# Coupling interactive fire with atmospheric composition and climate in the UKESM

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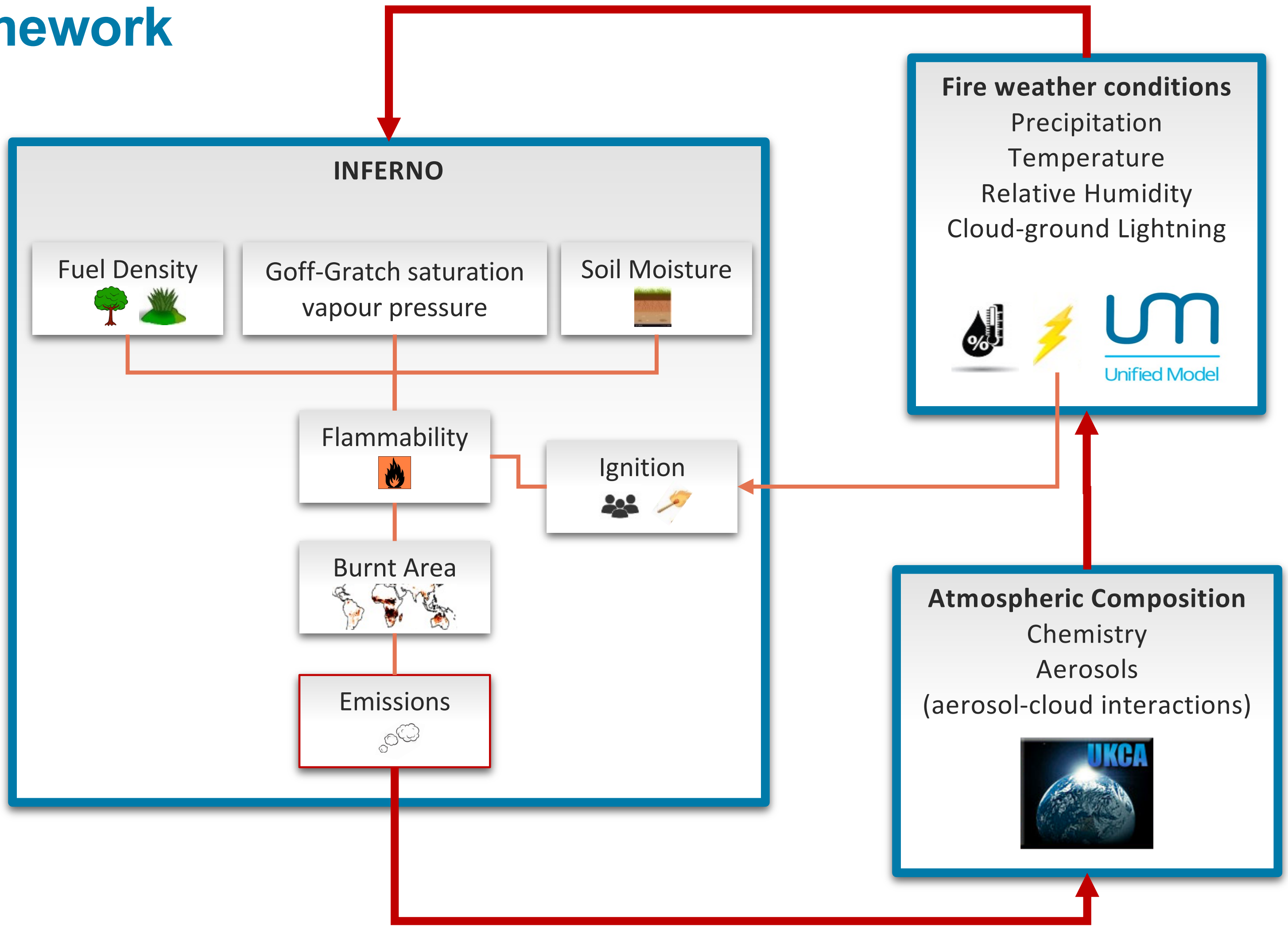
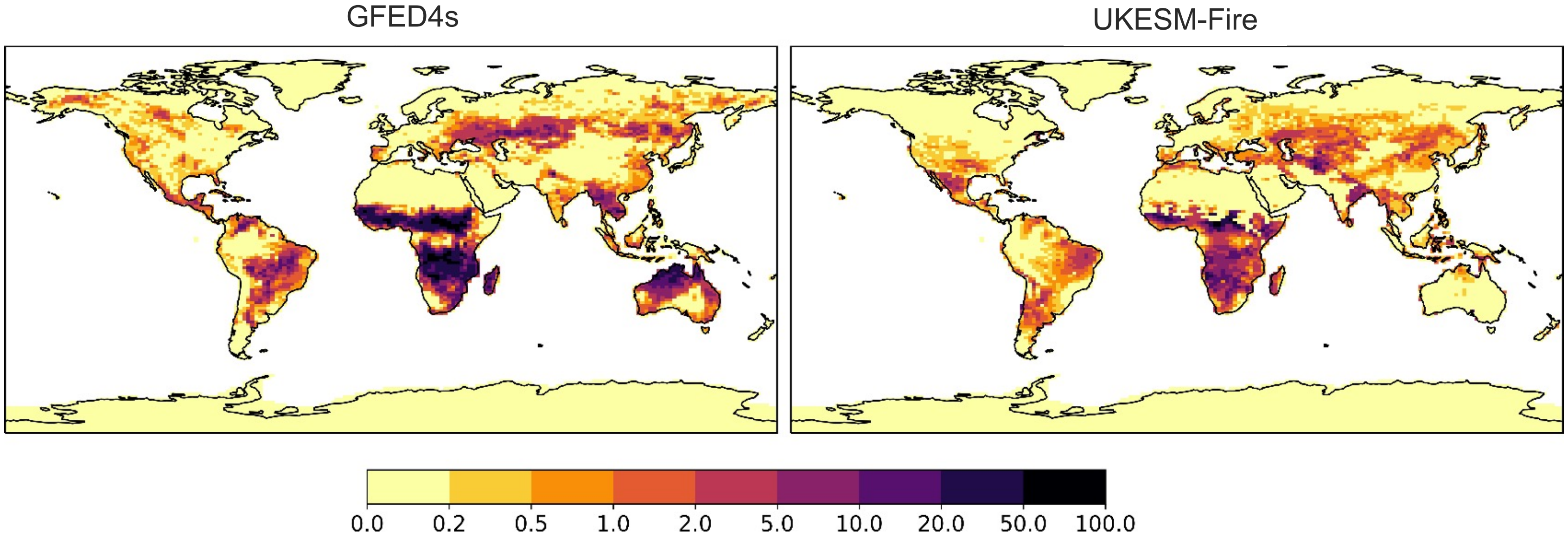
# Coupling framework



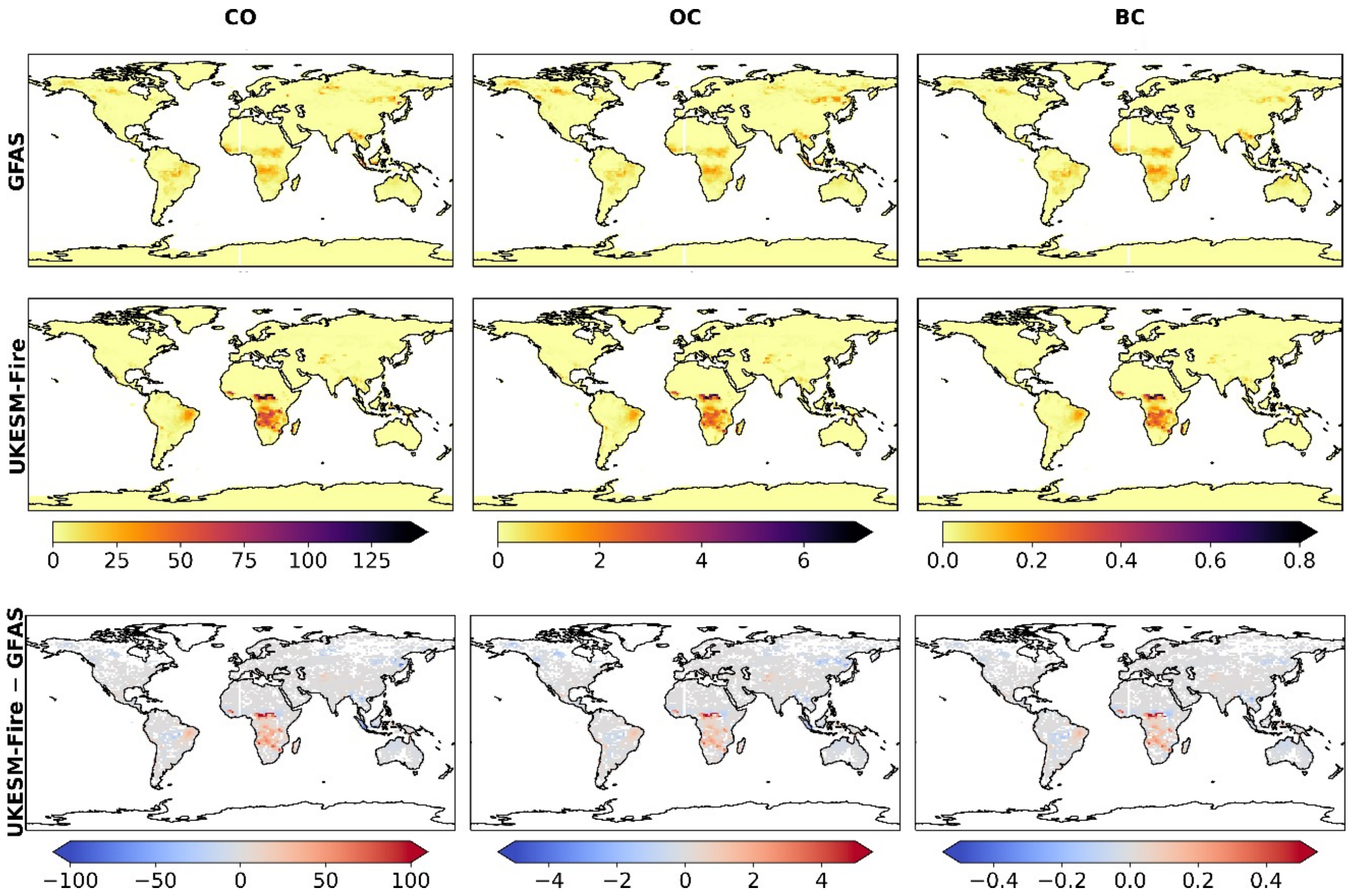

$CO$, $NO_x$, $C_2H_6$, $C_3H_8$, $HCHO$, $MeCHO$, $Me2CO$, $NH_3$, $DMS$, $OC$ and $BC$

# Burnt area fraction (%) mean annual average (1997 - 2010)




- Global pattern of the annual average burnt area fraction is well reproduced
- Global pattern correlation of 55.3 %
- Large (50%) underestimation of the fires over Africa (even more over Australia)

# Biomass burning emissions (kg $m^{-2}$) mean annual average (1997 - 2010)




- Global pattern well reproduced
- Large overestimation of the biomass burning emissions
  - ➢ NHAF
  - ➢ SHAF – emissions extend further south
  - ➢ SHSA – large bias on the eastern edge
- Underestimation over the peatland regions
  (e.g. Indonesia and boreal regions)

# Summary

❖ Coupling a fire model to UKESM1 results in a similar performance in reproducing the distribution of aerosols and CO atmospheric column.

❖ Limitations of current set-up

- ➢ No fire-vegetation feedbacks
- ➢ Peat fires are not represented
- ➢ Underlying vegetation bias can have a significant impact in modelled results

❖ This shows that we have developed a useful coupling framework that allows the representation of complex fire-composition-climate interactions and feedbacks in the Earth system

# Future work

❖ Include fire-vegetation feedbacks - brings improvements to Africa and South America

❖ Include representation of peatland fires - impact in the northern hemisphere

❖ Study and quantify the impacts of fire in climate change scenario and on atmospheric composition-climate interactions

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