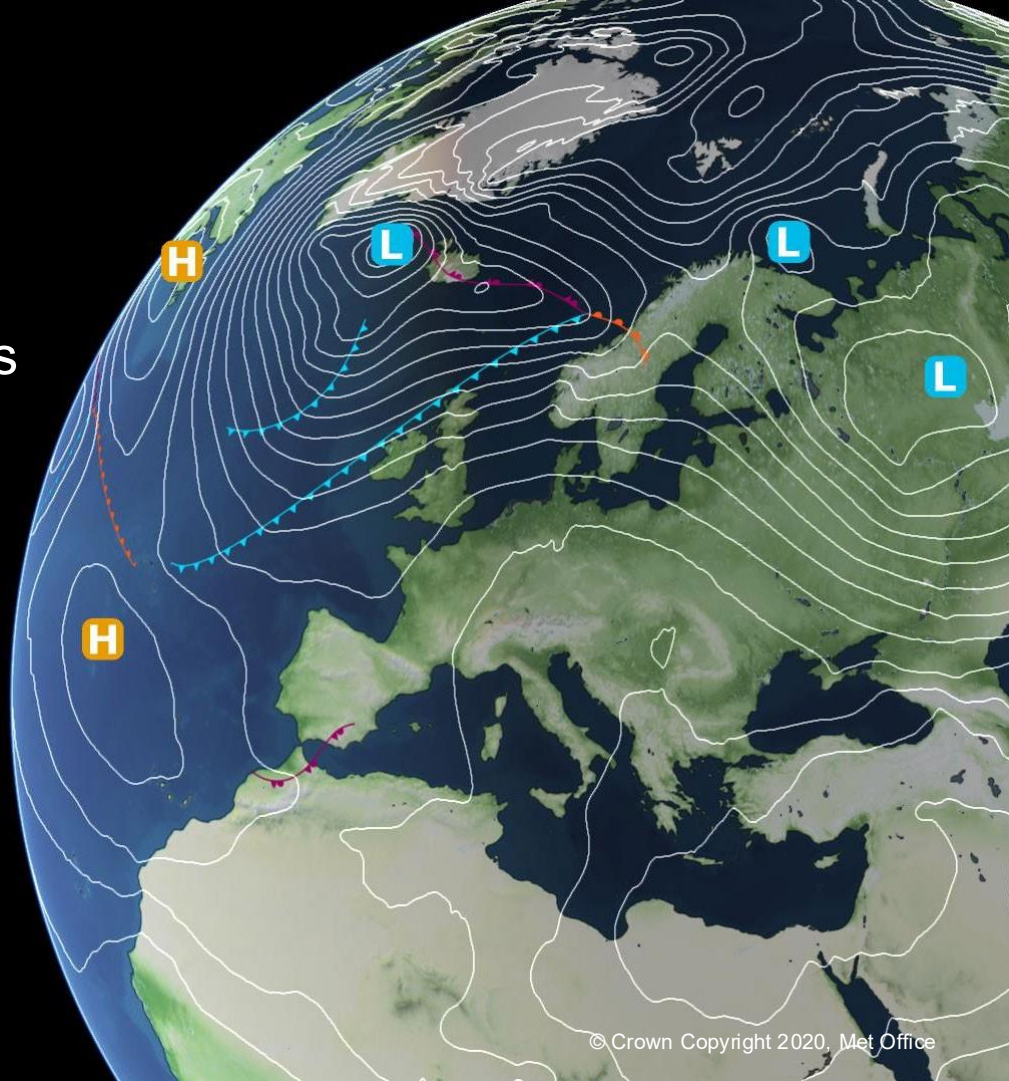


## Status update of HTAP3 Simulations with UKESM

**Steven Turnock and others in the UK  
helping to contribute simulations**

[Steven.turnock@metoffice.gov.uk](mailto:Steven.turnock@metoffice.gov.uk)



# UKESM Simulations

## Priorities for HTAP3 Simulations

Base (CLE 2040 emissions)

### Global Perturbations

- Decrease CH4 Conc
- Decrease CH4 Conc and all anthro emissions
- Decrease H2 conc
- Decrease All anthro emissions
- Decrease anthro NOx
- Decrease anthro VOC
- Decrease anthro CO

### Global Scenario Runs

- CLE 2015 emissions
- MTFR (2040)
- HILO (2040)

## 2015 meteorology / 2040 emissions

|                |   |
|----------------|---|
| BASE (CLE2040) | 1 |
| CH4DEC         | 1 |
| CH4ALL         | 1 |
| H2DEC          | 3 |
| GLOALL         | 1 |
| GLONOX         | 1 |
| GLOVOC         | 1 |
| GLOCO          | 1 |
| CLE2015        | 1 |
| MTFR2040       | 3 |
| HILO2040       | 3 |

Highest Priority  
Next Priority  
Lower Priority

|        |
|--------|
| 1 or 2 |
| n      |
|        |

## Regional Emissions Perturbation (2015 meteorology, 2050 CLE emissions)

|                              | All | NOx | VOC | CO | SO2 | NH3 | PM |
|------------------------------|-----|-----|-----|----|-----|-----|----|
| N America                    | 1   | 2   | 2   | 4  |     |     |    |
| EMEP Domain                  | 1   | 2   | 2   | 4  |     |     |    |
| EMEP West                    | 3   | 4   | 4   | 4  |     |     |    |
| EMEP East                    | 3   | 4   | 4   | 4  |     |     |    |
| East Asia                    | 1   | 2   | 2   | 4  |     |     |    |
| South Asia                   | 1   | 2   | 2   | 4  |     |     |    |
| South and East Mediterranean | 1   | 2   | 2   | 4  |     |     |    |
| Middle East                  | 3   | 4   | 4   | 4  |     |     |    |
| North Africa                 | 3   | 4   | 4   | 4  |     |     |    |
| SE Asia                      | 3   | 4   | 4   | 4  |     |     |    |
| Mex/C America/Caribbean      | 3   | 4   | 4   | 4  |     |     |    |
| Rest of World (SAM+SAF+PAN)  | 3   | 4   | 4   | 4  |     |     |    |
| South America                | 3   |     |     |    |     |     |    |
| Southern Africa              | 3   |     |     |    |     |     |    |
| Aust/NZ/Pacific              | 3   |     |     |    |     |     |    |
| International Shipping       | 1   |     |     |    |     |     |    |
| Aviation                     | 3   |     |     |    |     |     |    |
| Fires (all fires)            | 3   |     |     |    |     |     |    |

- Currently focussing on emission perturbation experiments
- Completed all global perturbation experiments.
- Have run 4 years with same emissions by varying meteorology
- Have also conducted test with and without radiative feedbacks

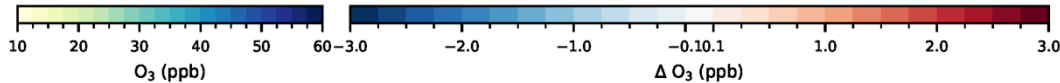
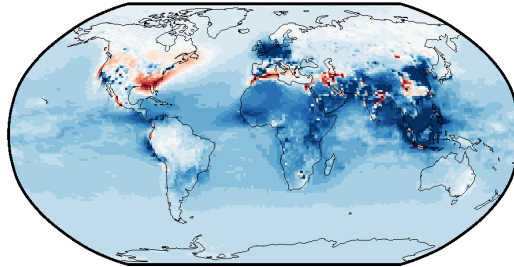
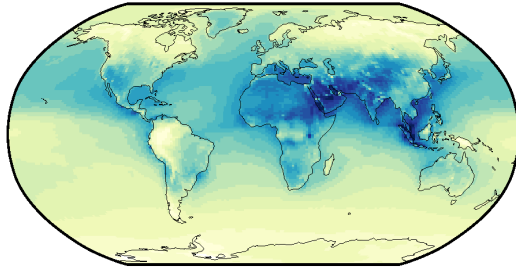
# Change between 2015 and 2040 CLE

**CLE2040**

CLE2040 (26.09)

**CLE2015 - CLE2040**

CLE2015 (25.16 (-0.93))



**Annual mean surface Ozone Concentrations in 2015**

Change from 2015 to 2040 tends to reduce surface ozone in most places but there are some interesting areas of increasing surface ozone

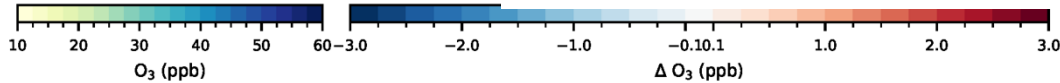
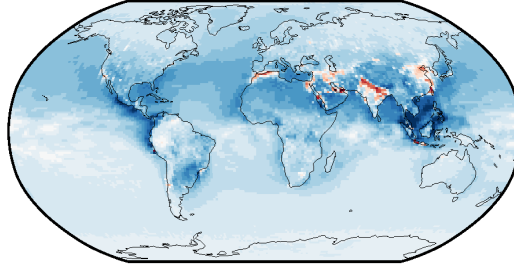
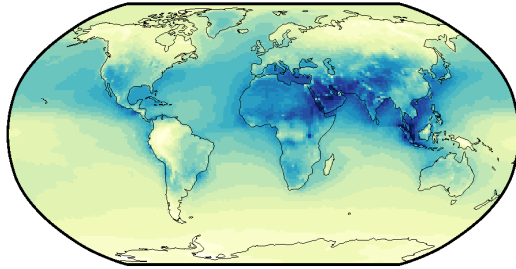
# Change between Exp and 2040 CLE

**CLE2040**

CLE2040 (26.09)

**GLOALL - CLE2040**

GLOALL (25.36 (-0.73))



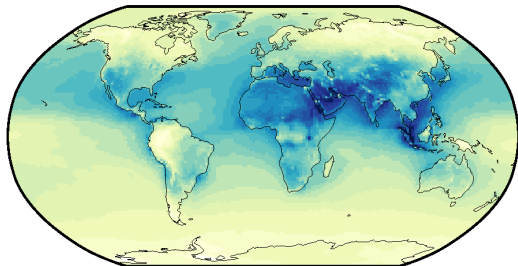
**Annual mean surface Ozone Concentrations in 2015**

surface ozone reduces in most places but there are some interesting areas of increasing surface ozone over Asia and Middle East

# Change Exps and 2040 CLE

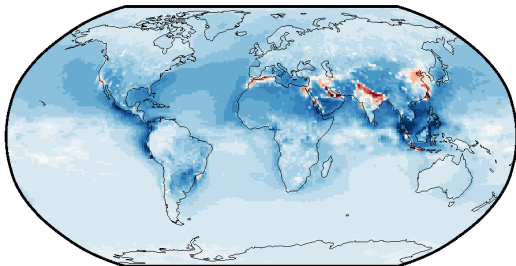
**CLE2040**

CLE2040 (26.09)



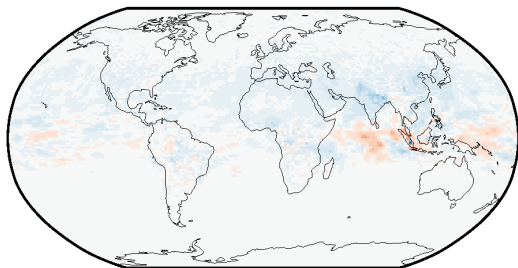
**GLONOX - CLE2040**

GLONOX (25.32 (-0.77))



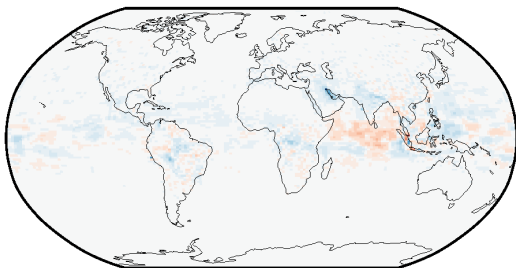
**GLOCO - CLE2040**

GLOCO (26.04 (-0.05))



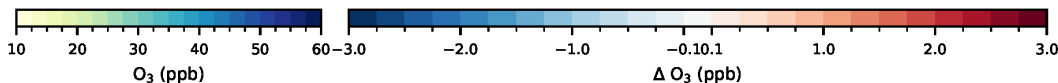
**GLOVOC - CLE2040**

GLOVOC (26.06 (-0.03))



Reductions in NO<sub>x</sub> dominate the changes in surface ozone with small contributions from CO and VOC.

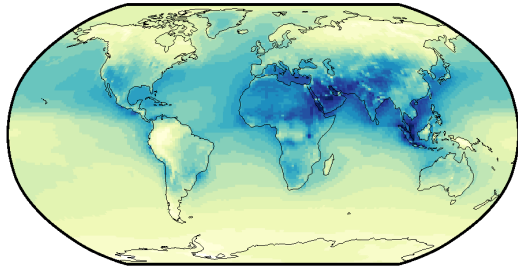
Also shown is some variability from radiative feedbacks



# Change Exps and 2040 CLE

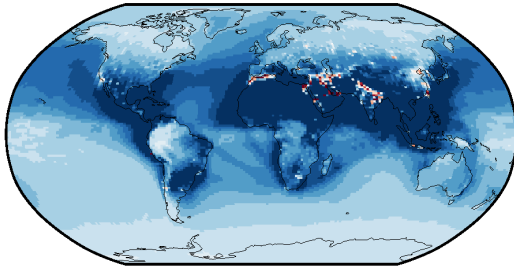
## CLE2040

CLE2040 (26.09)



## MTFR - CLE2040

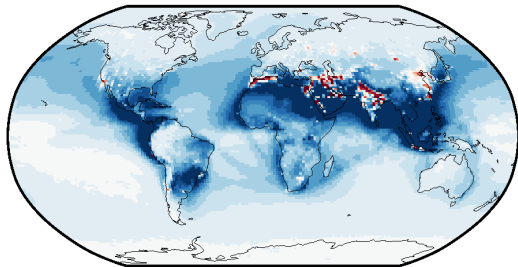
MTFR2040 (22.97 (-3.12))



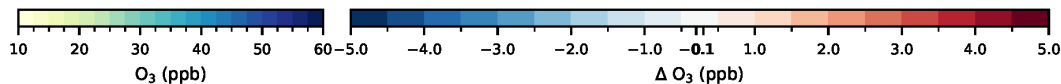
Large reductions from reducing both CH<sub>4</sub> and anthropogenic Emissions in MTFR

## HILO - CLE2040

HILO2040 (24.34 (-1.75))



Comparing MTFR to HILO show the impact of CH<sub>4</sub> reductions, accounting for ~45% of the global total reduction in surface ozone



# Future Plans

- To continue with regional emission perturbation experiments, focussing on ALL and NOx reductions
- To look into future emissions and climate experiments