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Asian CH₄ fluxes estimated from CTE-CH₄ coupled with TM5-MP

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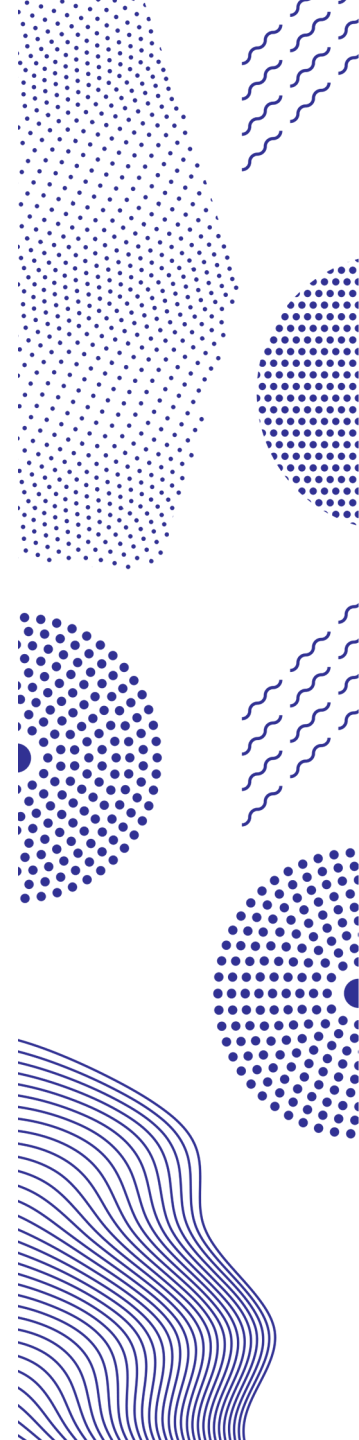
FMI: Aki Tsuruta

22.10.2024 Sara Hyvärinen



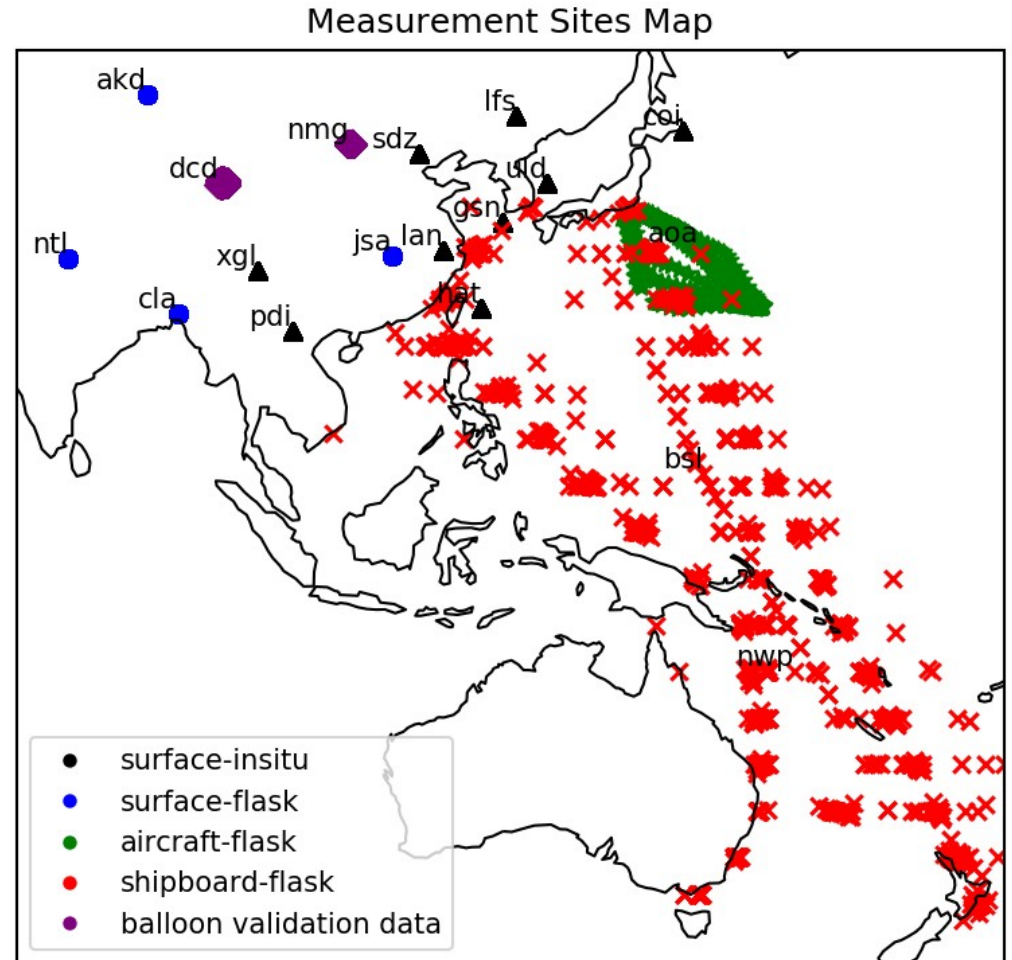
Background

- Study by National Institute for Environmental Studies (NIES), Japan
- National/regional scale Methane Inversion inter-Comparison for the Asian region (MICA).
- Assess the constraints of atmospheric measurements on country-level methane (CH₄) fluxes, in particular the long-term trend in emissions, to support the evaluation of methane emissions in Asian regions (Eastern Asia, Southern Asia, Southeast Asia, and big Asian emitting countries).
- Main focus is on the emissions trends, sectorial anthropogenic and natural emissions, their uncertainties, and the added value of satellite-based XCH₄ observations in constraining methane fluxes



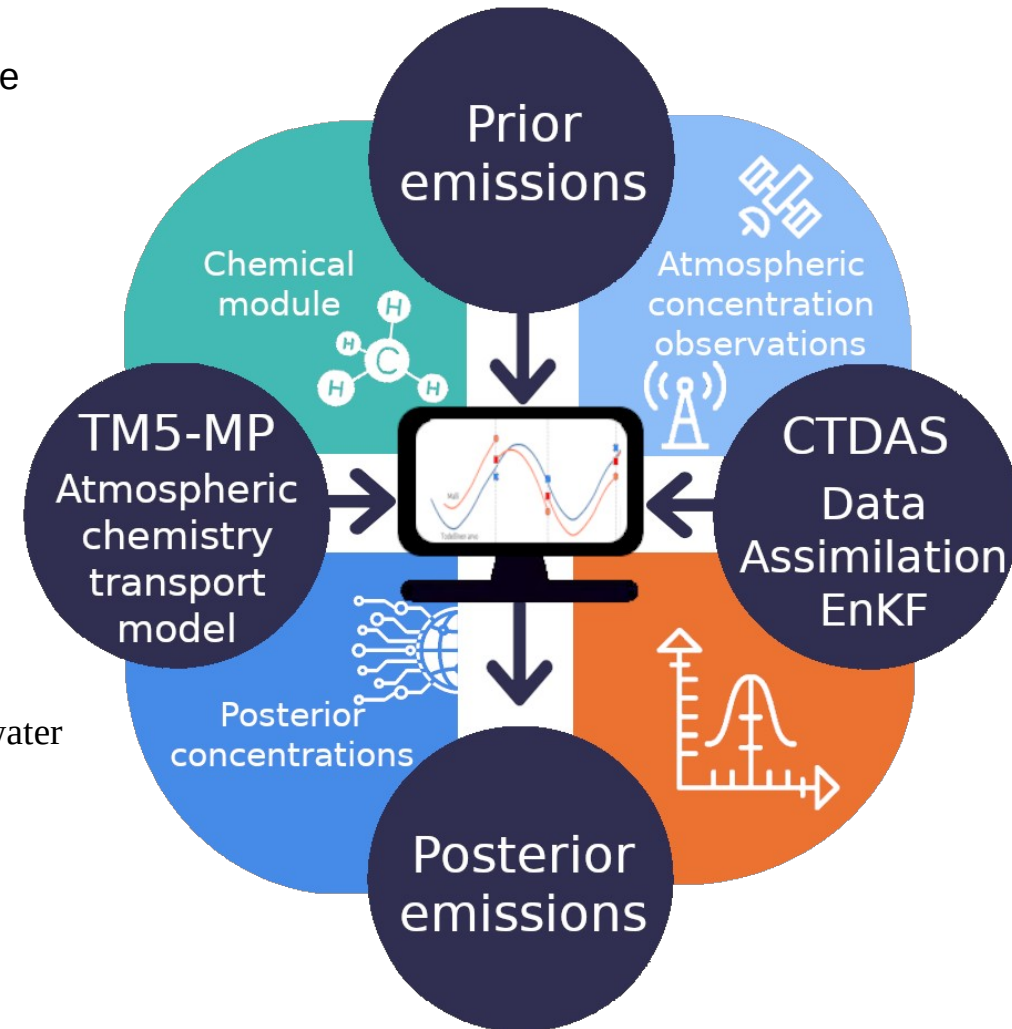
Measurement stations

- New stations from Asia
- Surface-insitu, surface-flask, aircraft-flask, shipboard-flask
- Additional balloon validation data



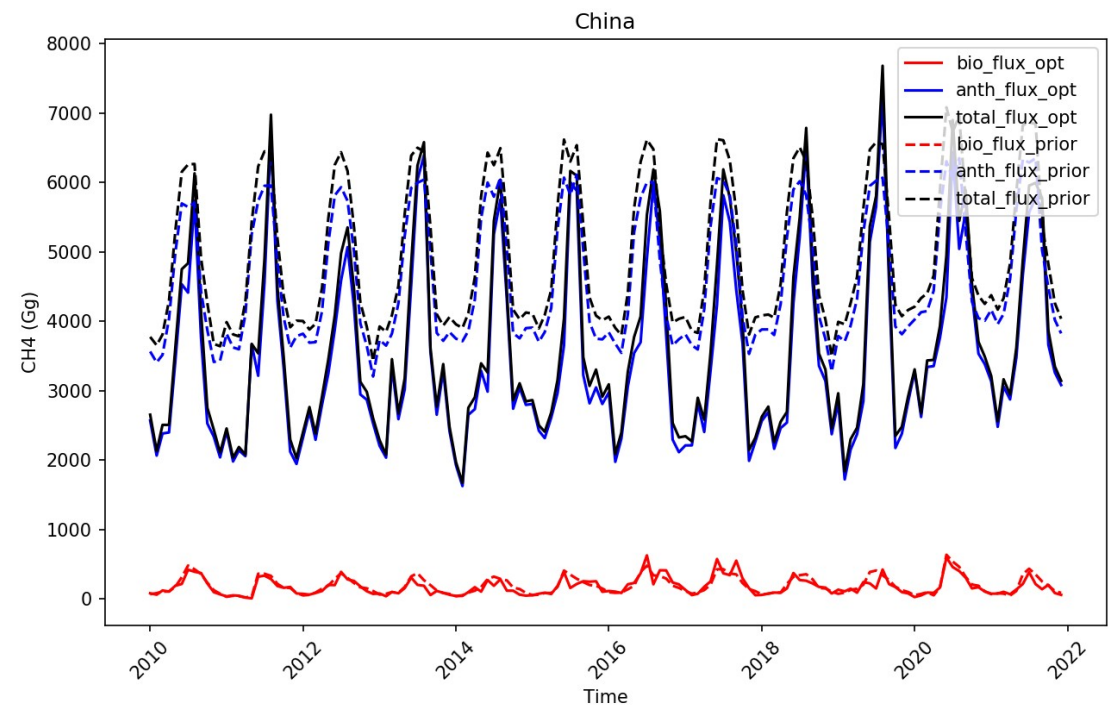
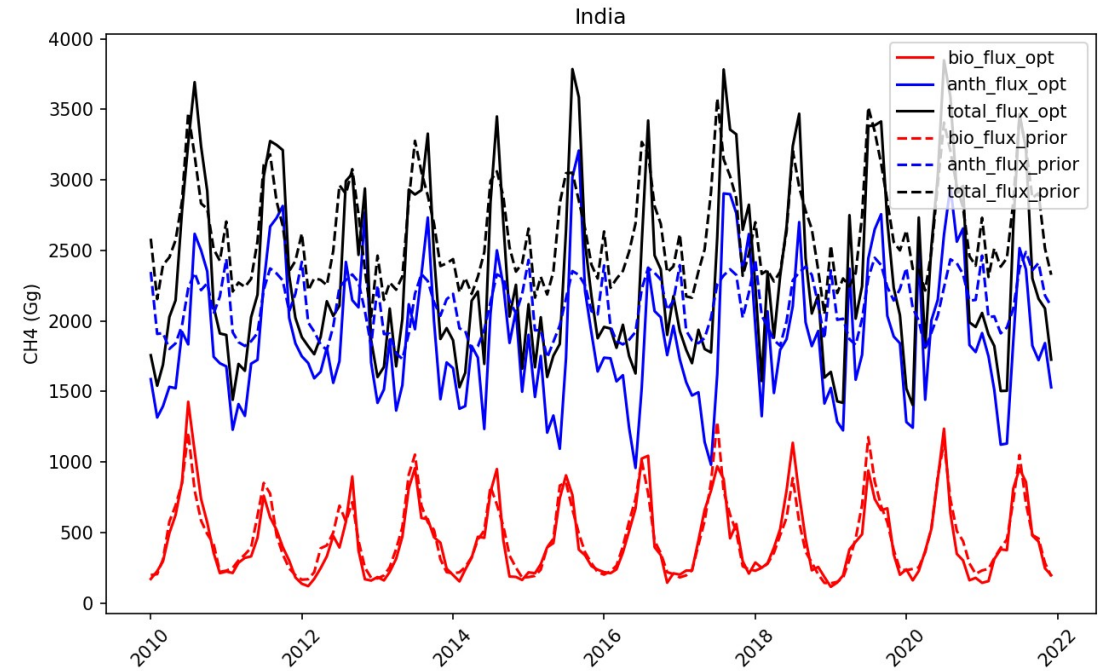
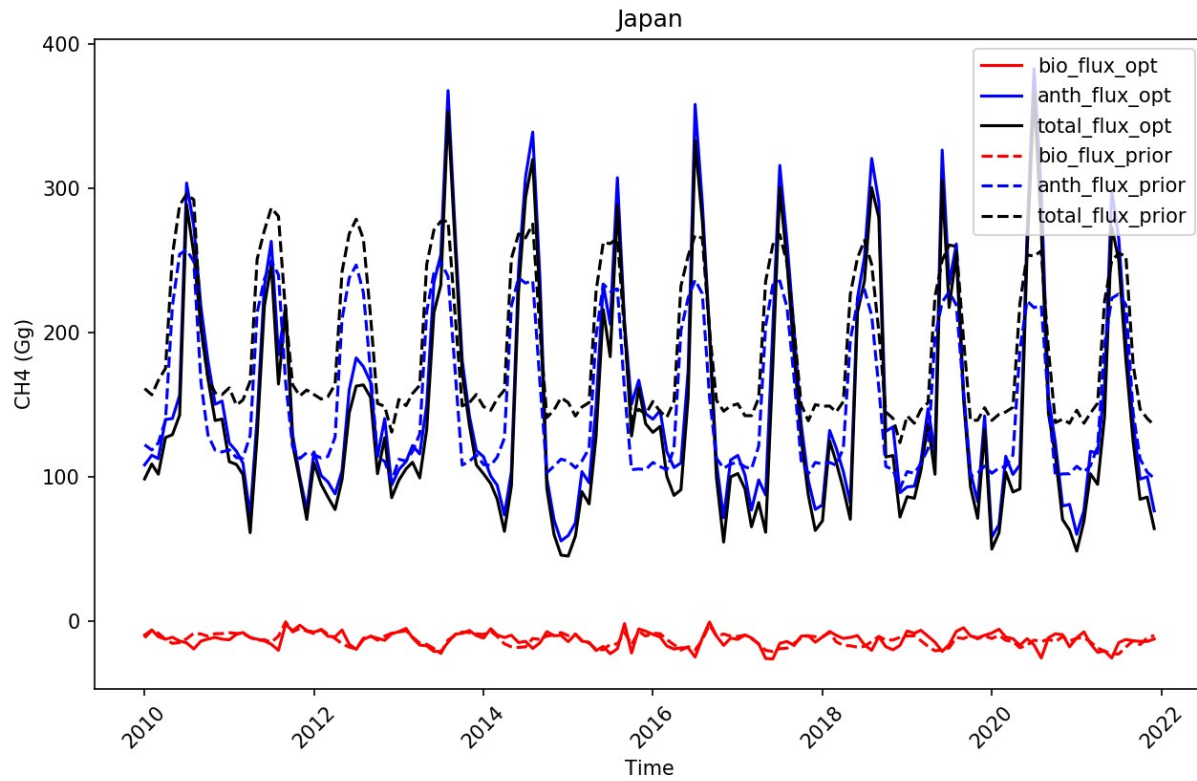
Model setup: CTE-CH4 and TM5-MP

- Simulated for the years 2009-2021 in four parts (2009, 2012, 2015 and 2018 as the spin-up years)
- TM5-MP
 - Global resolution $3^\circ \times 2^\circ$
 - UTOPYA setup
- Optimization
 - Weekly temporal resolution, 5 weeks lag
 - 150 ensemble members (smaller than before, for faster running)
- Prior emissions
 - EDGAR v7.0 (EDGAR v6.0 monthly resolution variation 2010-2018), VISITv20230209b, GFEDv4.1s (bb) and Termites, Ocean, geological and freshwater from Saunois et. al., 2022
 - Freshwater only 25% of the original size
 - Flux multipliers all positive before but after adding freshwater emissions the optimized fluxes were not reasonable. Now also negative multipliers included
 - Anth ja bio emissions optimized, others not optimized

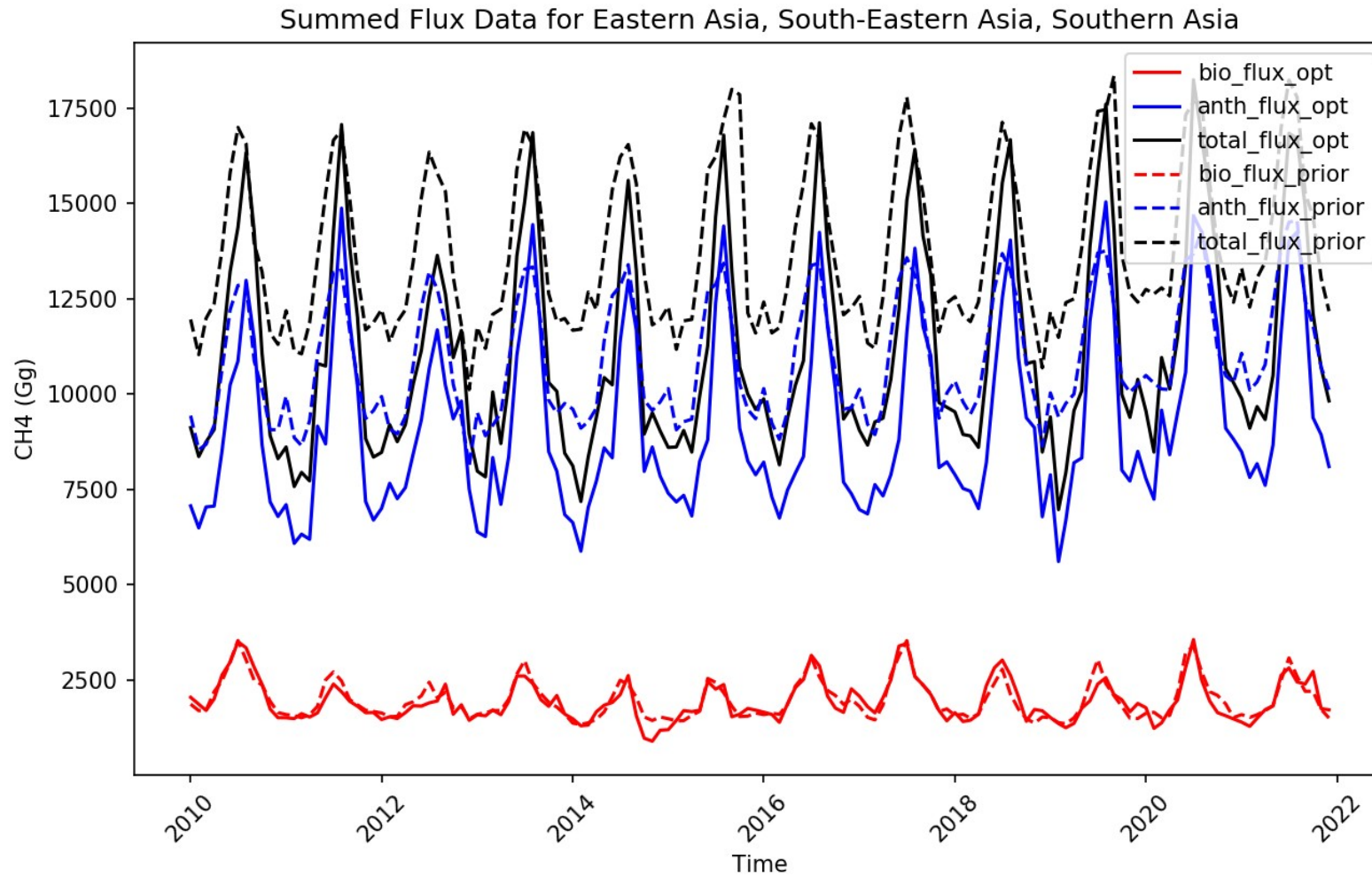


Results

- Monthly fluxes



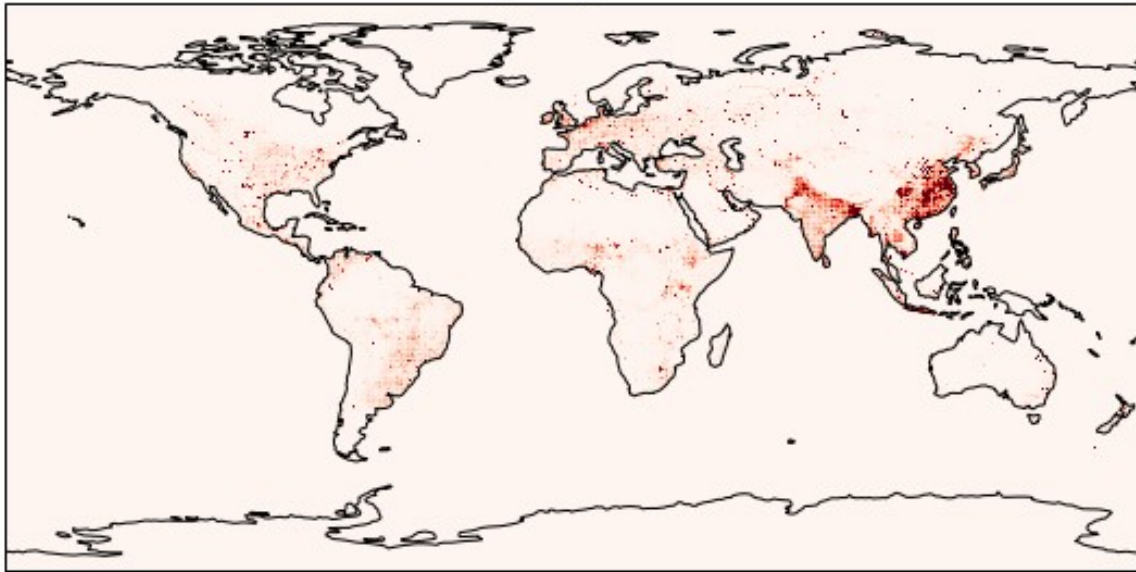
Monthly flux for whole Asia



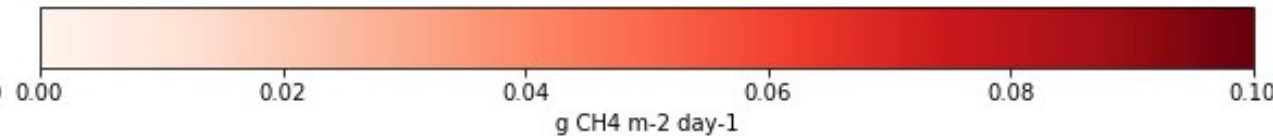
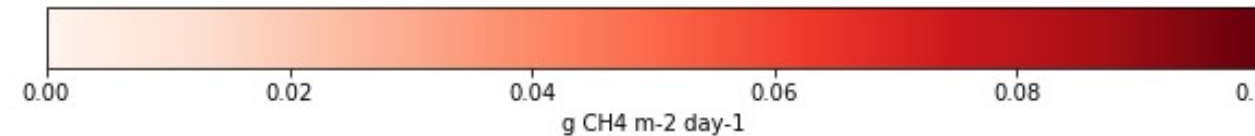
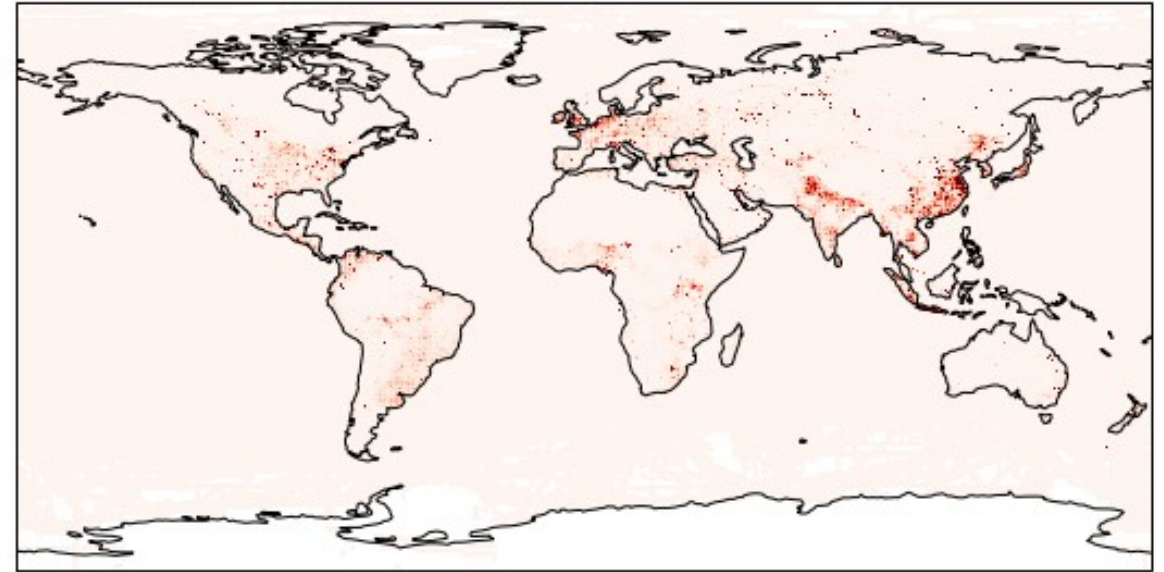
Results: Global monthly anthropogenic maps of fluxes

- Changed resolution of flux multipliers from $1^\circ \times 1^\circ$ to $0.25^\circ \times 0.25^\circ$

anth_prior - June 2015

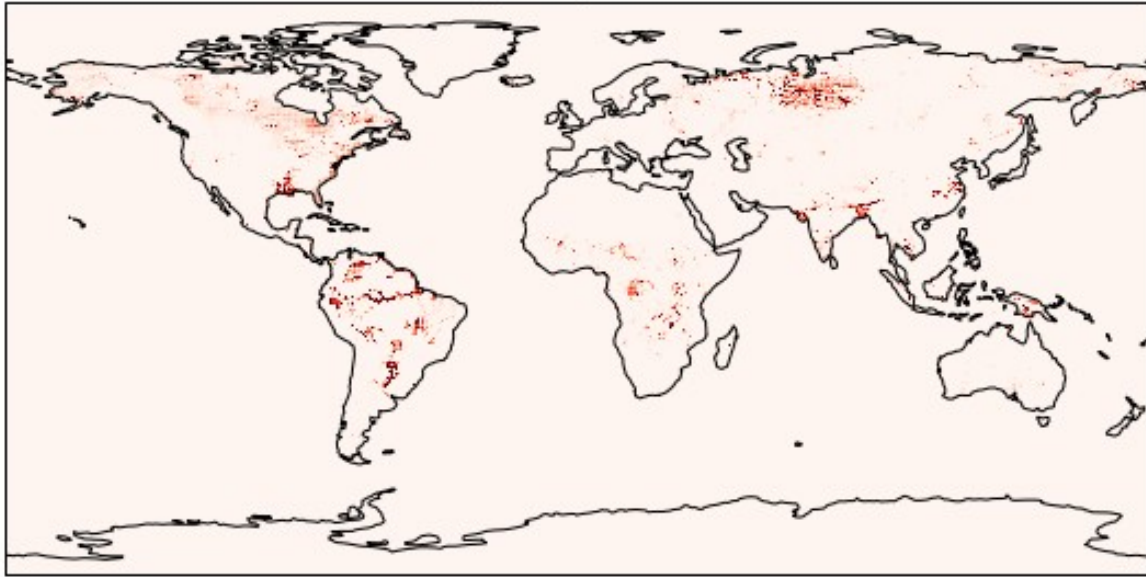


anth_post - June 2015

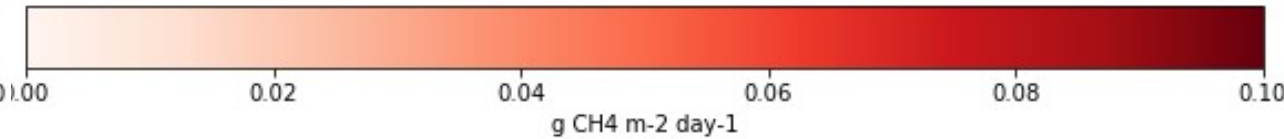
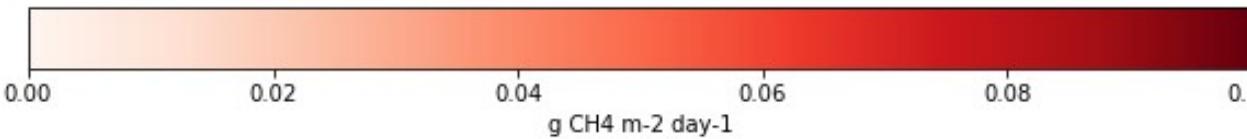
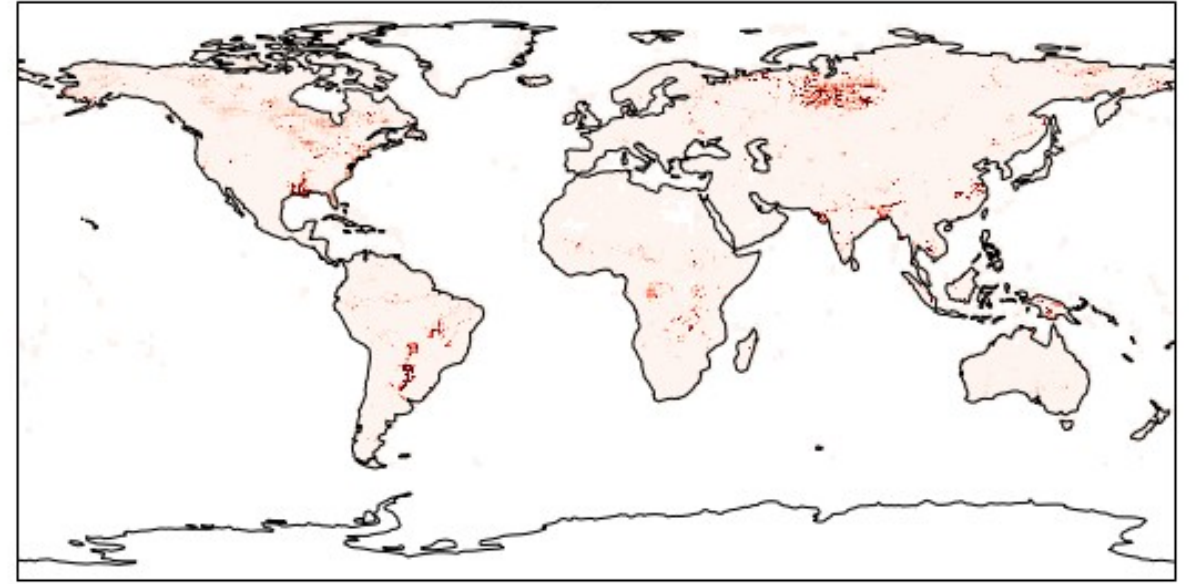


Results: Global monthly biogenic maps of fluxes

bio_prior - June 2015

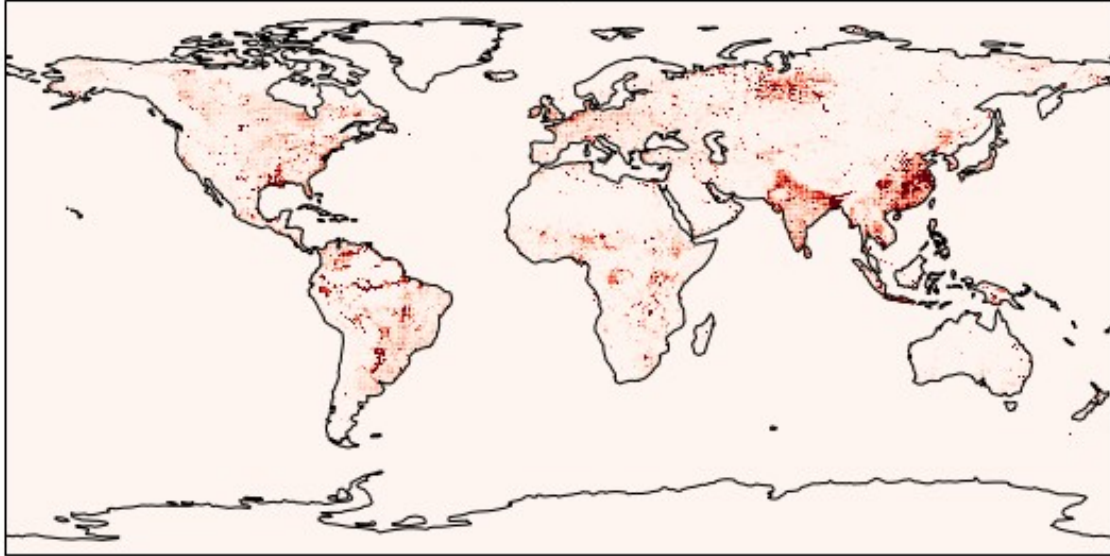


bio_post - June 2015

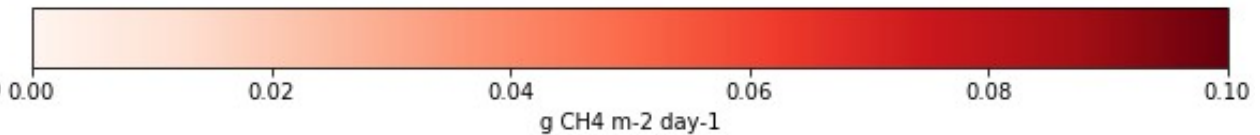
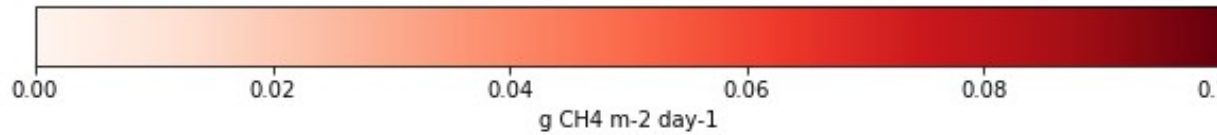
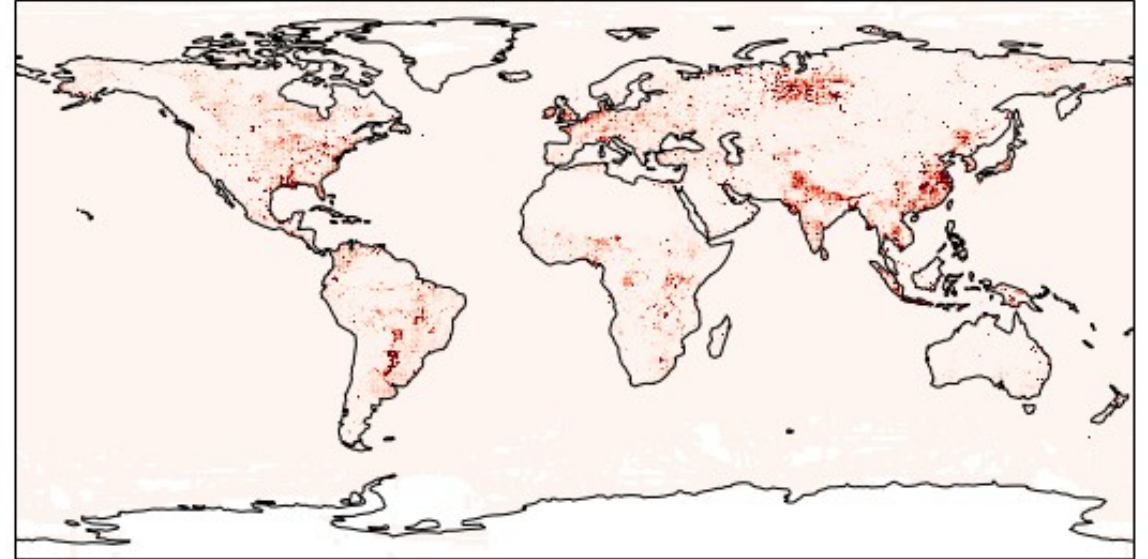


Results: Global monthly total maps of fluxes

tot_prior - June 2015

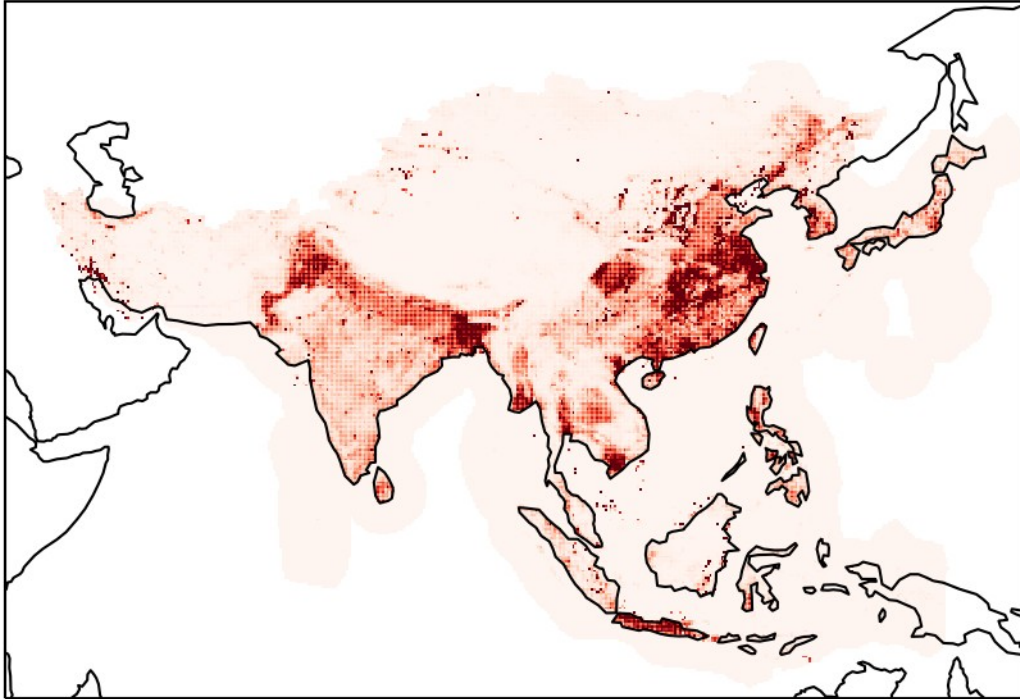


tot_post - June 2015

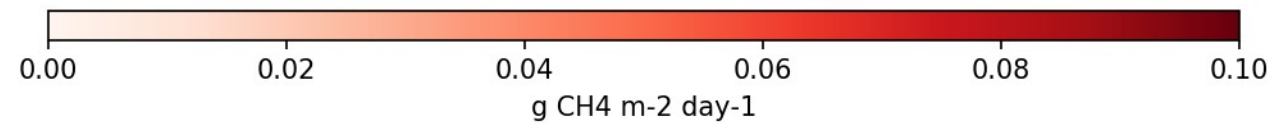
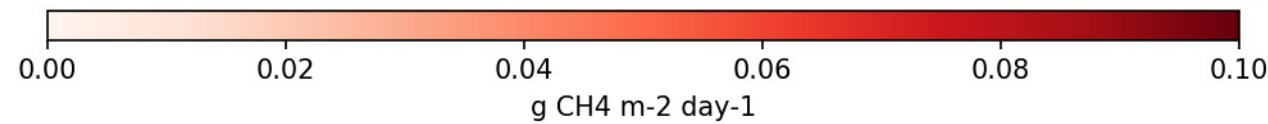
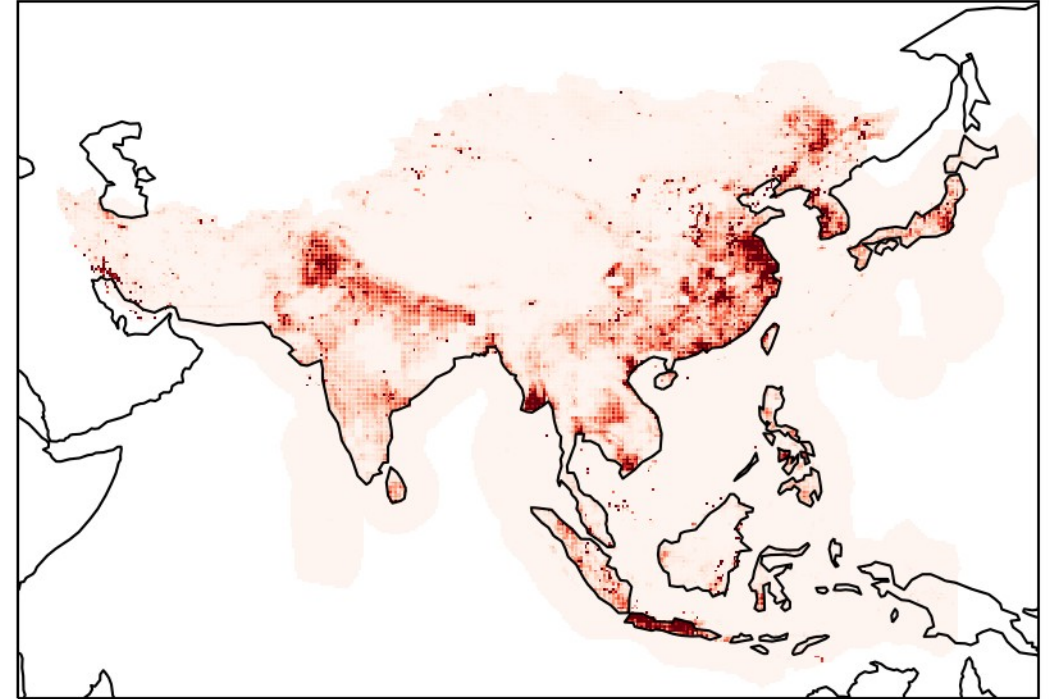


Results: Asia monthly anthropogenic maps of fluxes

anth_prior - June 2015

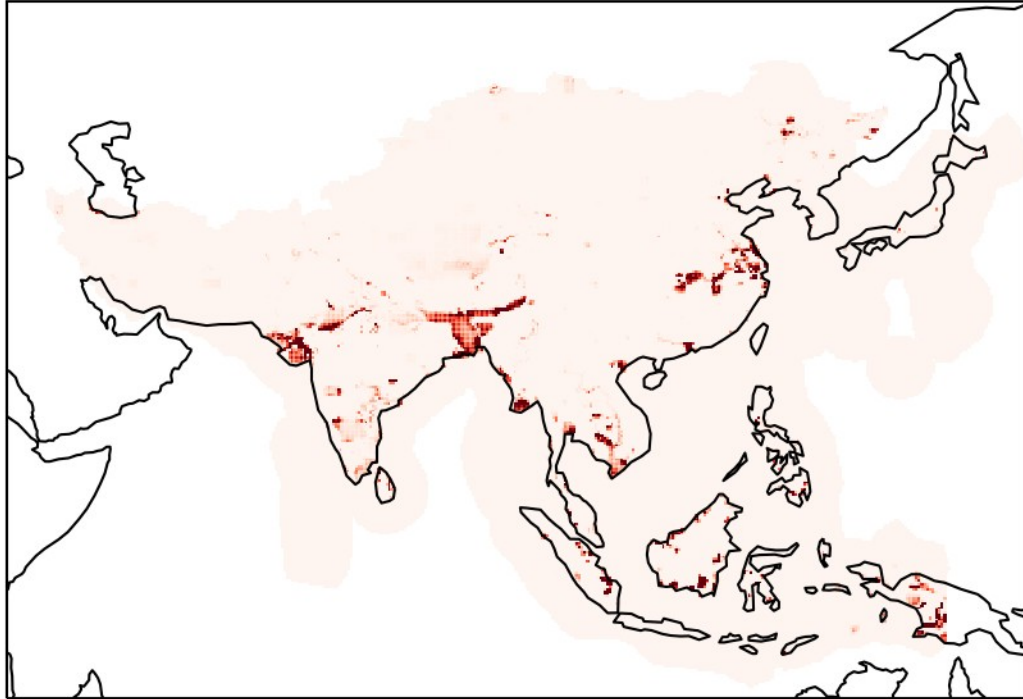


anth_post - June 2015

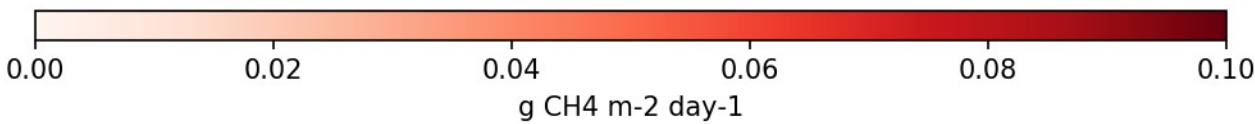
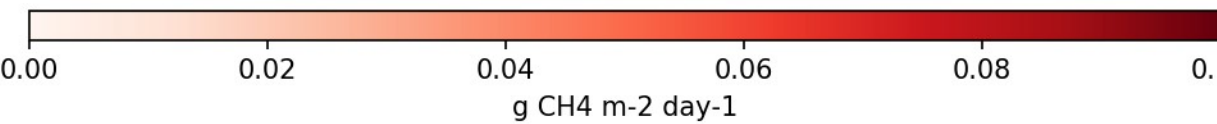
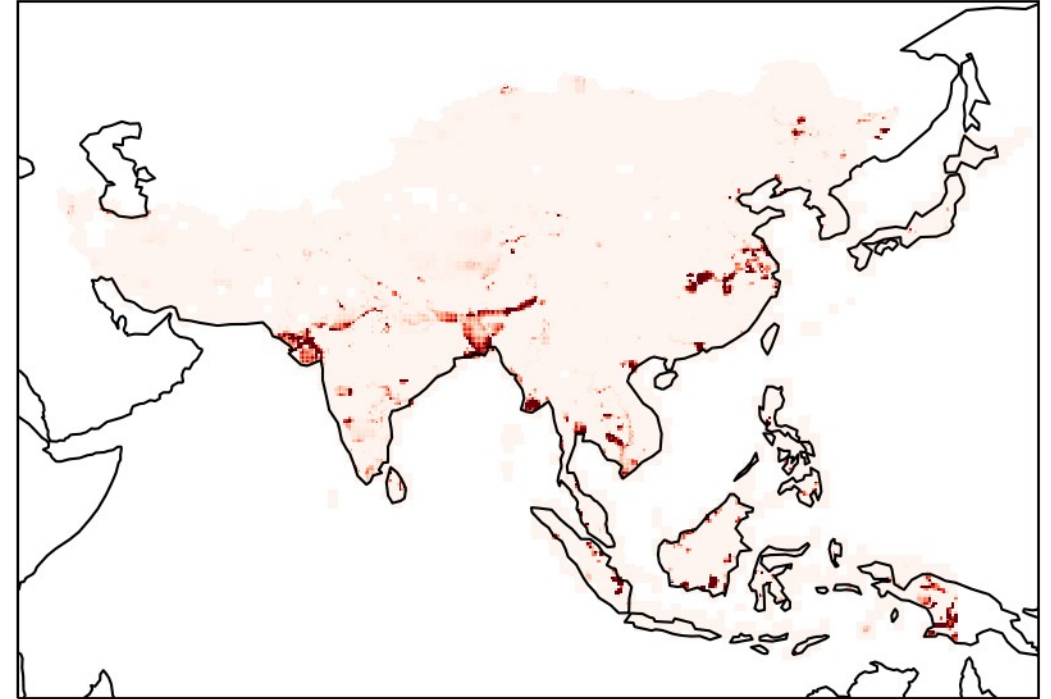


Results: Asia monthly biogenic maps of fluxes

bio_prior - June 2015

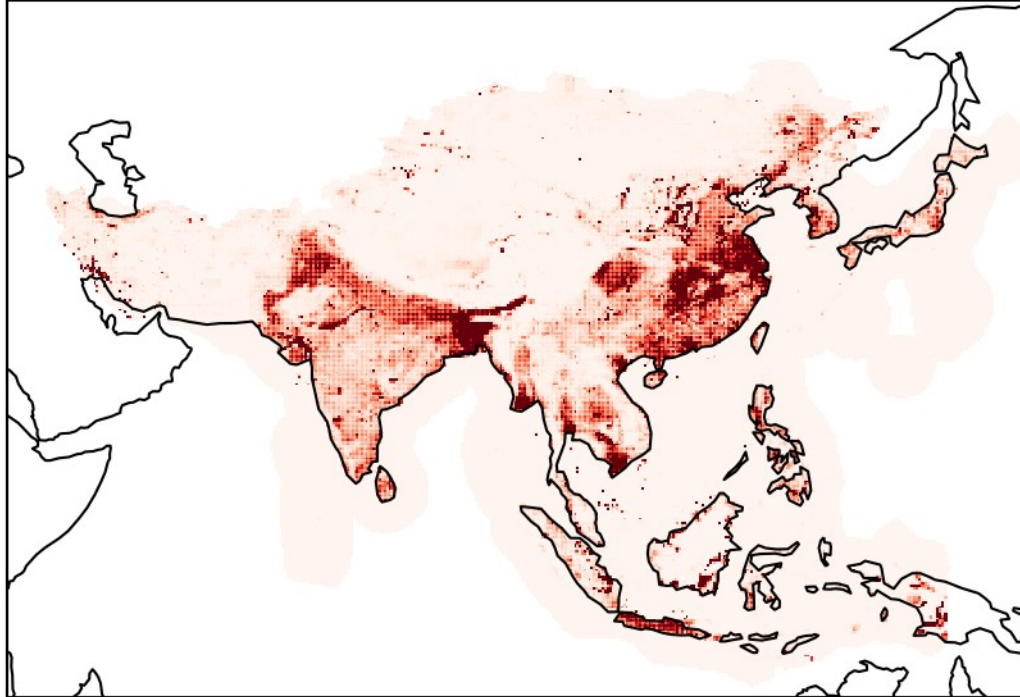


bio_post - June 2015

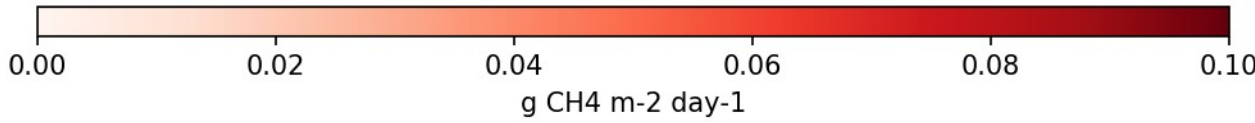
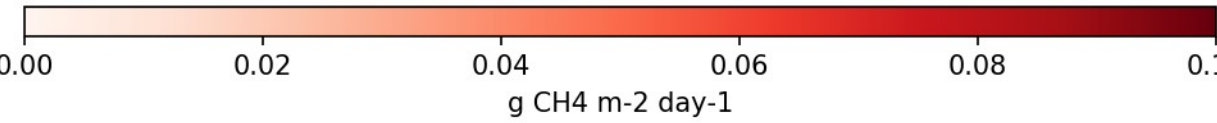
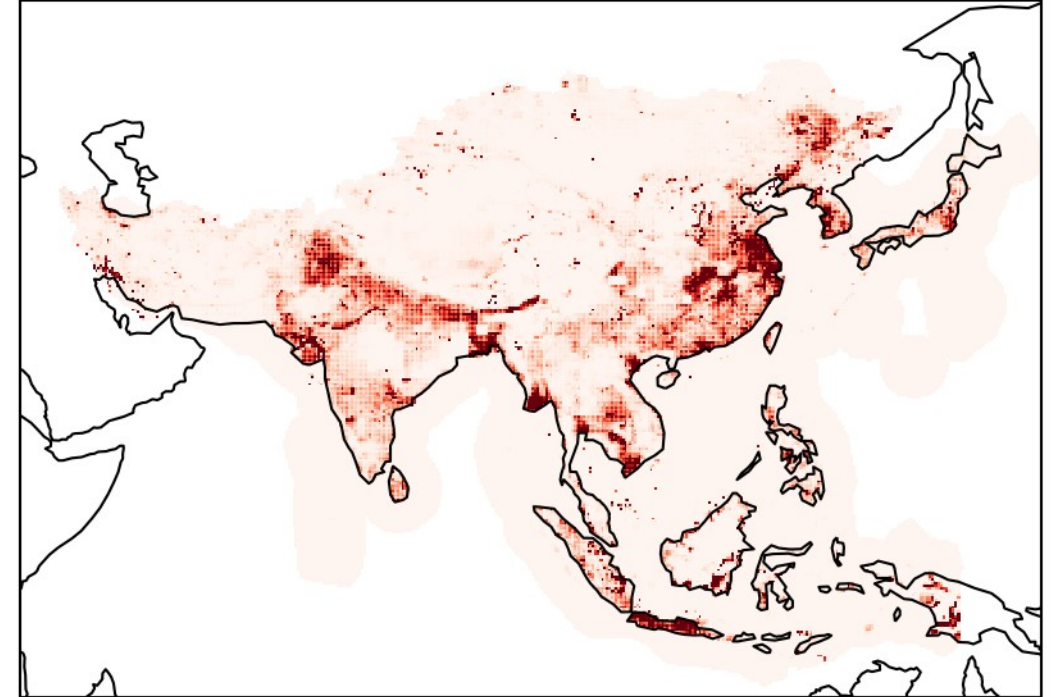


Results: Asia monthly total maps of fluxes

tot_prior - June 2015



tot_post - June 2015



Next steps

- Defining the validation data and checking concentration data
- Gosat inversions



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Thank you!

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