

Biosphere-atmosphere exchange on site and regional scales in China

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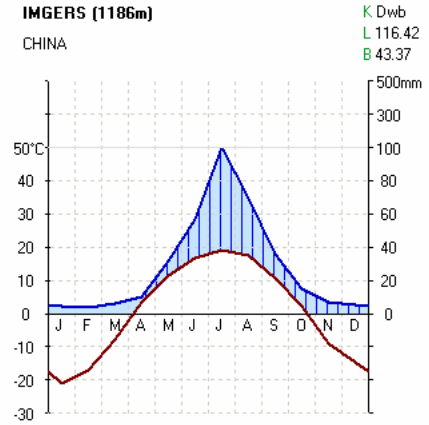
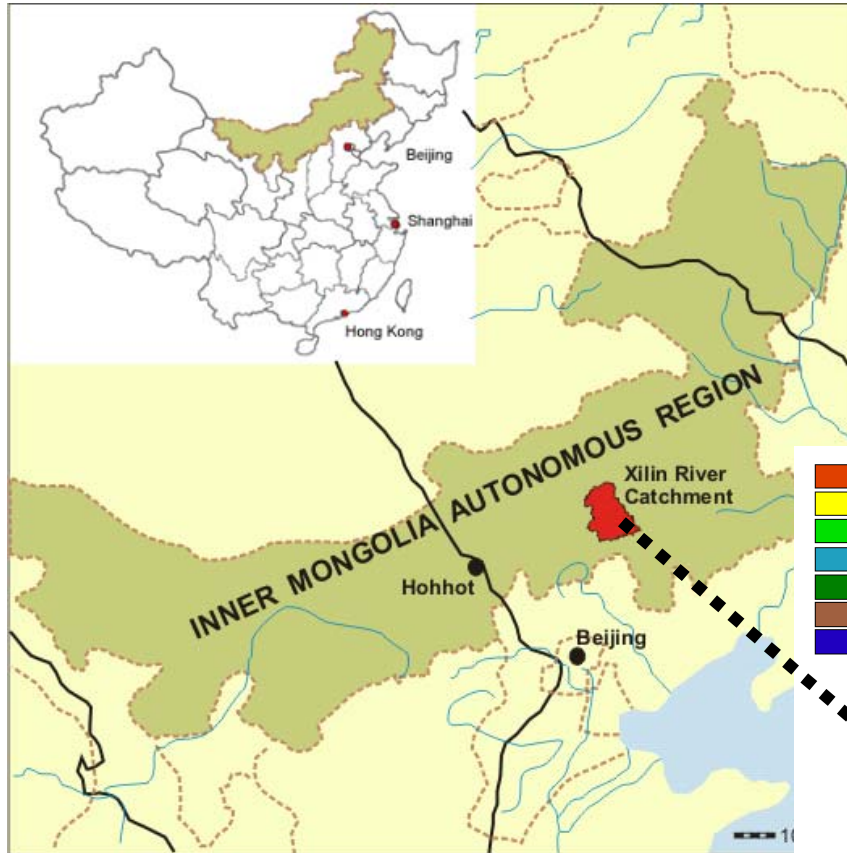
Garmisch-Partenkirchen
Germany

Helmholtz Association of German Research Centres



Helmholtz Association = 15 centres; 24,000 staff

Location of the study region

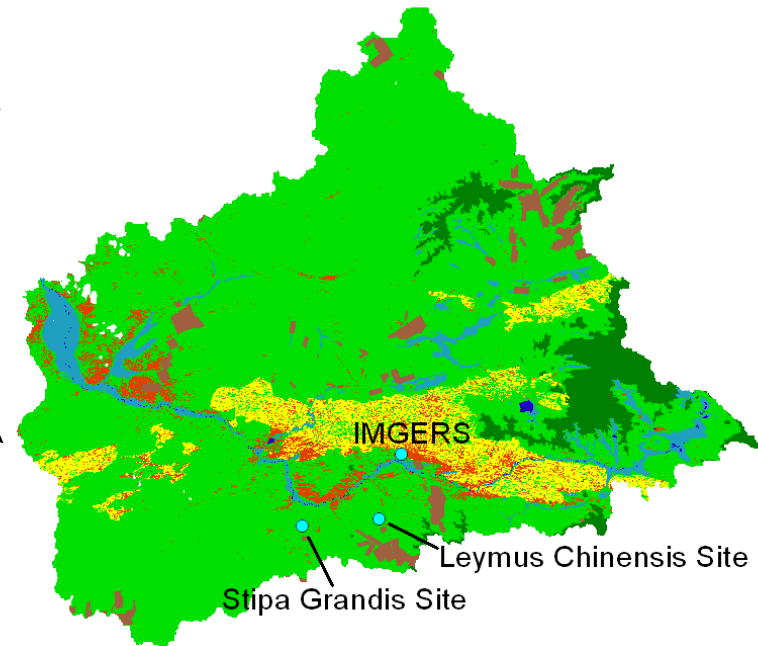


	Precipitation [mm]
Mean	343.4
2003	371.3
2004	324.6
2005	166.1

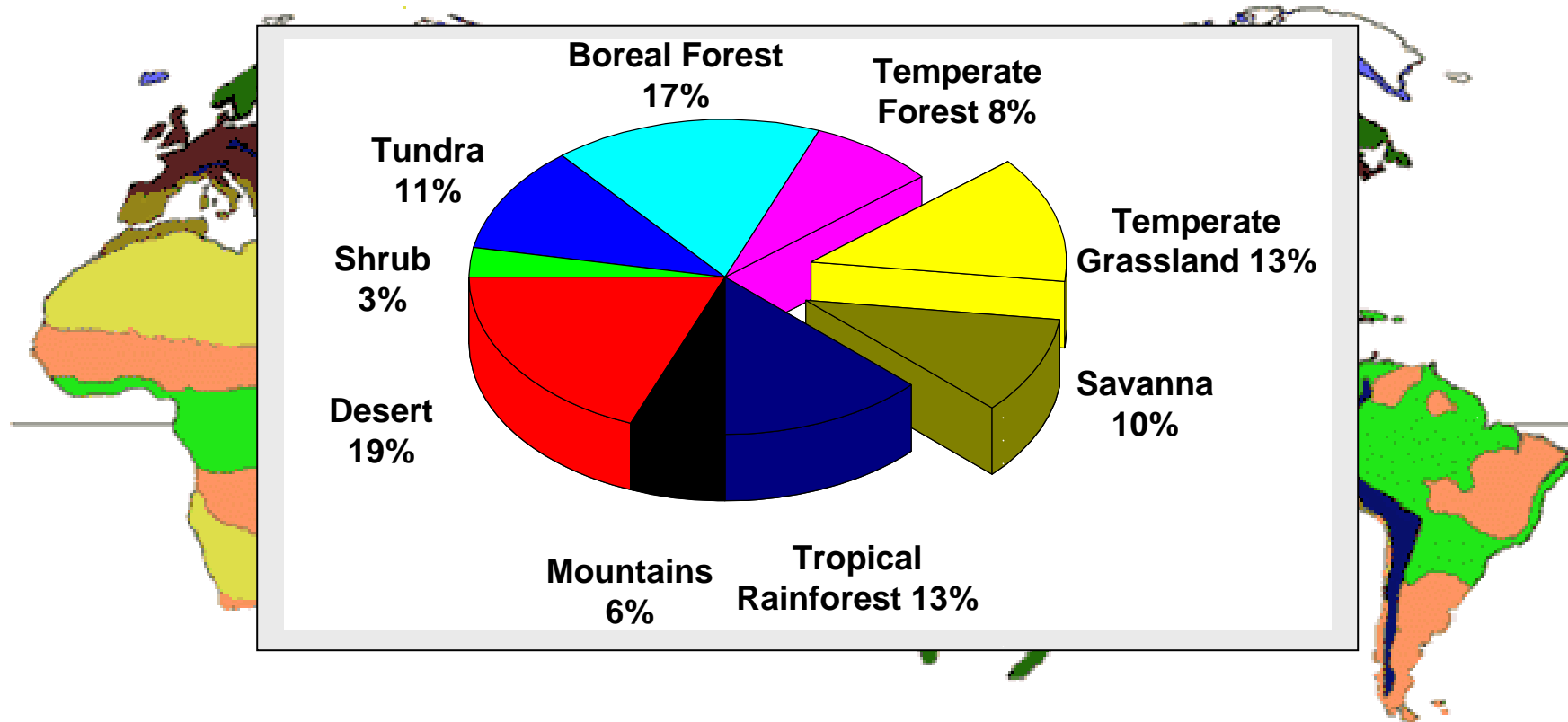
- Bare Soil
- Sand Dunes
- Steppe
- Marshland/Water
- Mountain Meadow
- Arable Land
- Water



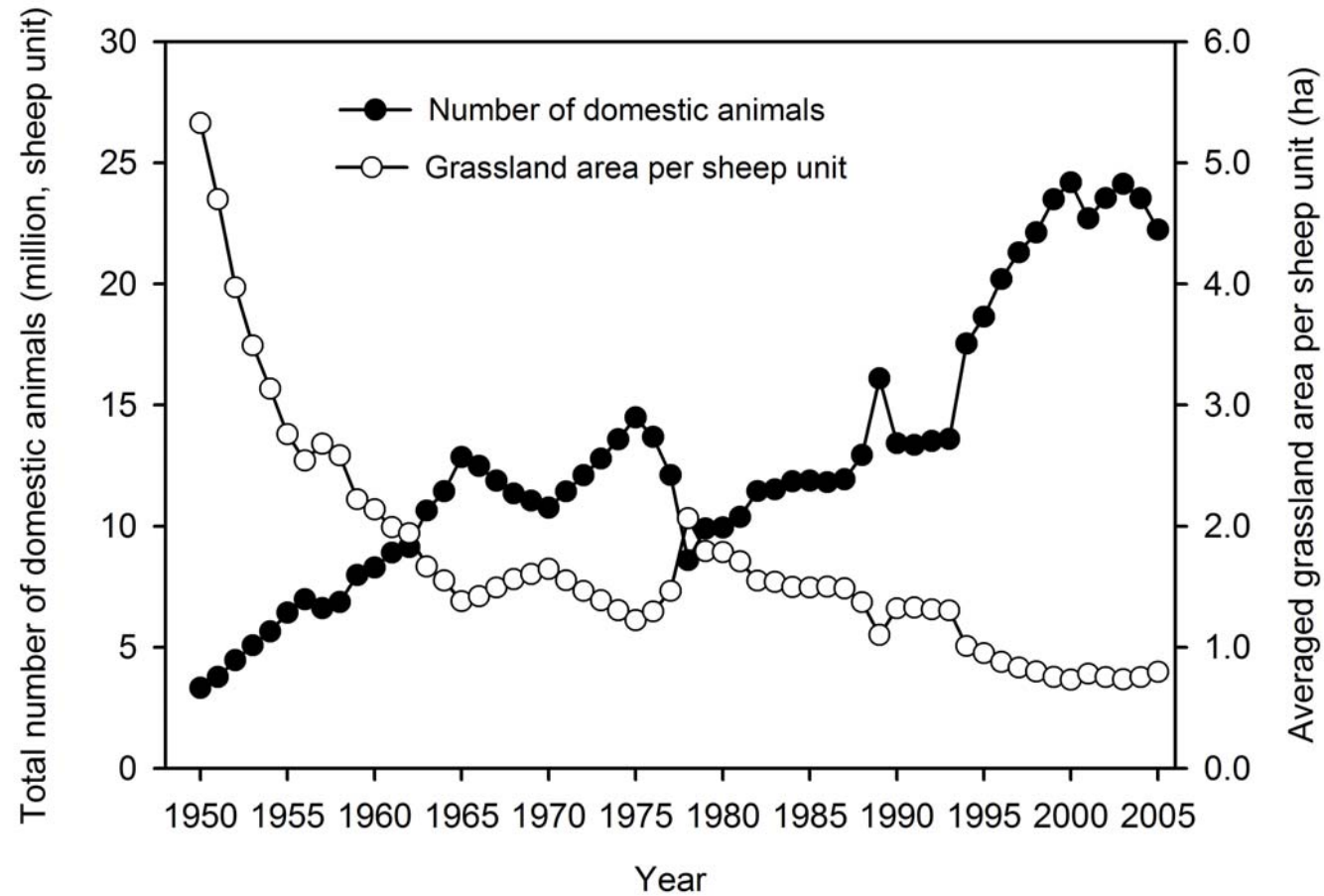
IMGERS = Inner Mongolia Grassland Research Station



Global importance of the biome type „grassland“



Grazing pressure and degradation



Intact steppe in Inner Mongolia, PR China



Problem: Overgrazing by sheep and goats



Result: floristic composition changes



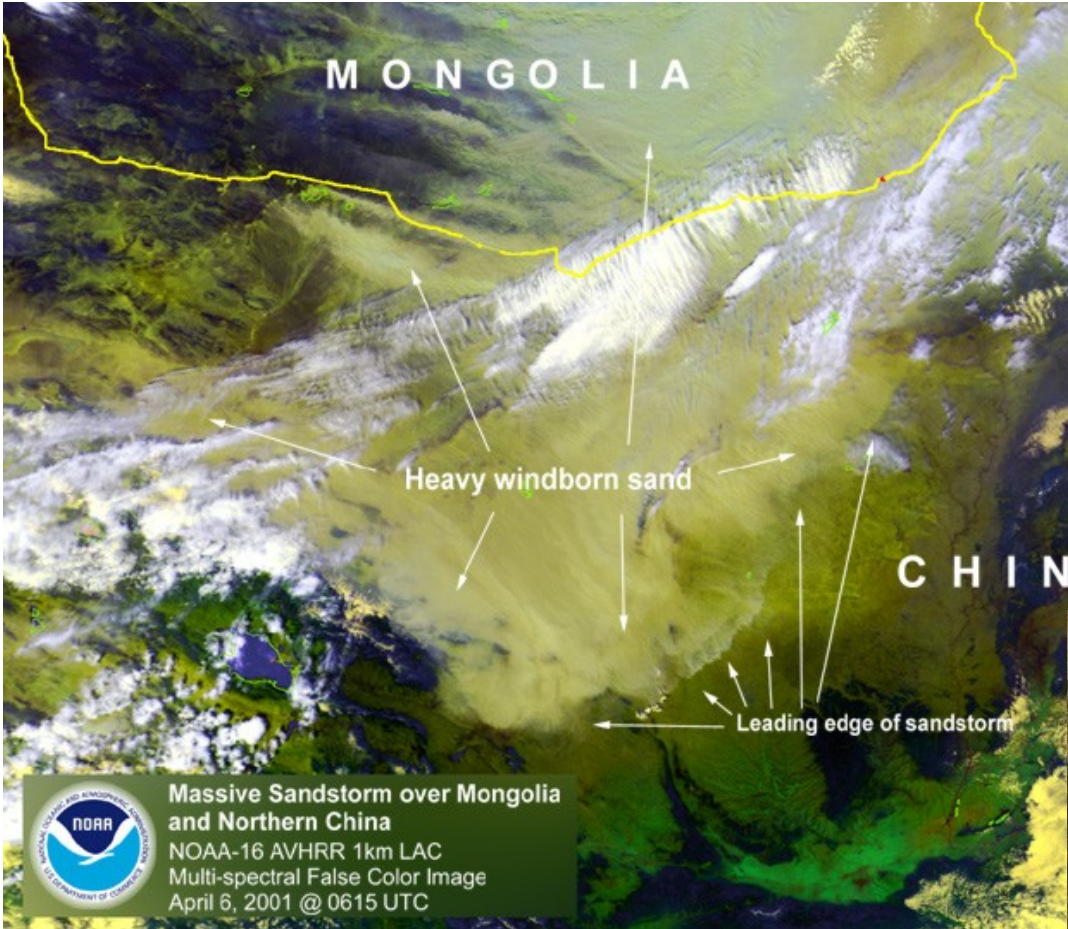
Result: reduction of plant cover



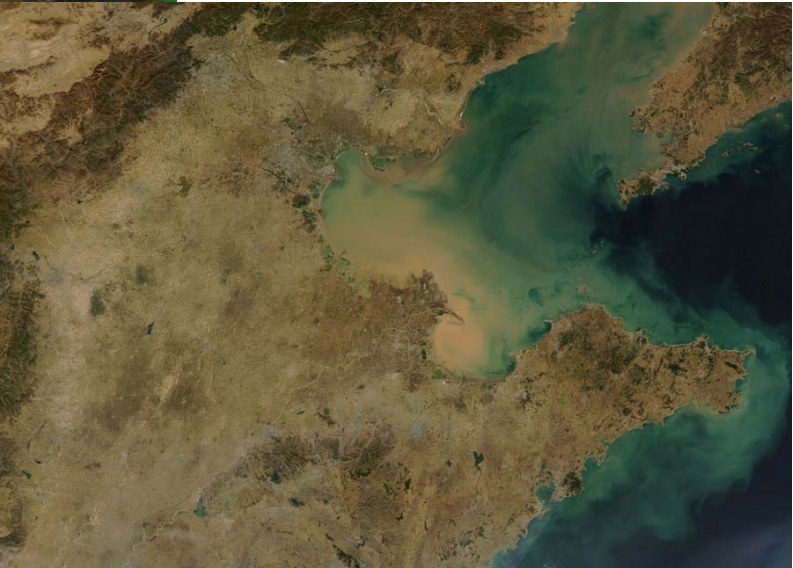
Result: Enhanced water erosion



Large scale implications of steppe degradation



Sand storm in Beijing



Wind erosion = Sand storms

Water erosion

An Interdisciplinary Sino-German Research Project on Effects of Grazing on Matter Fluxes in Grasslands of Inner Mongolia (MAGIM)



Funding: DFG, NSFC

German Speaker: PD Dr. Klaus Butterbach-Bahl

German Co-Speaker: Prof. Dr. Hans-Georg Frede

Chinese Speaker: Prof. Dr. Xingguo Han

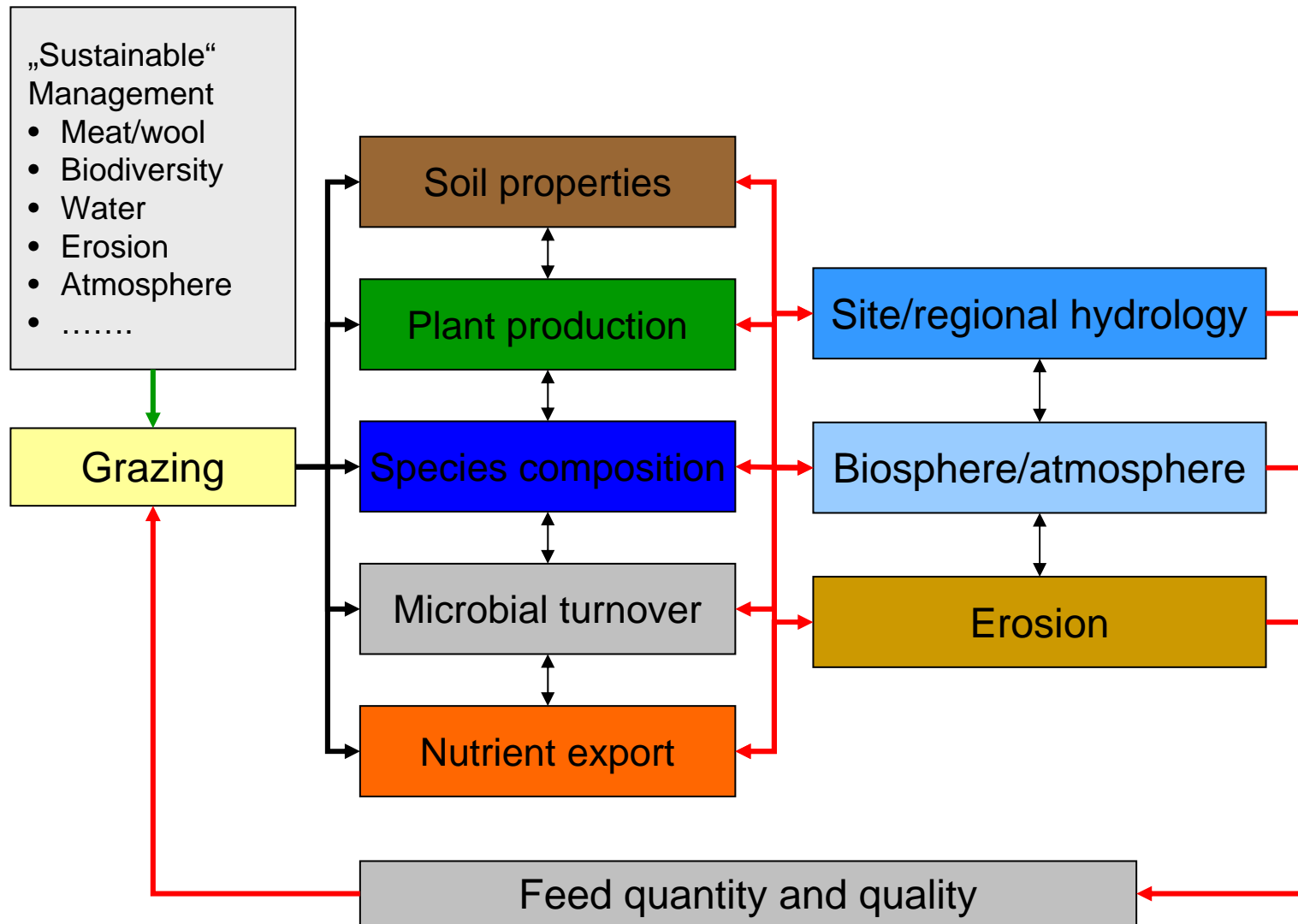
German partner institutions:

- Research Center Karlsruhe
- Universities
 - Dresden (TUD)
 - Gießen (JLU)
 - Kiel (CAU)
 - Munich (TUM)
- ZALF
- German Weather Service

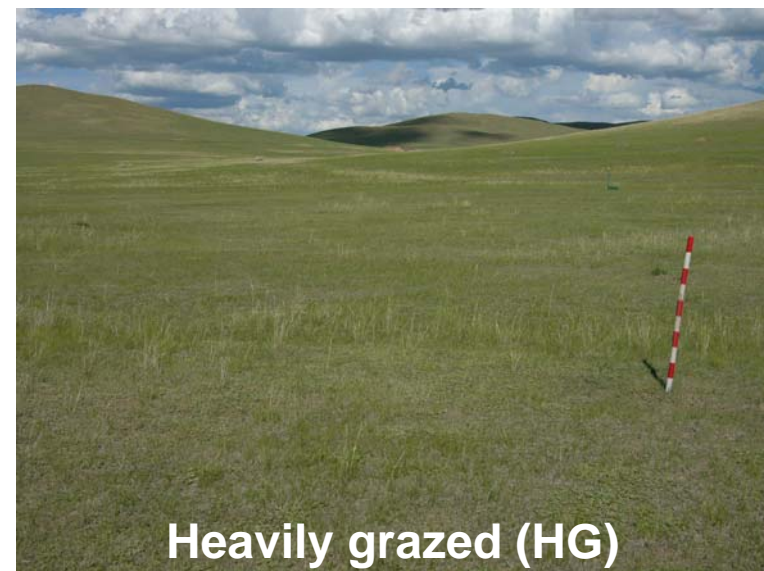
Chinese partner institutions:

- Institute of Botany (CAS)
- Institute of Atmospheric Physics (CAS)
- Institute of Soil Science (CAS)
- China Agricultural University
- Chinese Academy of Agricultural Sciences (CAAS)
- Chinese Meteorological Administration

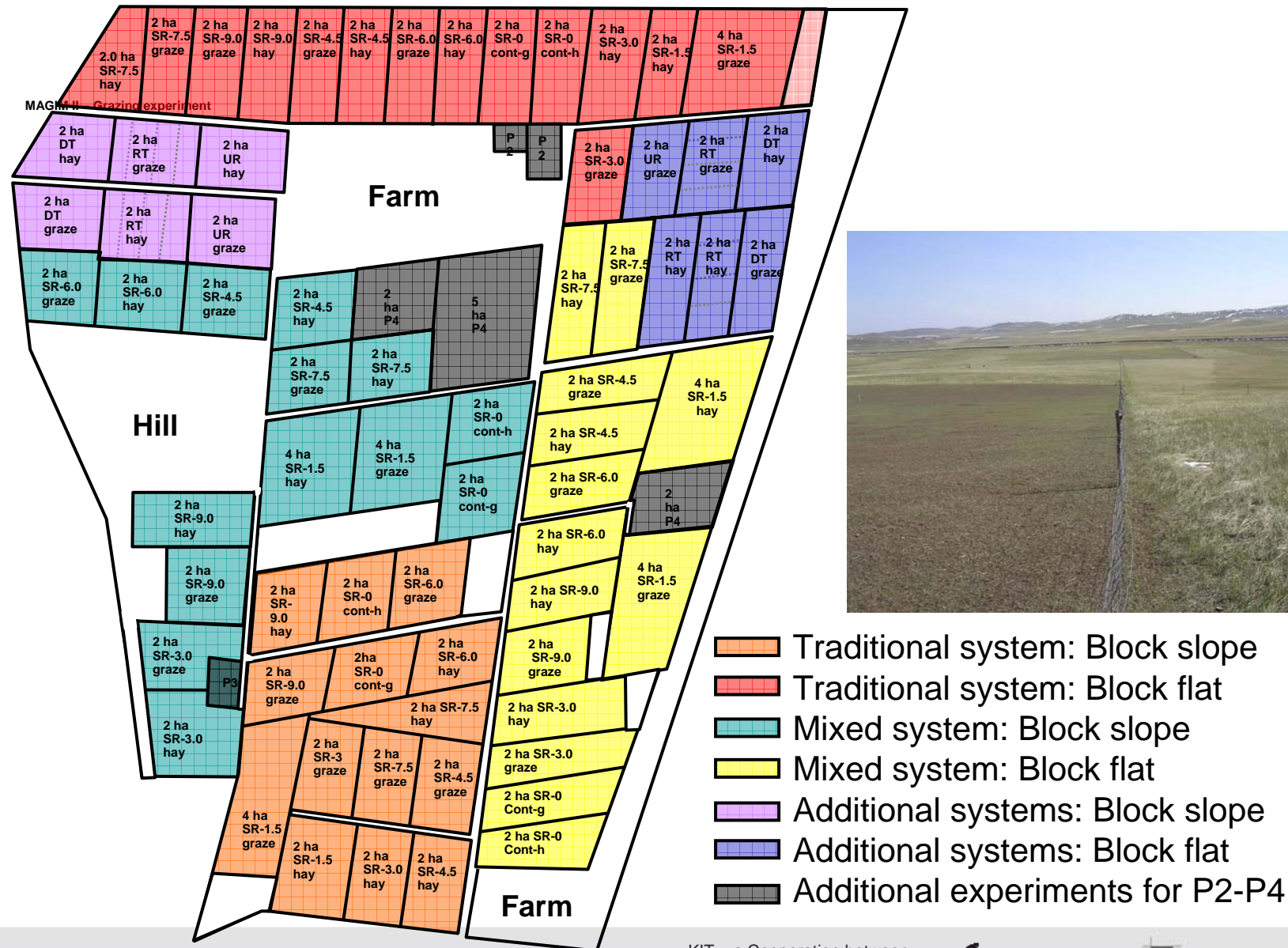
Grazing effects



Experimental sites in Inner Mongolia



Joint experiments – Grazing management

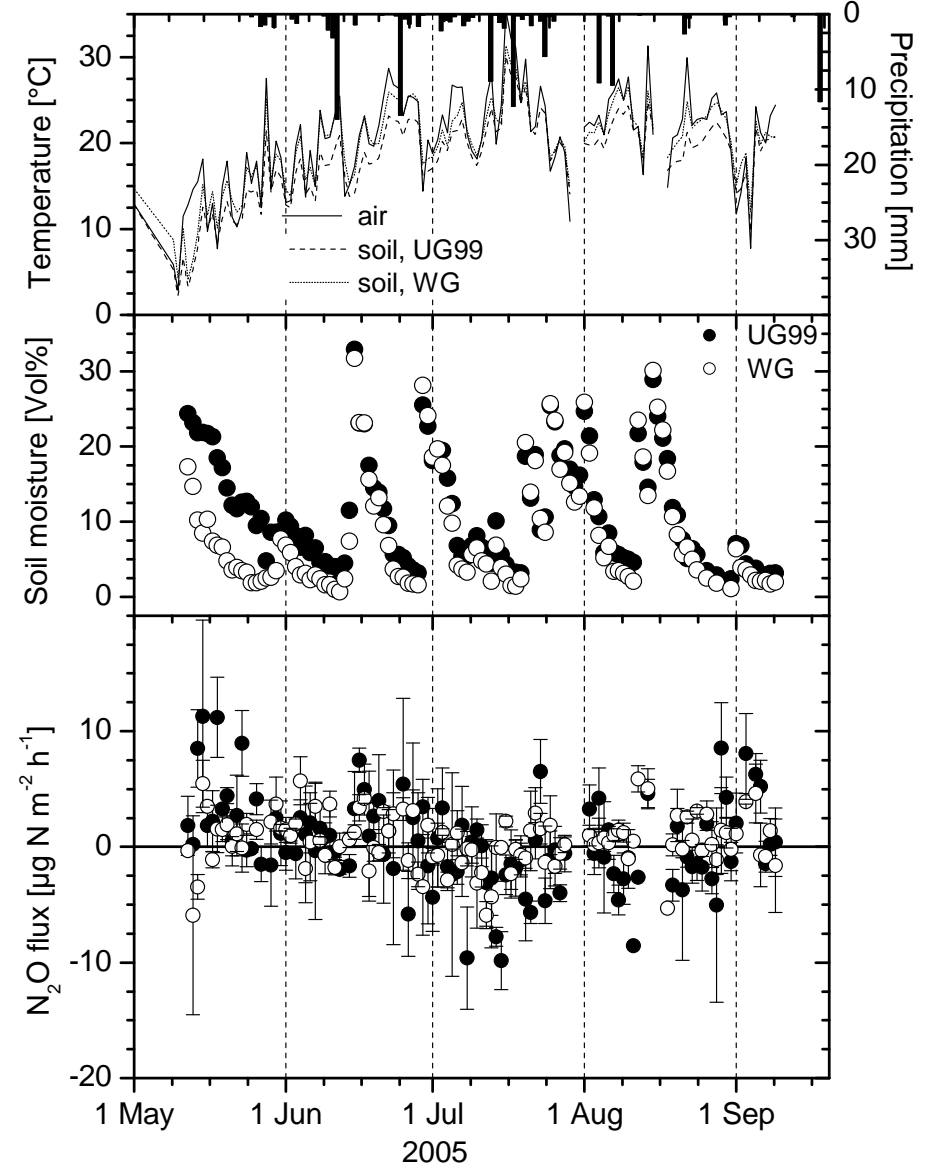
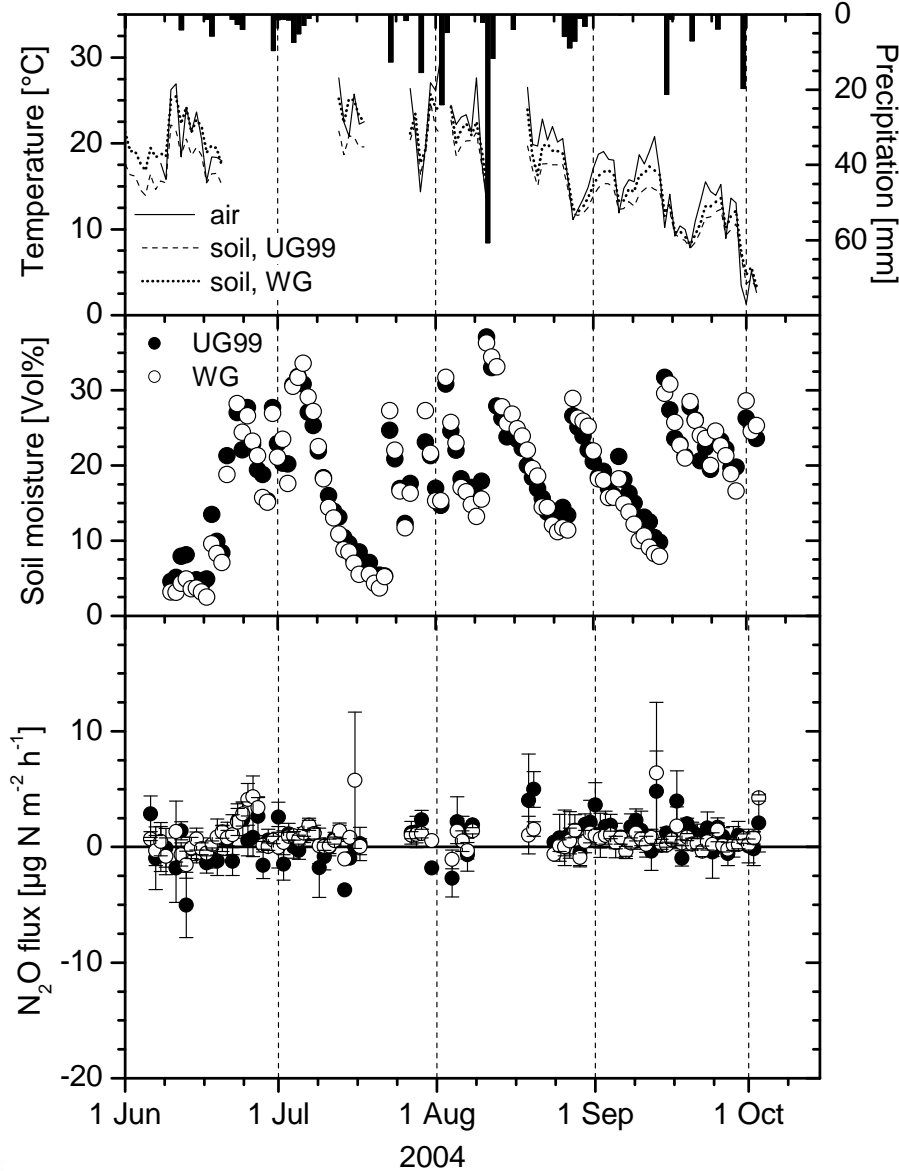


Automated and manual chamber measurements



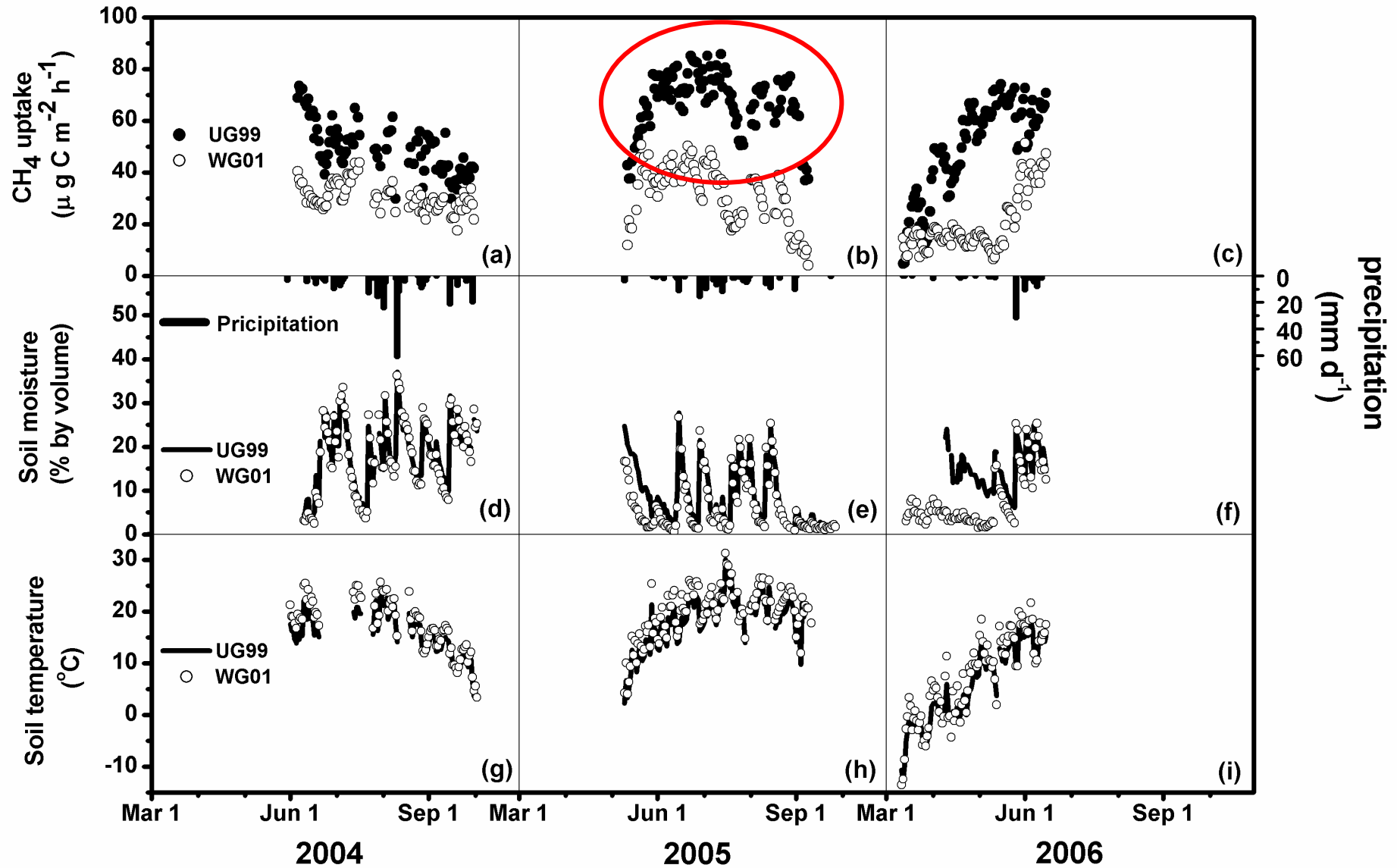
No significant grazing effect on N₂O fluxes

Holst et al. 2007, *Ecosystems* 10, 623–634



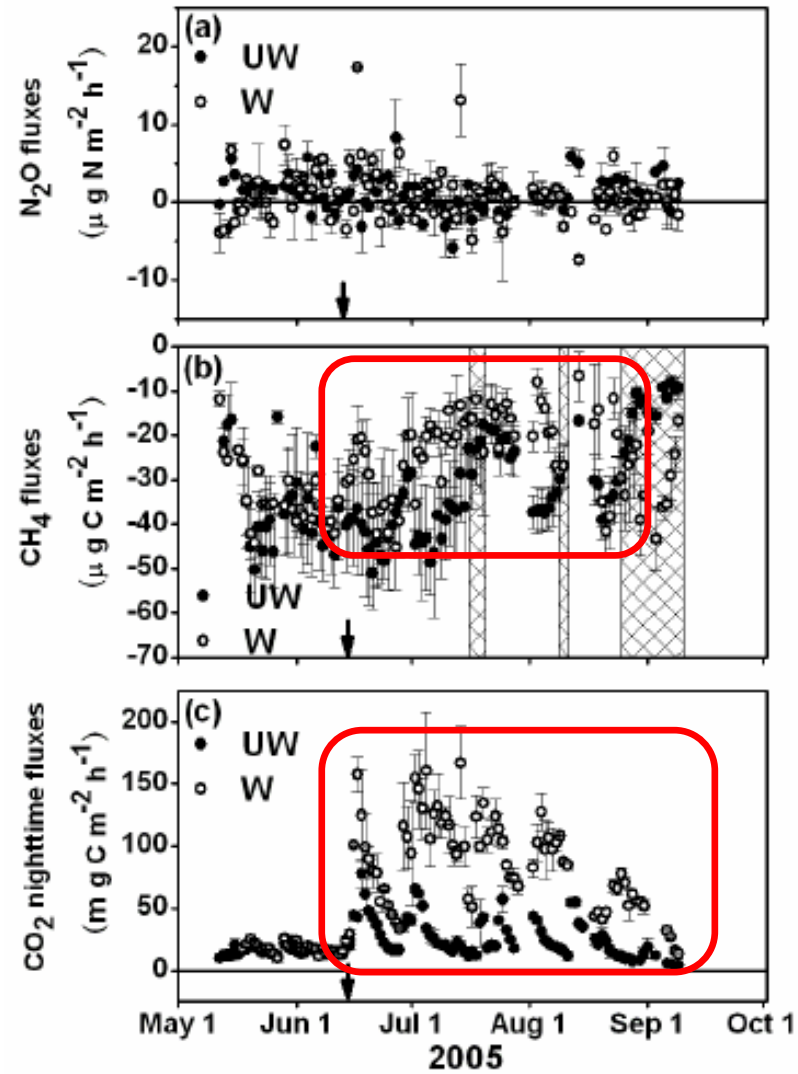
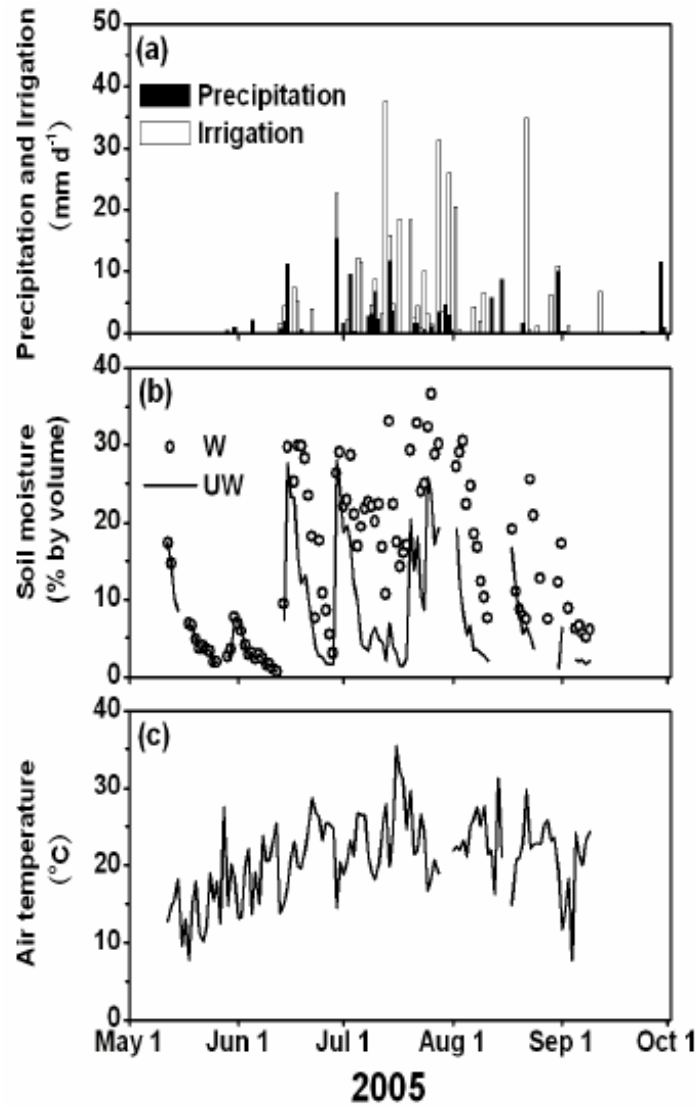
Reduction of CH₄ uptake by grazing/trampling

Liu et al. 2007, *Atmospheric Environment* 41, 5948–5958



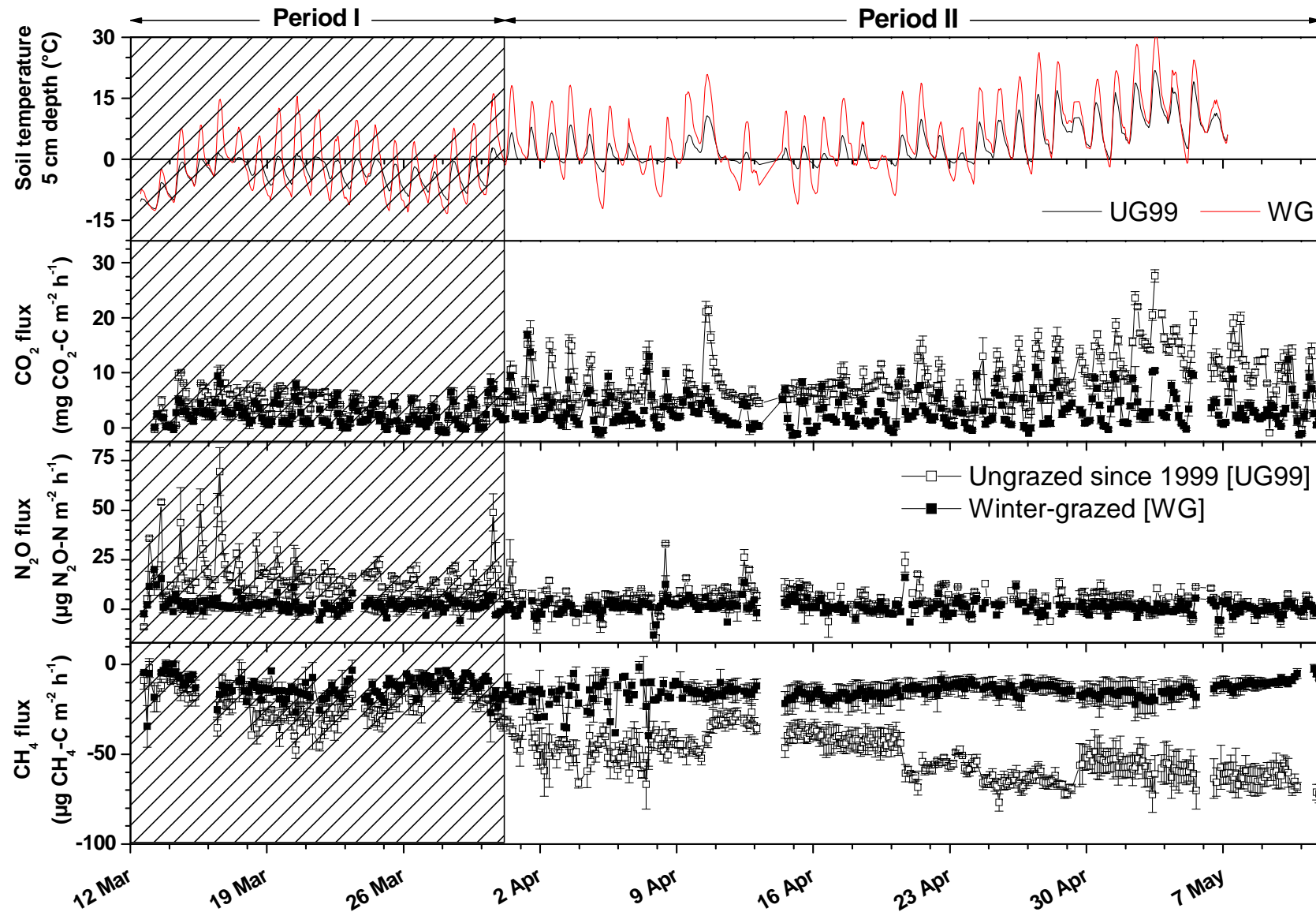
Significant effects of watering on CO₂ and CH₄ fluxes

Liu et al. 2008, *Advances in Atmospheric Sciences* 25, 748–756



Significantly enhanced N₂O fluxes during thawing of the soil

Holst et al. 2008, *Plant Soil* 308, 105–117



Sheepfolds: Large point sources of N₂O-Emissions

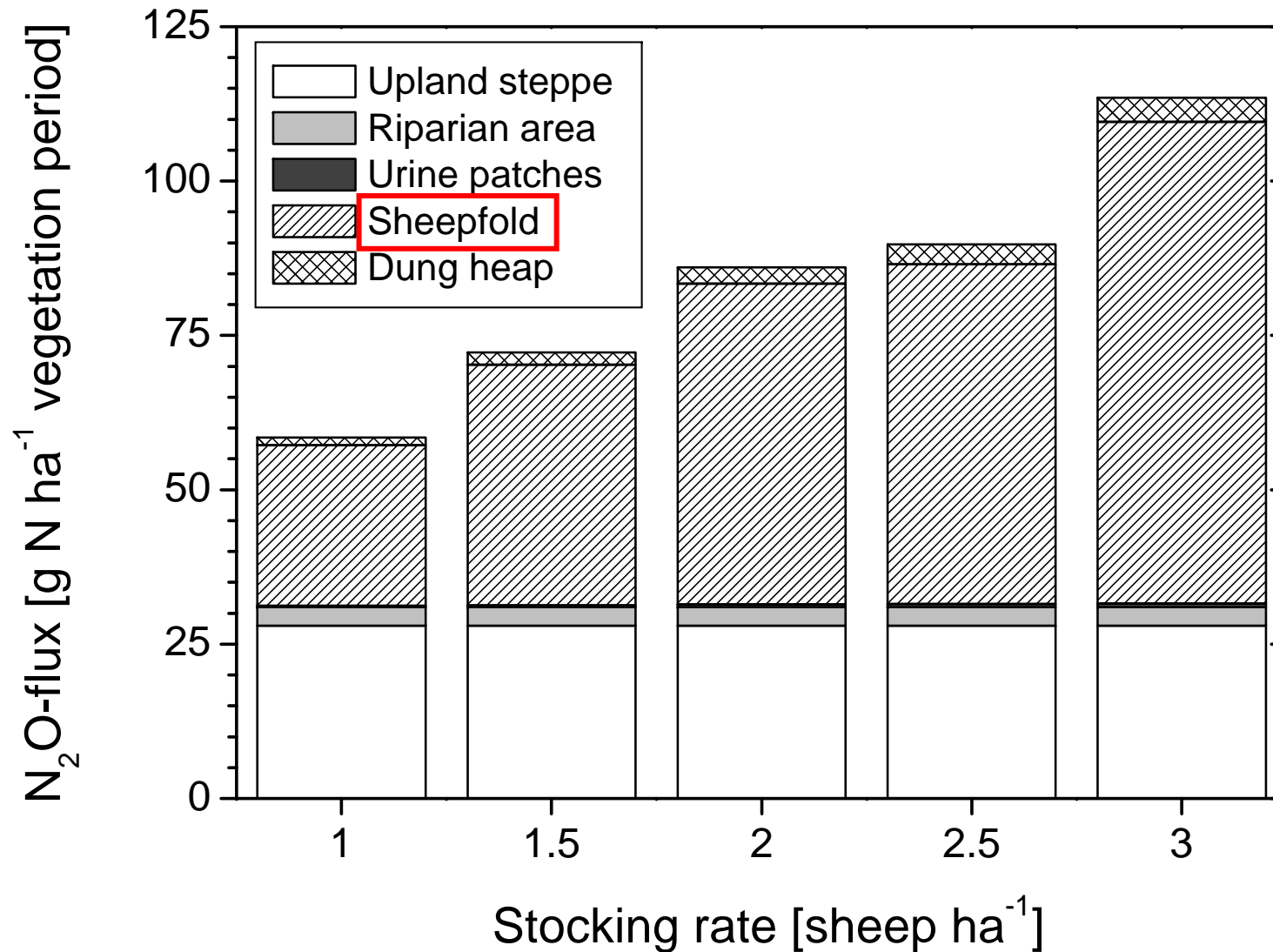
Holst et al. 2007, *Plant Soil* 296, 209–226



Precipitation
(mm)

Contribution of point sources to regional N₂O emissions

Holst et al. 2007, *Plant Soil* 296, 209–226



Airborne measurements on regional scale

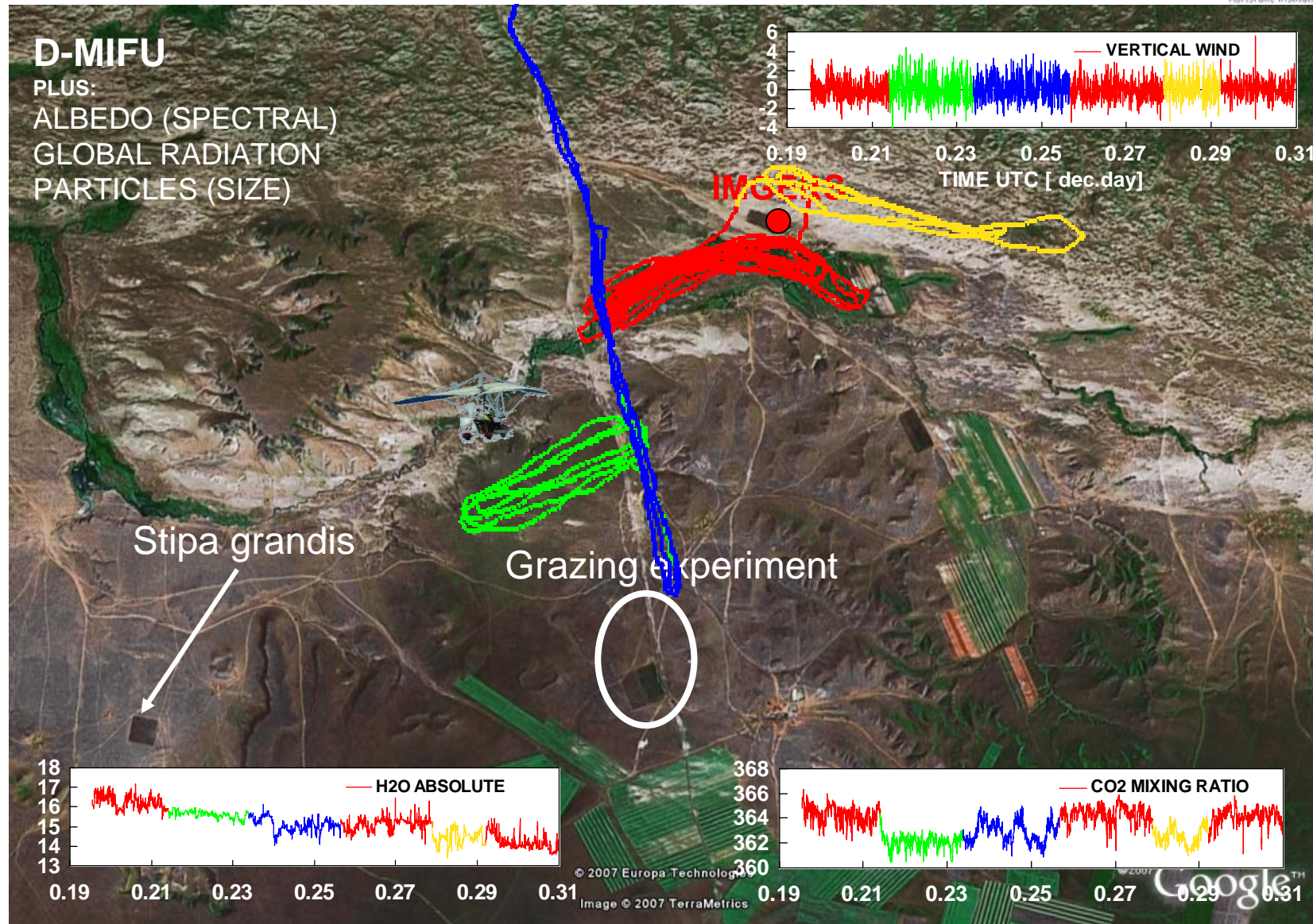


Objectives:

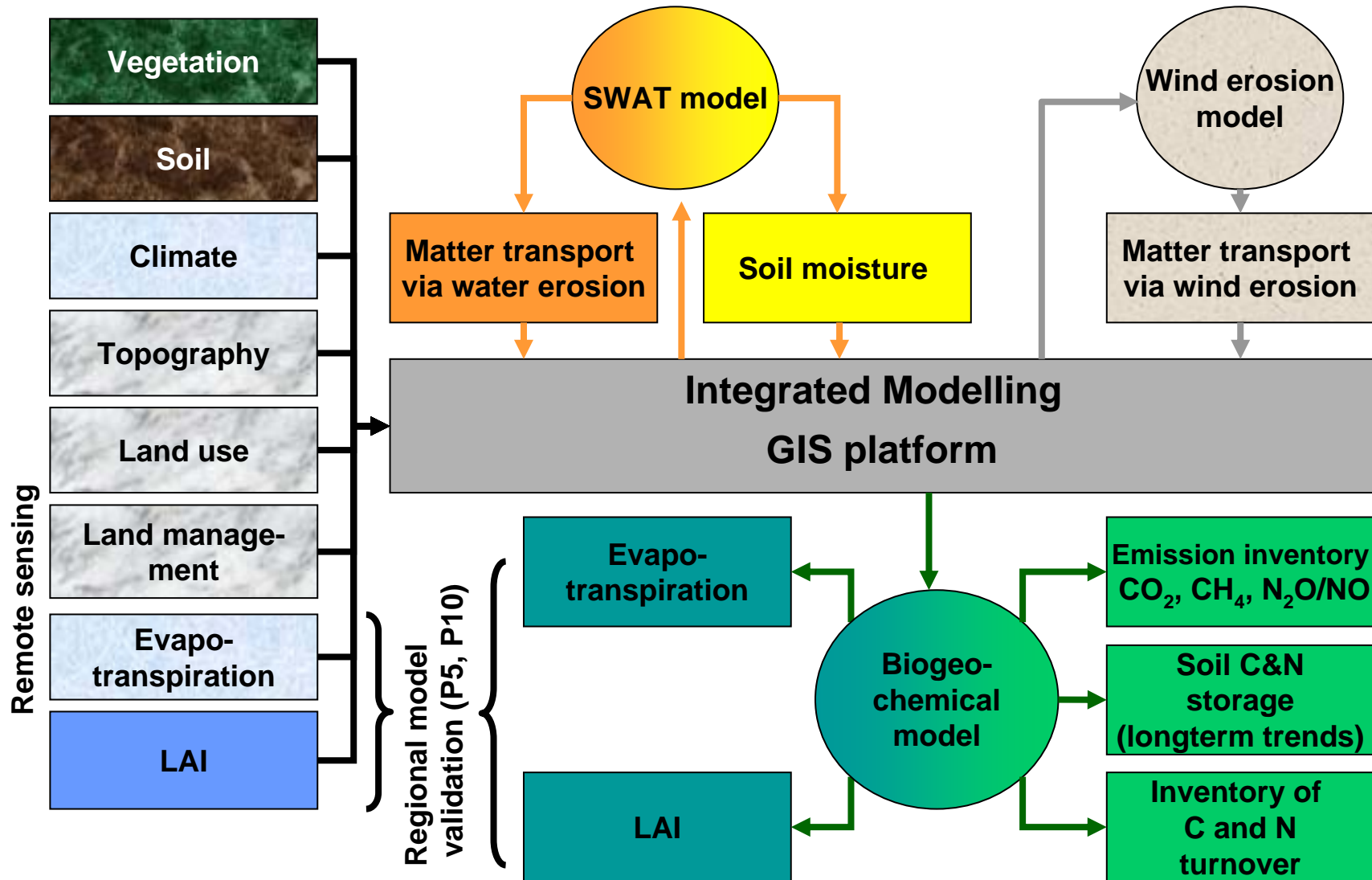
- Fluxes of CO₂/ H₂O vapour/ energy at landscape scale
- Spatial patterns of soil temperature/ soil moisture
- Spatial patterns of surface roughness

→ Validation datasets on a regional scale

Airborne measurements on regional scale



Regionalisation of C and N matter fluxes



Future research needs in semi-arid regions of China



Effects of

- land-use change (grassland -> agriculture)
- land management (e.g., irrigation, fertilization)
- future climate change

on C and N cycling and GHG exchange