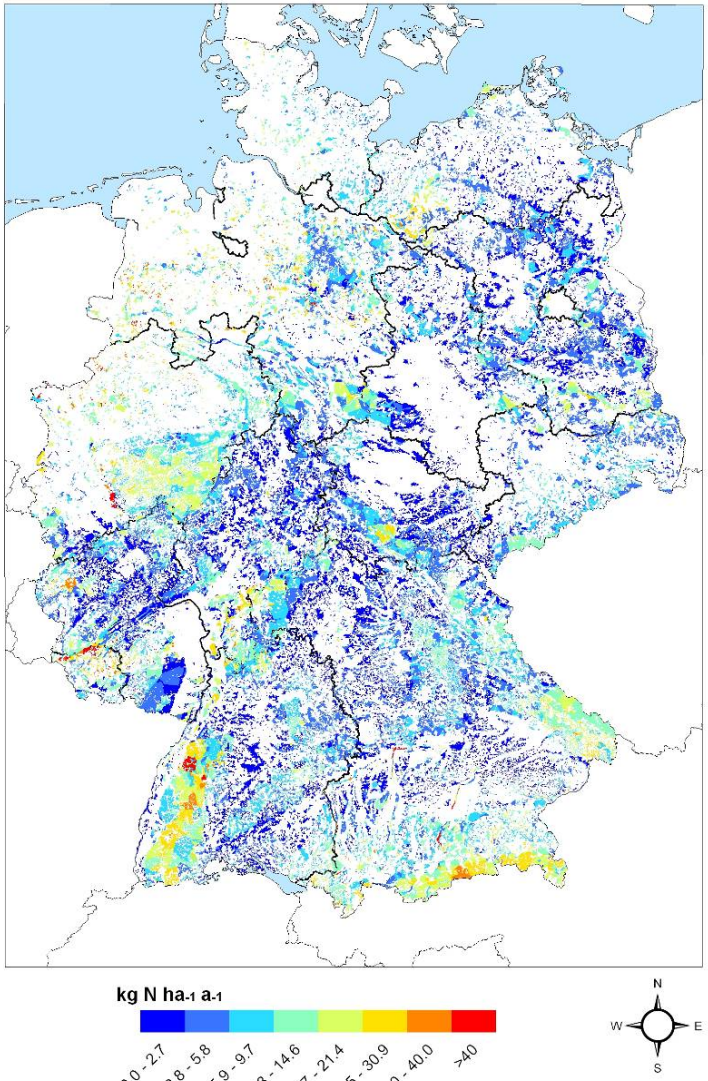


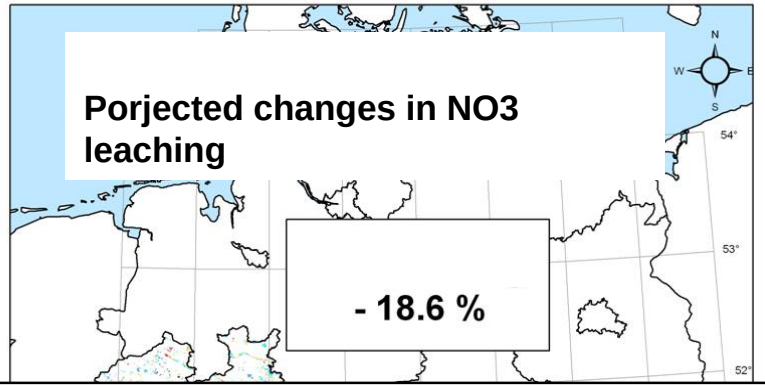
Process based biogeochemical Modell DNDC

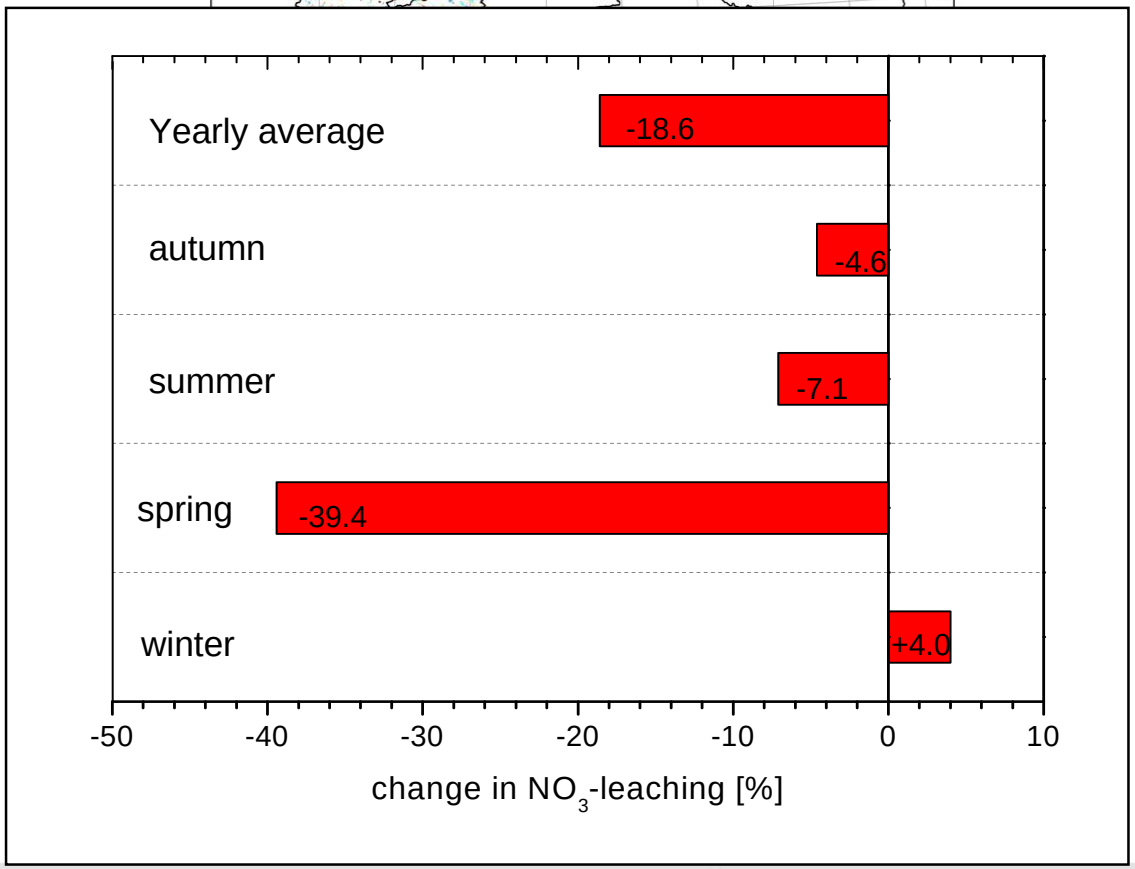


Model application – nitrate leaching at regional scale / Germany

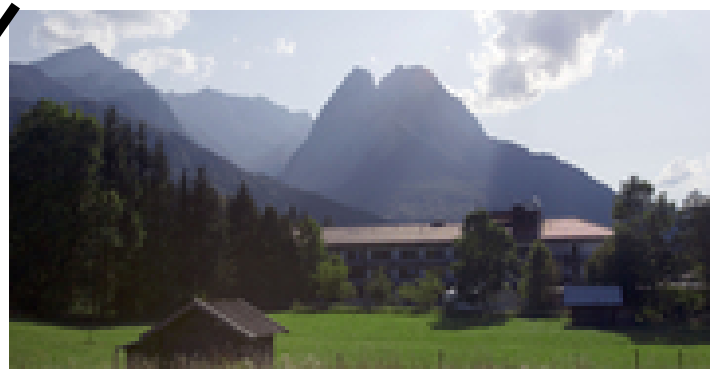
NO_3 Leaching







Tank you for your attention



Garmisch-Partenkirchen