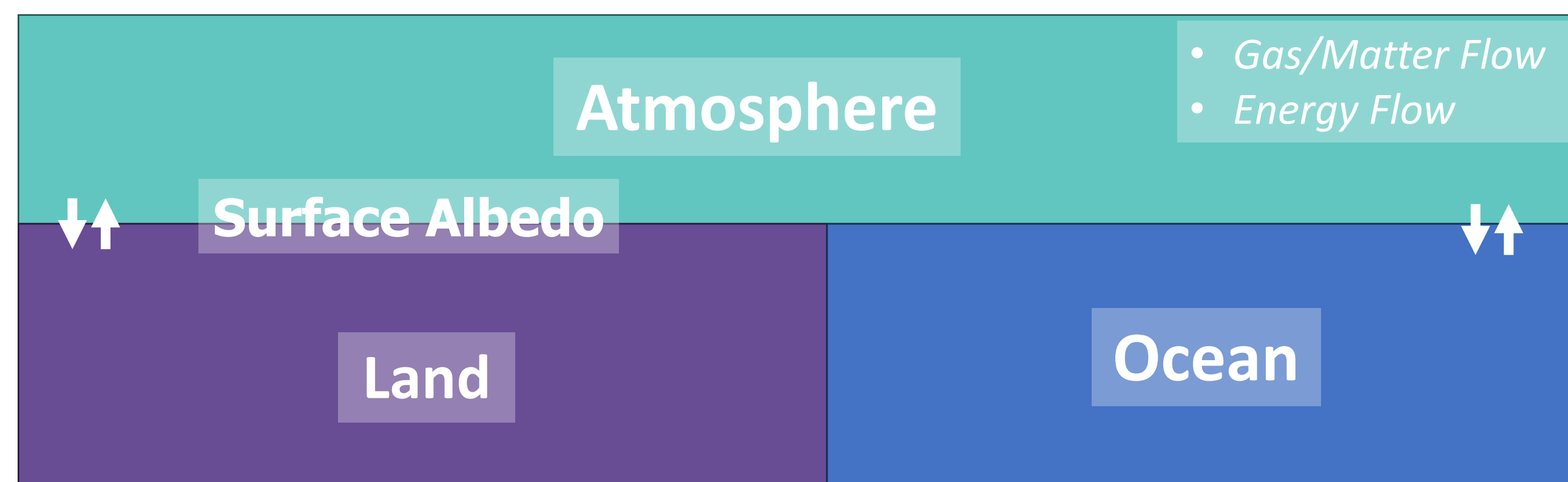


Forcing

- Anthropogenic emissions
- Land Use and Land-cover change
- Radiative forcing (including volcanic aerosols (RF_{volc}) and solar irradiance (RF_{solar}))



Species

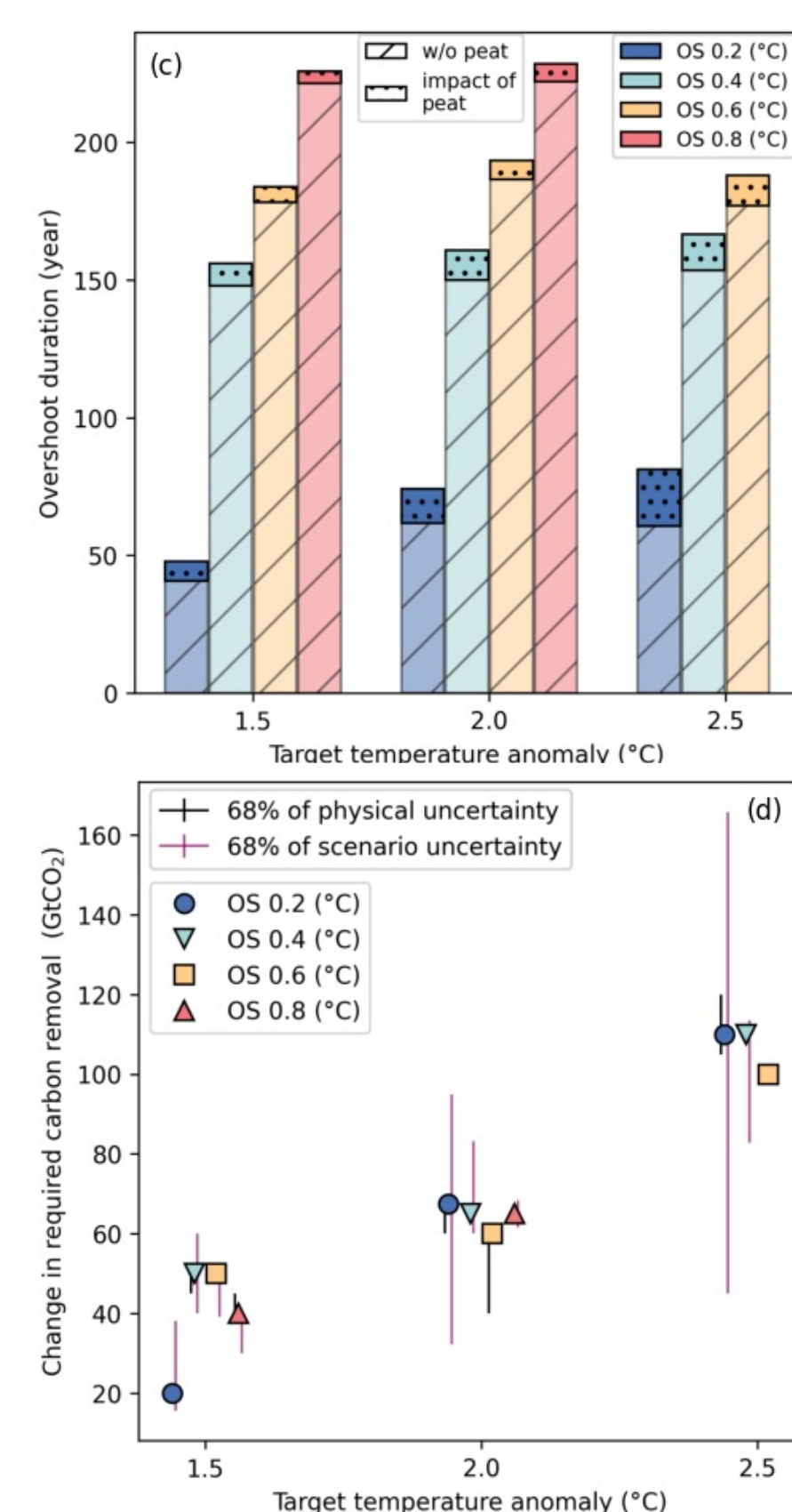
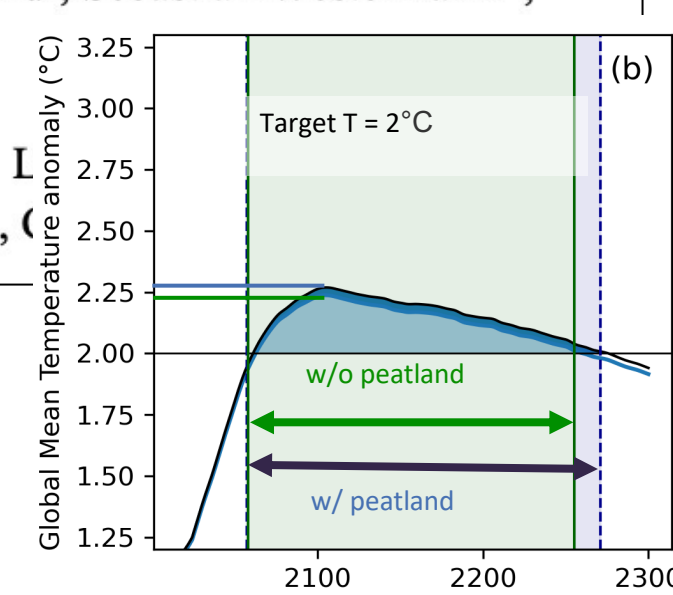
- CO_2
- CH_4
- N_2O
- Ozone
- Aerosols
- Hologenetic compounds

OSCAR-Peat Northern peatlands carbon dynamics

Warming of Northern Peatlands Increases the Global Temperature Overshoot Challenge

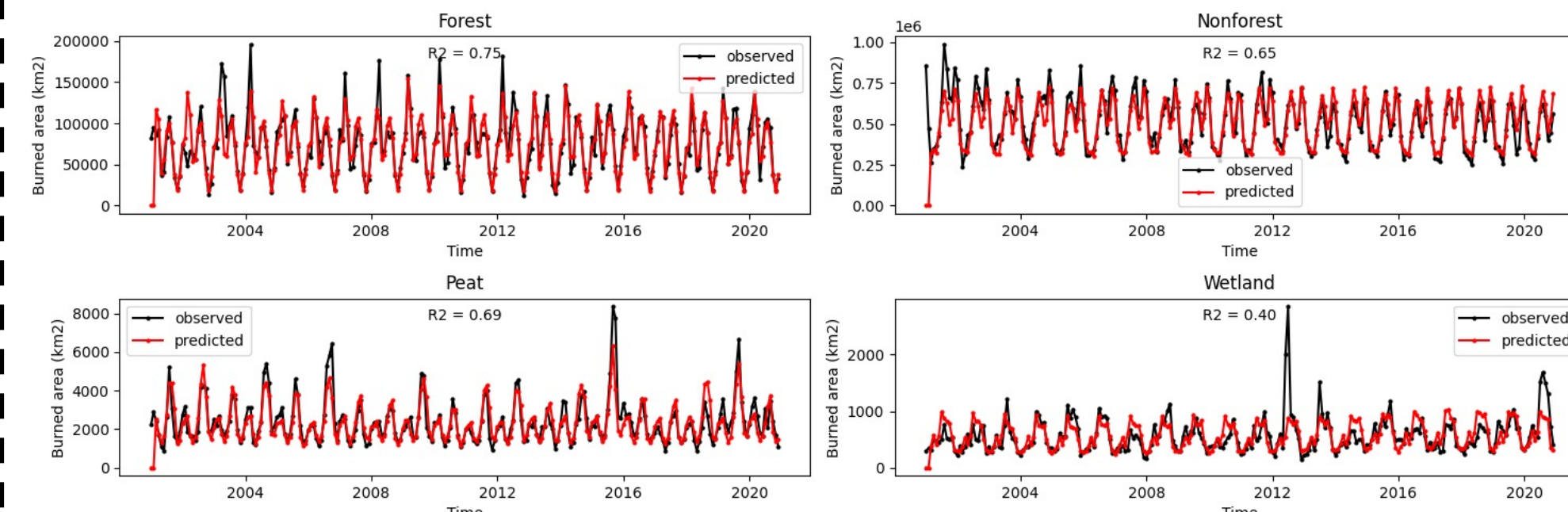
Biqing Zhu^{1,2,*}, Chunjing Qiu^{1,4,2*}, Thomas Gasser¹, Philippe Ciais², Robin D. Lamboll⁵, Ashley Ballantyne^{2,6}, Jinfeng Chang⁷, Nitin Chaudhary^{8,9}, Angela V. Gallego-Sala¹⁰, Bertrand Guenet¹¹, Joseph Holden¹², Fortunat Joos^{13,14}, Thomas Kleinen¹⁵, Min Jung Kwon^{2,16}, Irina Melnikova^{2,17}, Jurek Müller^{13,14}, Susan Page¹⁸, Elodie Salmon², Carl-Friedrich Schleussner^{19,20,1}, Guy Schurgers²¹, Gaurav P. Shrivastav¹, Narasinha J. Shurpali²², Katsumasa Tanaka^{2,17}, David Wärlind⁸, Sebastian Westermann²³, Yi Xi², Wenxin Zhang^{8,21}, Yuan Zhang^{2,24}, Dan Zhu²⁵

¹International Institute for Applied Systems Analysis (IIASA), 2361
²Laboratoire des Sciences du Climat et de l'Environnement (LSCE), Université Paris-Saclay, 91191 Gif-sur-Yvette, France



Needed: tropical peatland, historical drainage, restoration scenarios

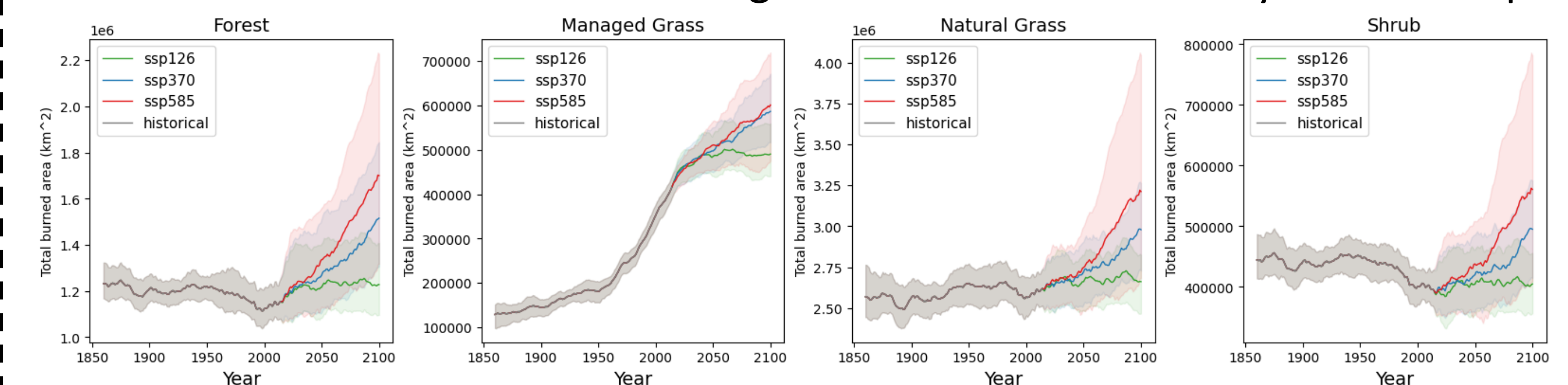
GFED5-based emulation



OSCAR-Fire

Biome specific burnt area

Emulation based on Machine Learning reconstructed fire history and future projections



Under-development: ISIMIP3b-based emulation

Needed: PFT-based estimates, more sensitivity experiments

We need more models!

Needed: detailed cSoil profile, longer scenarios, more sensitivity experiments

Needed: bio-energy crop simulations, more sensitivity experiments

ARTICLES nature geoscience

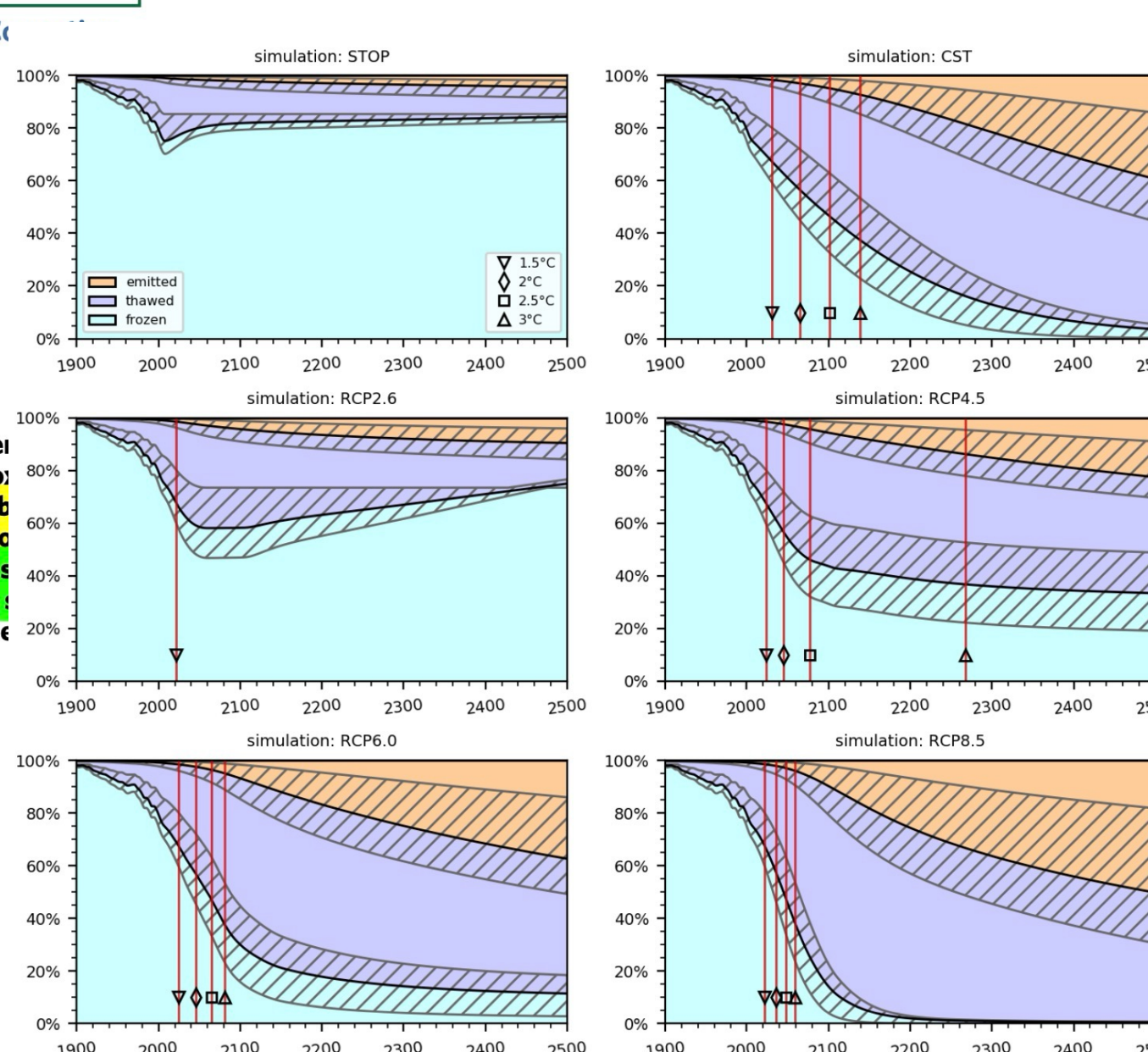
Path-dependent reductions in CO_2 emission budgets caused by permafrost carbon release

T. Gasser^{1*}, M. Kechiar^{1,2}, P. Ciais³, E. J. Burke⁴, T. Kleinen⁵, D. Zhu⁶, Y. Huang³, A. Ekici⁶ and M. Obersteiner¹

Emission budgets are defined as the cumulative amount of anthropogenic CO_2 emission compatible with a global temperature target. The simplicity of the concept has made it attractive to policy-makers, yet it relies on a linear approach to the global carbon-climate system's response to anthropogenic CO_2 emissions. Here we investigate how emission budgets are impacted by the inclusion of CO_2 and CH_4 emissions caused by permafrost thaw, a non-linear and tipping process in the system. We use the compact Earth system model OSCAR v2.2.1, in which parameterizations of permafrost thaw, matter decomposition and CO_2 and CH_4 emission were introduced based on four complex land surface models that represent high-latitude processes. We found that permafrost carbon release makes emission budgets path dependent.

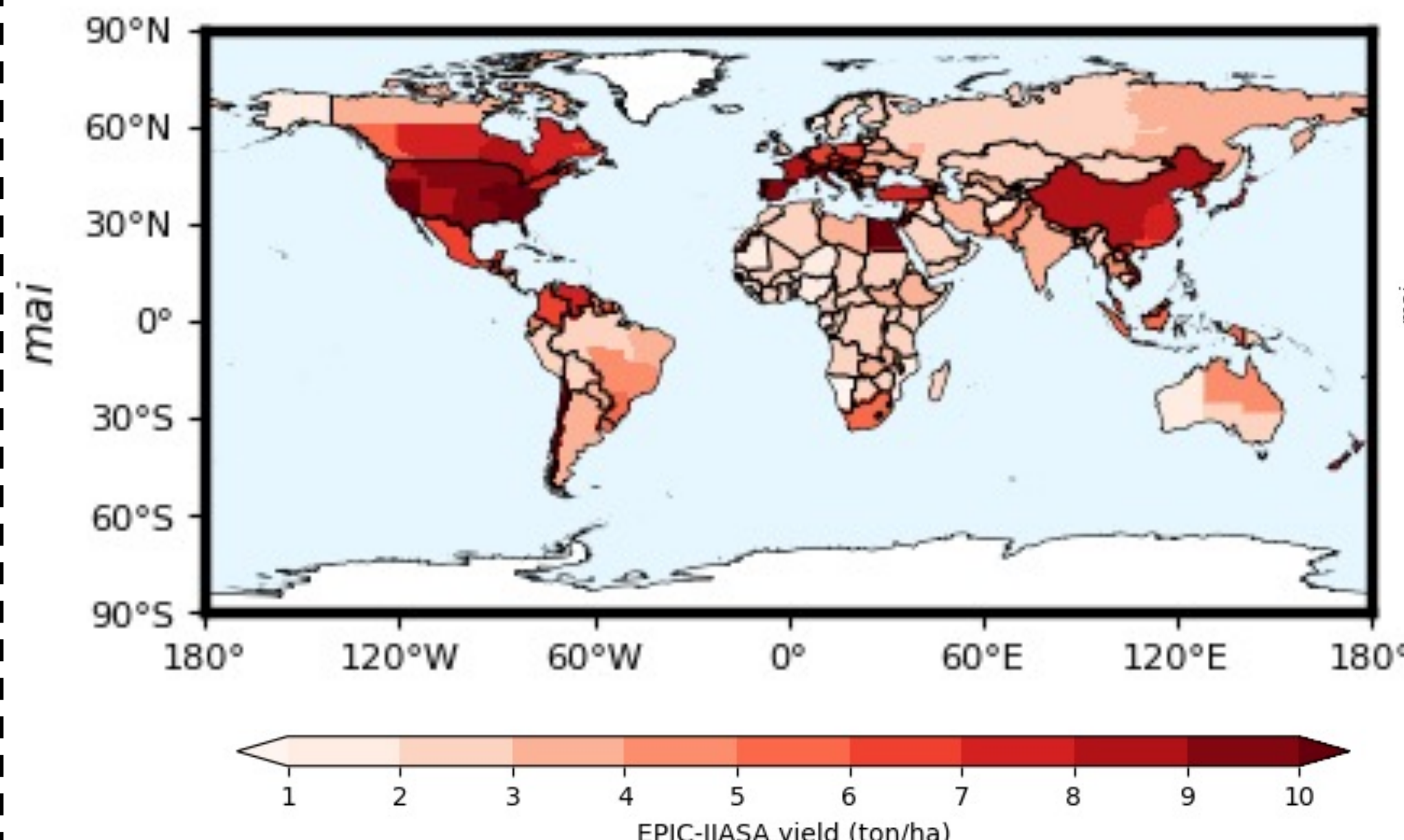
permafrost thaw, soil organic matter decomposition and CO_2 and CH_4 emission

OSCAR-Permafrost

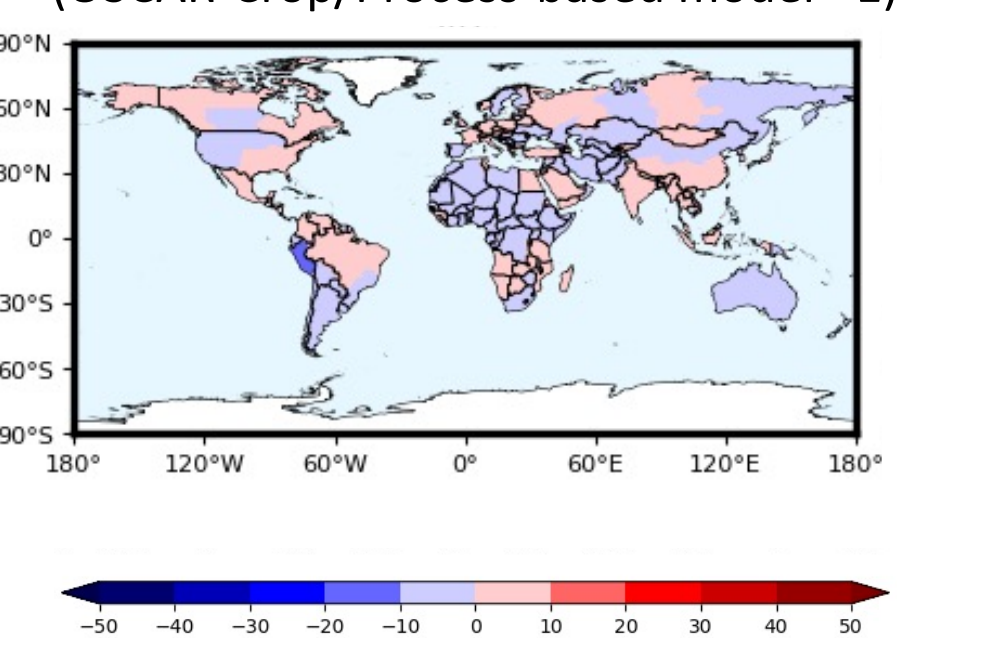


Supplementary Figure 3. Status of initially frozen carbon in the exceedance simulations. Colours

Historical yield, fully-irrigated condition



Validation (OSCAR-Crop/Process-based model - 1)



Crop yield, (crop production, food energy intake, negative emissions related to bioenergy crops)

OSCAR-Crop