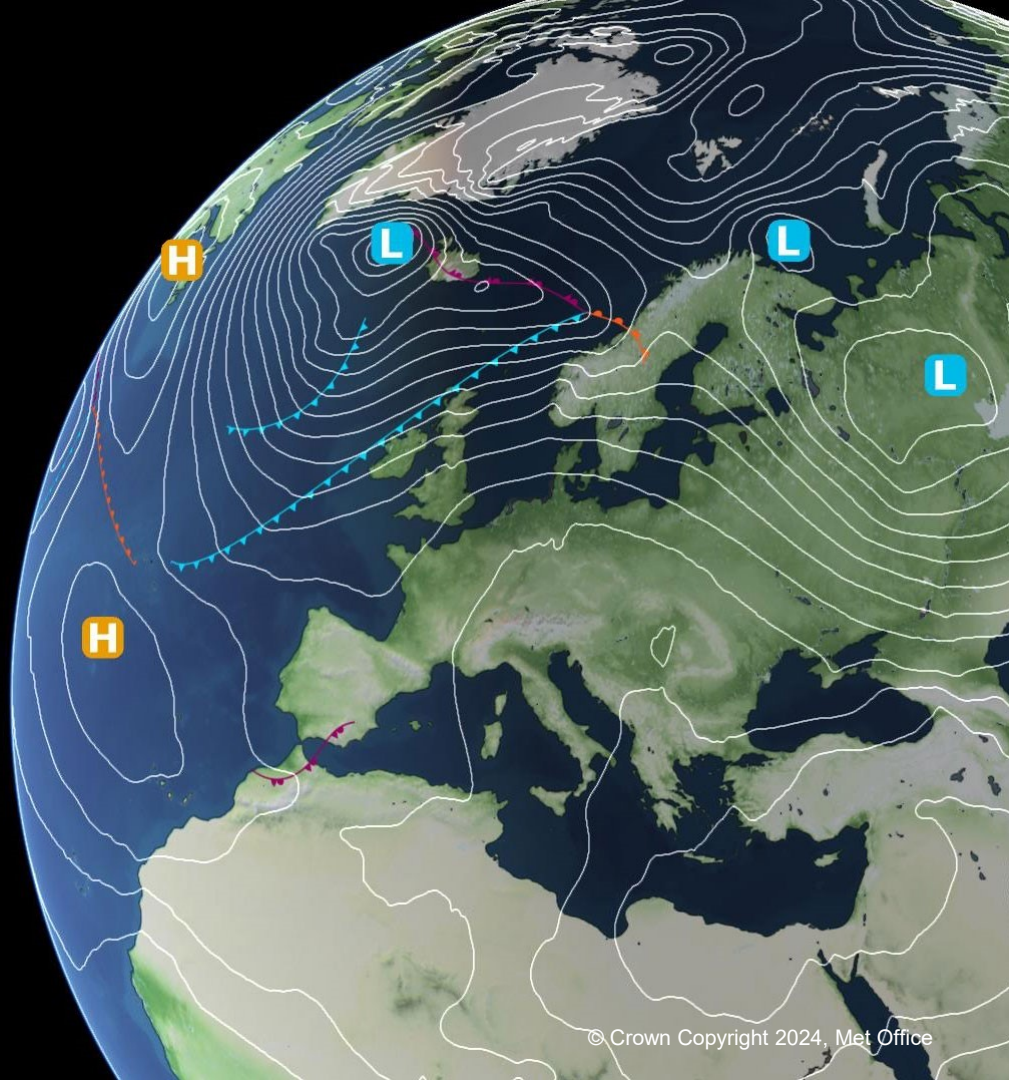
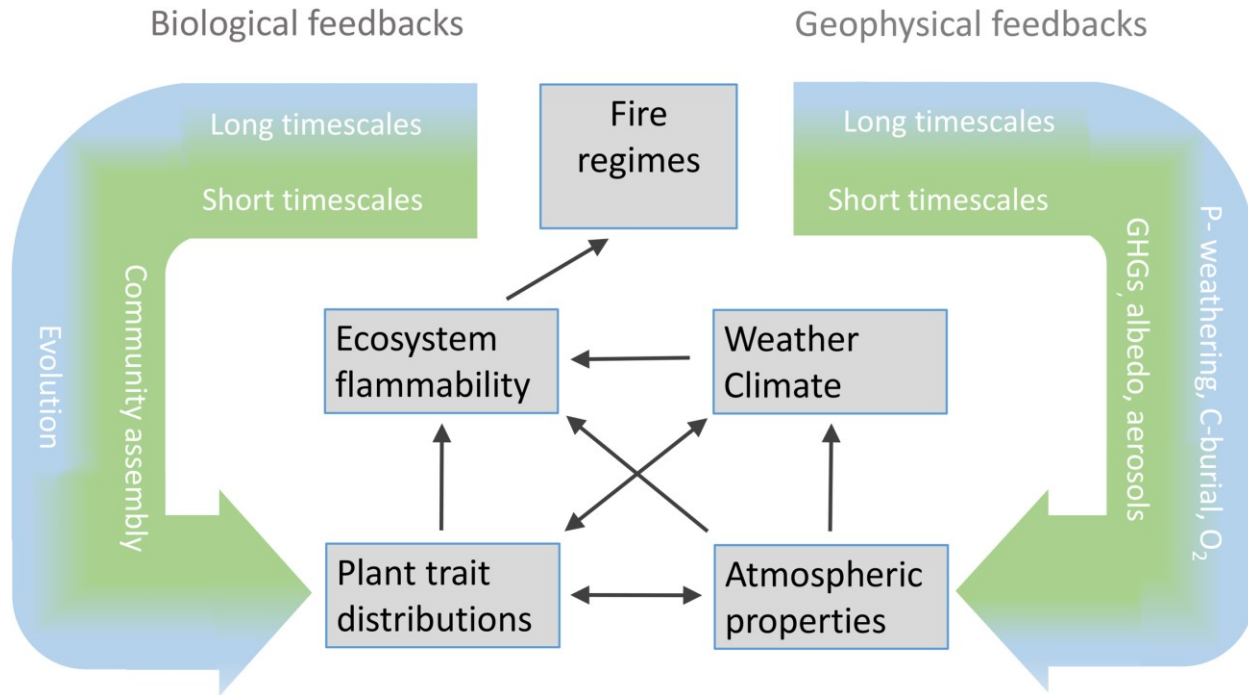


# Towards UKESM2: The Role of Interactive Fire on Atmospheric Composition

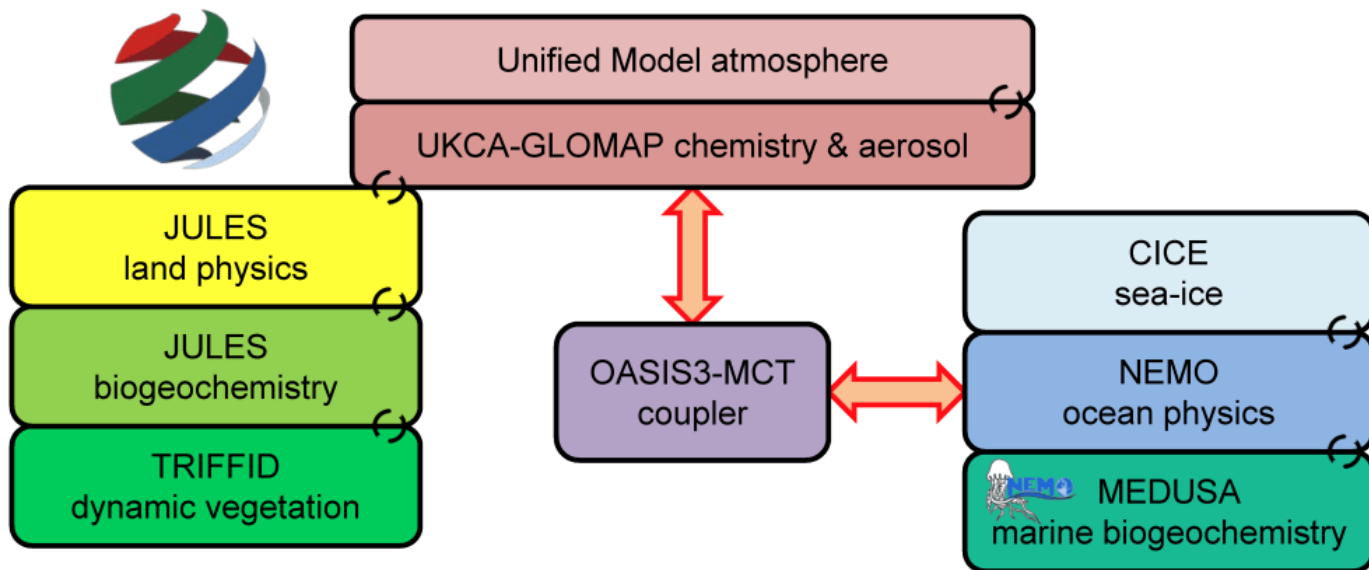
Amy Peace, Jane Mulcahy,  
João Teixeira, Amy Peace



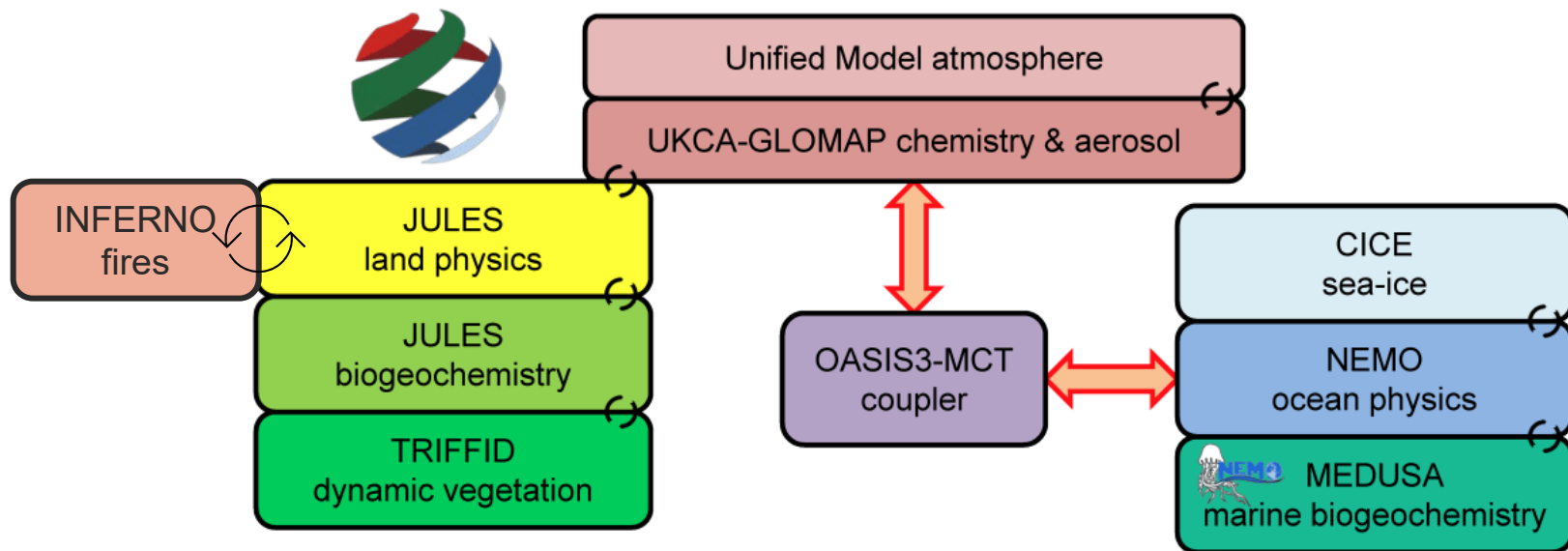
# Fire in the Earth system



# UKESM overview

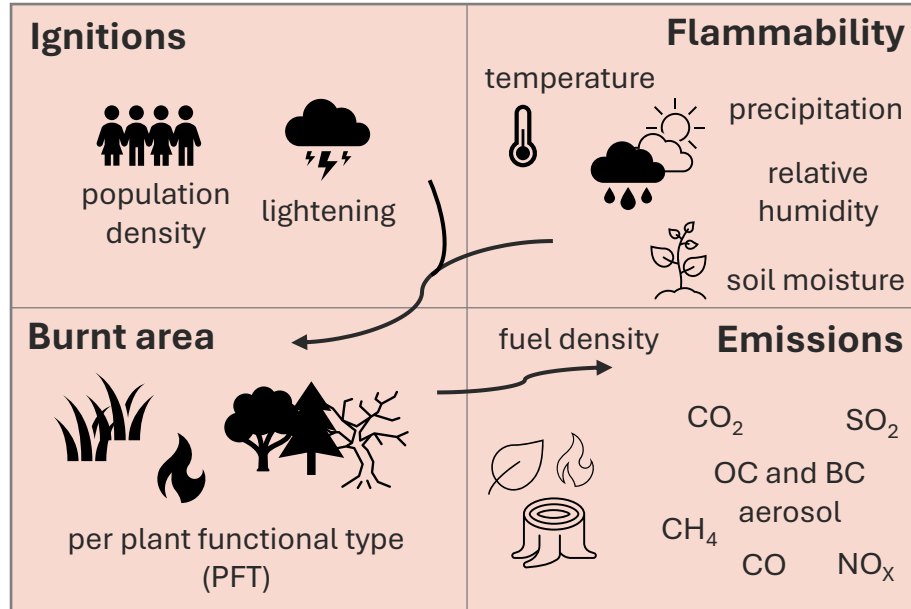


# UKESM overview



# Fire-composition-climate coupling overview

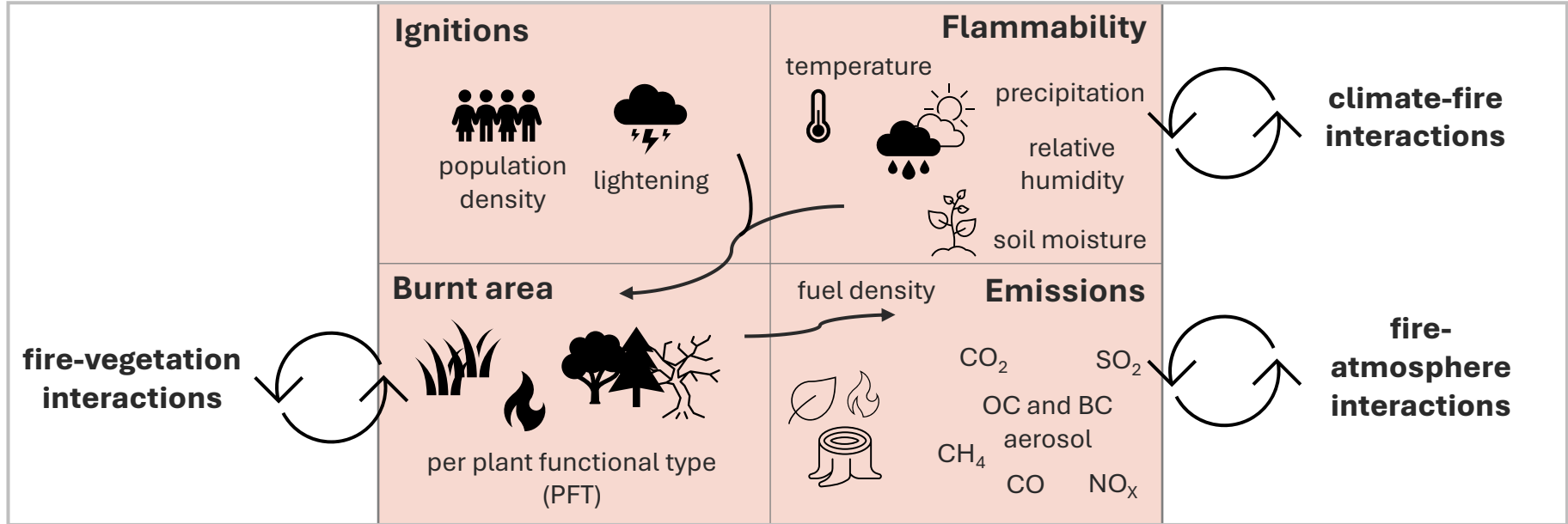
## INFERNO



# Fire-composition-climate coupling overview

## Coupling for UKESM2

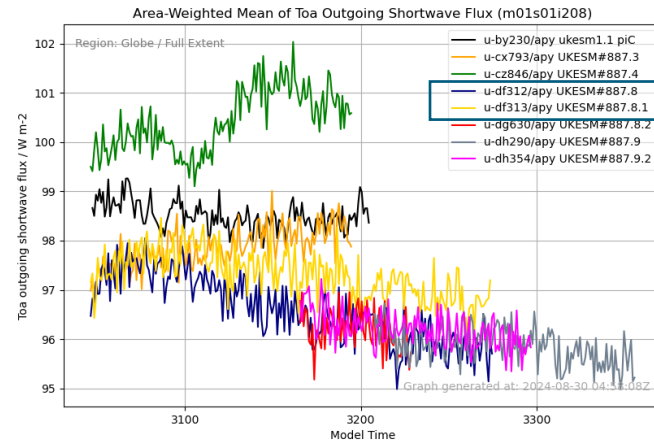
## INFERNO



# Fire-composition impacts in UKESM2 tests

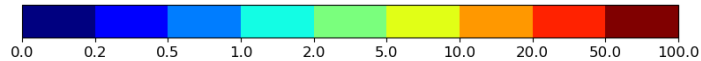
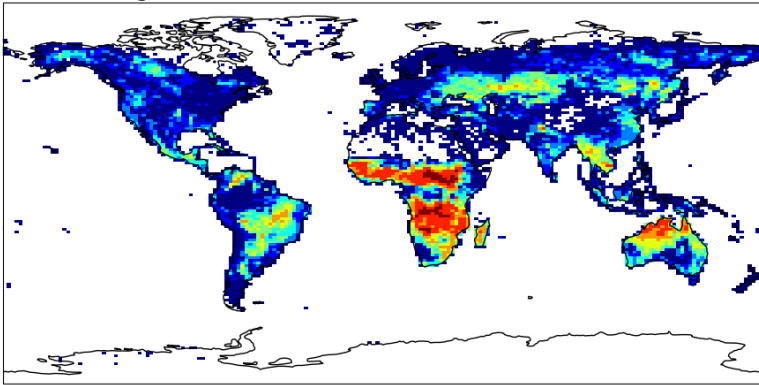
## Testing fire impacts in UKESM2 prototypes:

- Pre-industrial simulations: fully coupled
- New science capability added in iterations
- Evaluate UKESM2 proto simulations with fire coupling ON/OFF e.g.

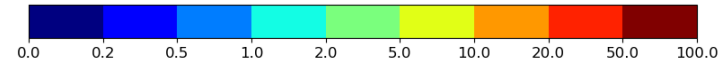
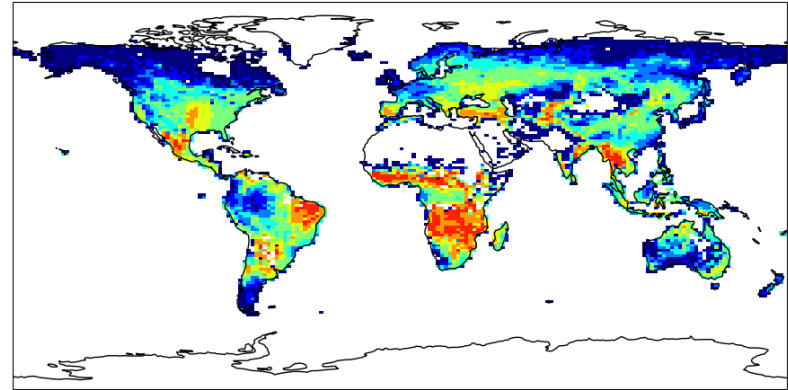


# Interactive fire and burnt area

Observations: GFED



UKESM2 Interactive with fire

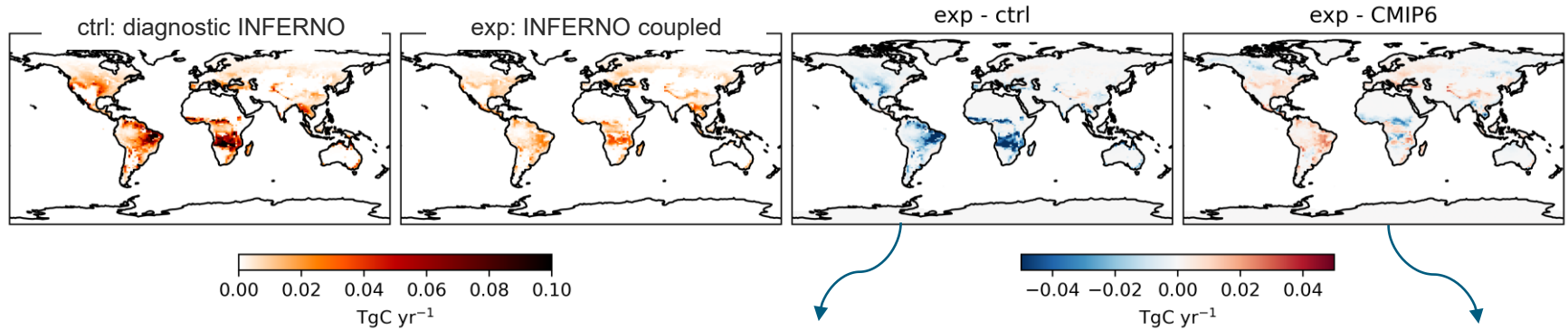




# Fire coupling impacts on emissions

## Organic carbon aerosol emissions

Annual OC biomass burning emissions  
30-year average



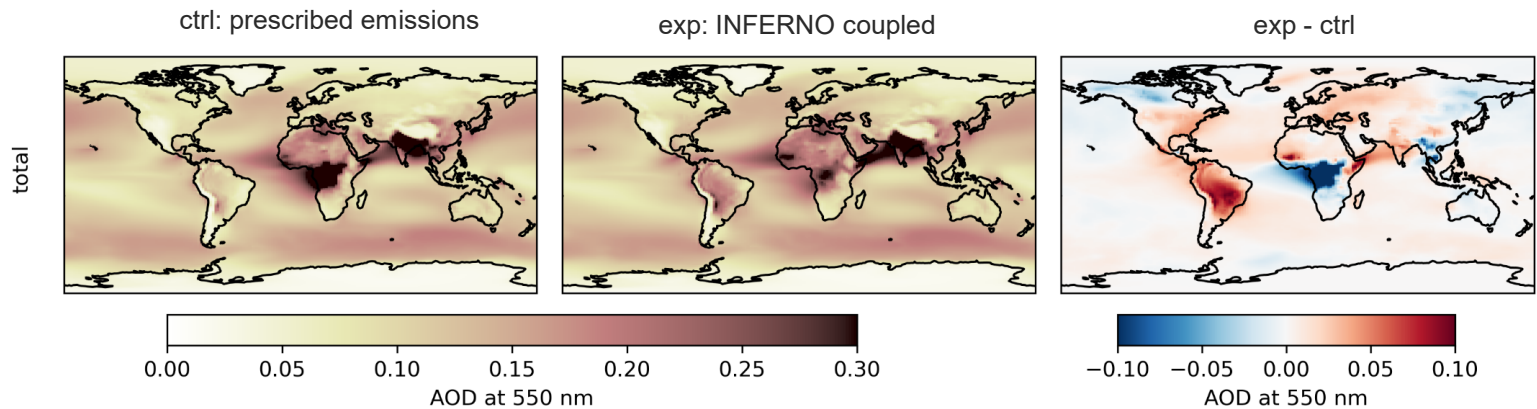
INFERNO emissions  
reduced with  
vegetation-climate couplings

Regional biases  
compared to CMIP6

- Missing emissions
- Vegetation biases
- Climate biases
- Ignitions

# Fire coupling impacts on aerosol loading

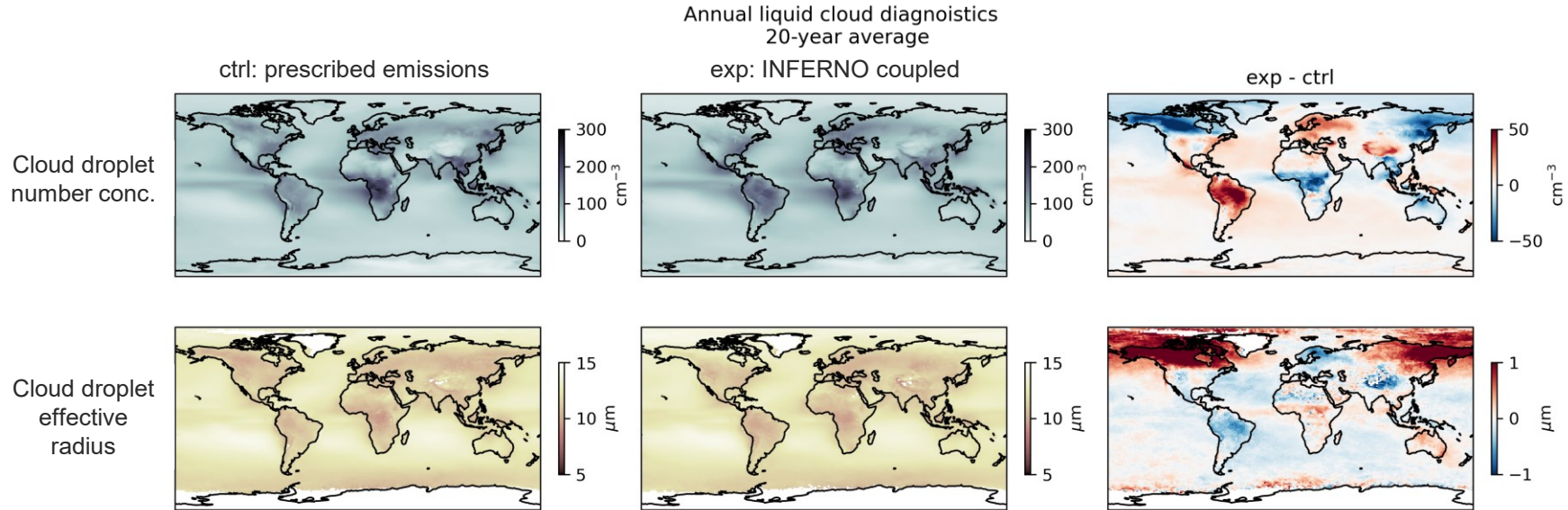
## Aerosol optical depth



- Due to regional changes in aerosol emissions compared to CMIP6
- Changes in land surface modulate natural emissions e.g. dust

# Fire coupling impacts on cloud properties

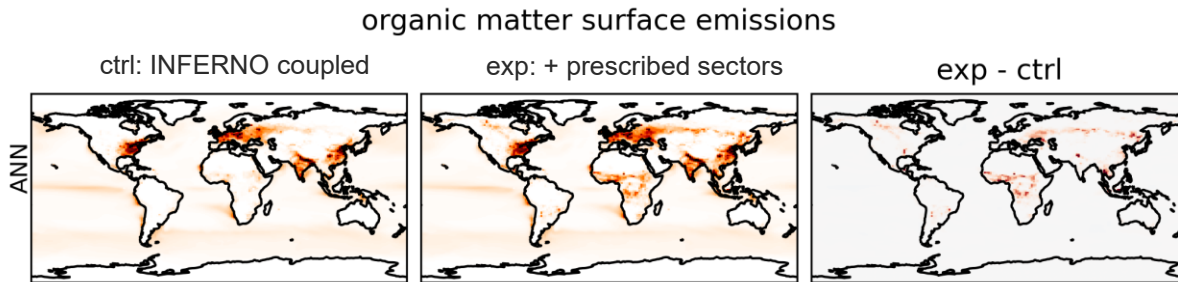
## Cloud properties



# Improving emissions biases

Prescribing additional emissions:

- INFERNO does not represent peat or agricultural waste burning emissions
- Testing prescribing these emissions sectors from GFED



- Underlying vegetation and ignitions may have larger impact on improving biases

# Conclusions and next steps

## Conclusions:

- Fire-vegetation-climate couplings now included in UKESM2 prototypes
- Evaluation work ongoing to assess the impact of this and improve biases

## In progress:

- Atmosphere-only simulations throughout satellite era with INFERNO on/off
- Community evaluation effort
- Anthropogenic forcing experiments in UKESM2 proto