

# Impact of biomass burning emission distributions on atmospheric pollutant lifetimes

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# Outline

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  - Temporal and spatial differences
- Experiment setup
- Results
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  - Lifetimes
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  - TM4-ECPL parallelization

# Biomass burning emission datasets

Databases used

- ECLIPSE
- GFEDv3 (van der Werf et al., 2010)
- GFEDv2 (van der Werf et al., 2006)
- ACCMIP (Lamarque et al., 2013)
- PEGAERESS (Knorr W. et al., 2012)

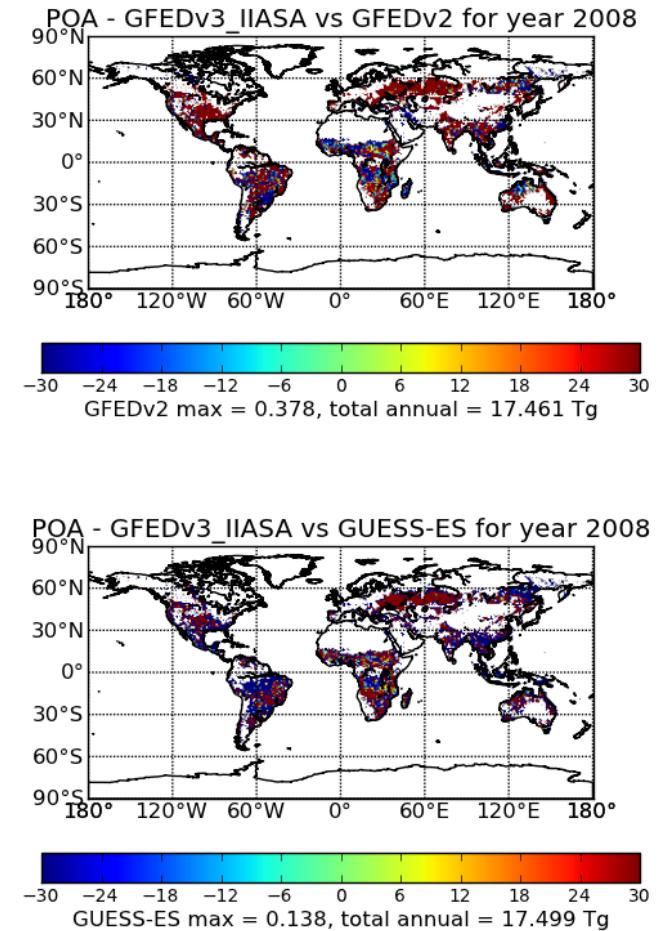
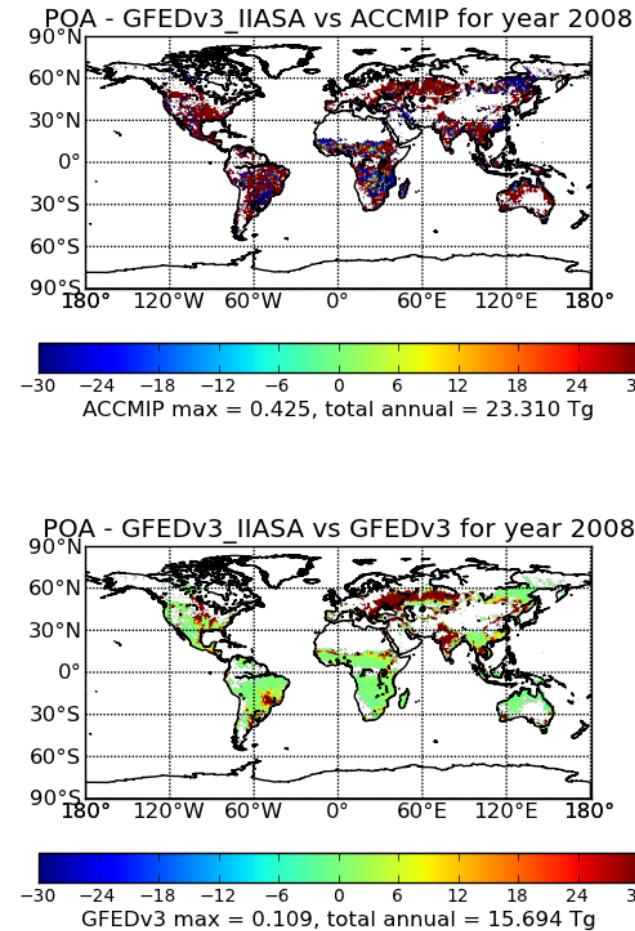
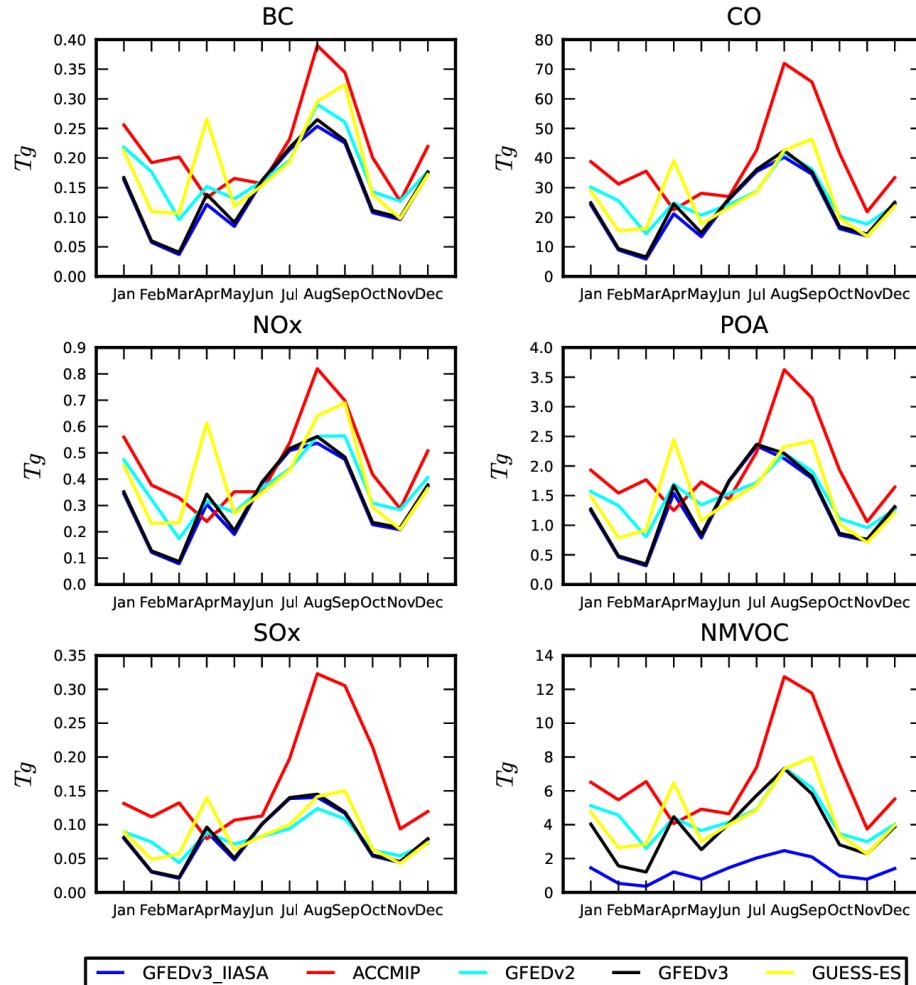
# Differences between the fire emissions

	BC (Tg/a)	NOx (Tg/a)	POA (Tg/a)
ACCMIP	2.62	5.479	23.31
GFEDv2	2.13	4.491	17.461
GFEDv3	1.759	3.894	15.694
GFEDv3_IIASA	1.695	3.751	15.197
PEGAERES	2.188	4.781	17.499

Agricultural  
Waste  
Burning

	BC (Tg/a)	Nox (Tg/a)	POA (Tg/a)
GFEDv3	1.759	3.894	15.694
GFEDv3_IIASA	1.695	3.751	15.197
difference	0.064	0.143	0.497

# Differences between the fire emissions

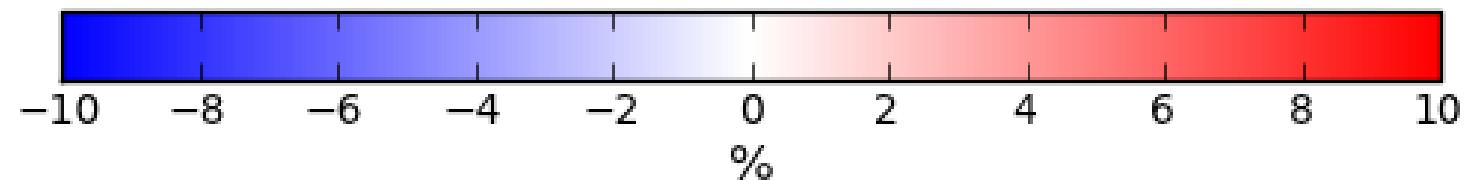
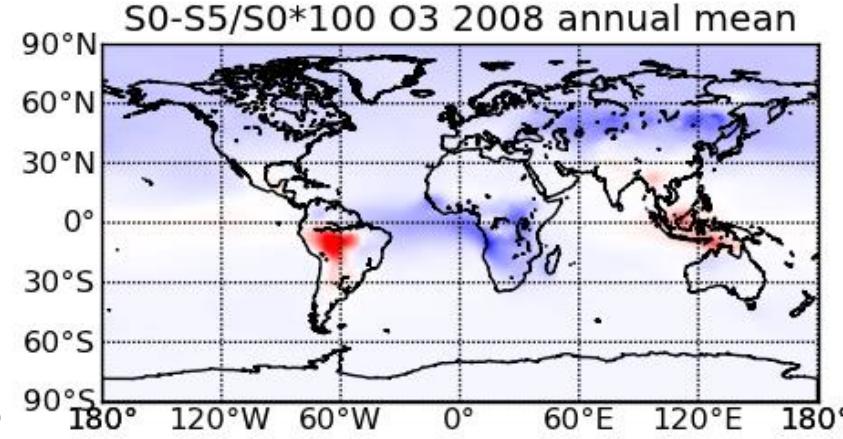
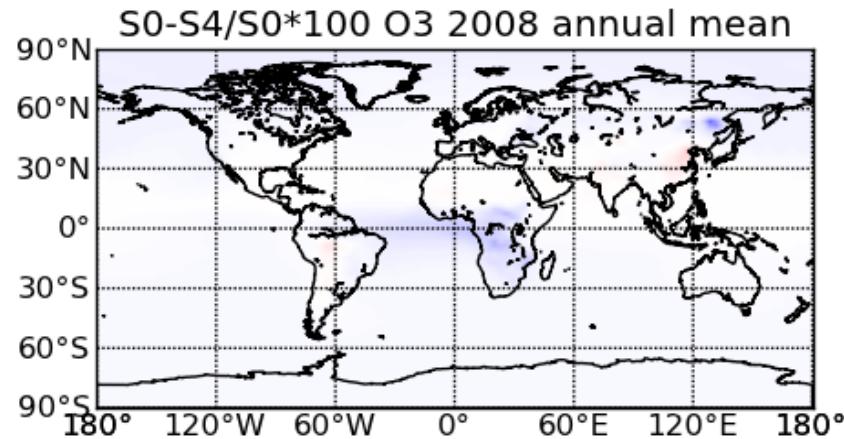
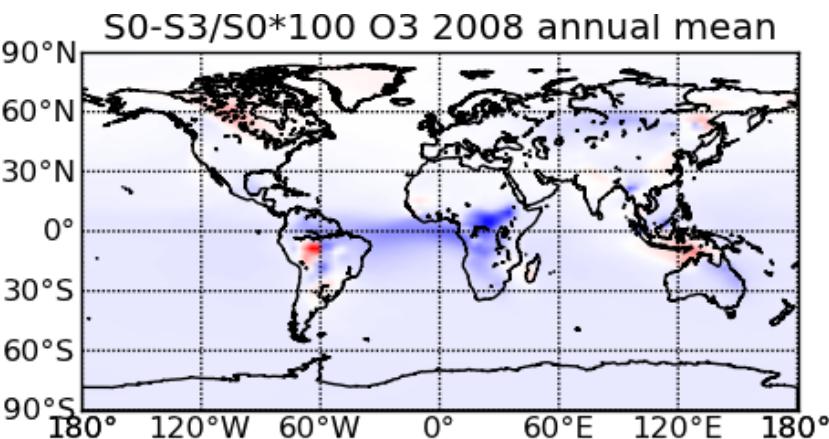
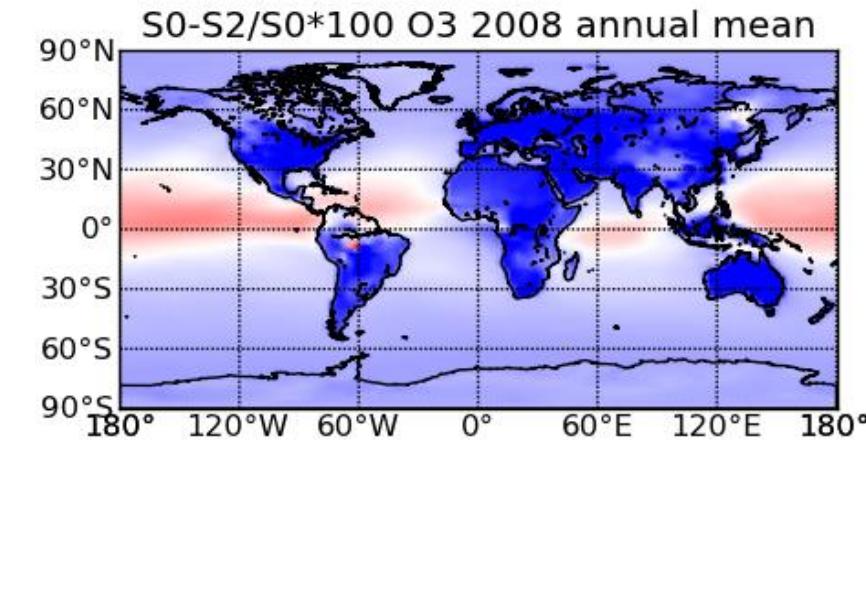
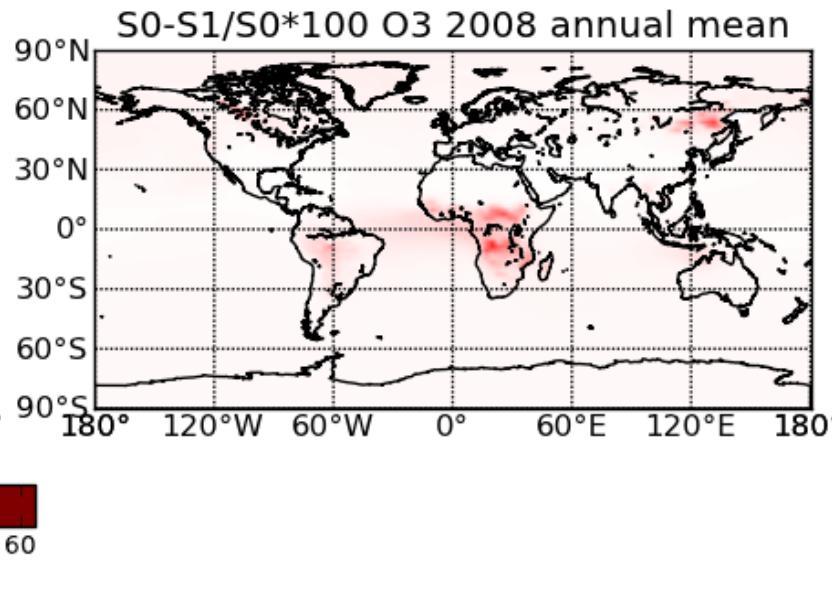
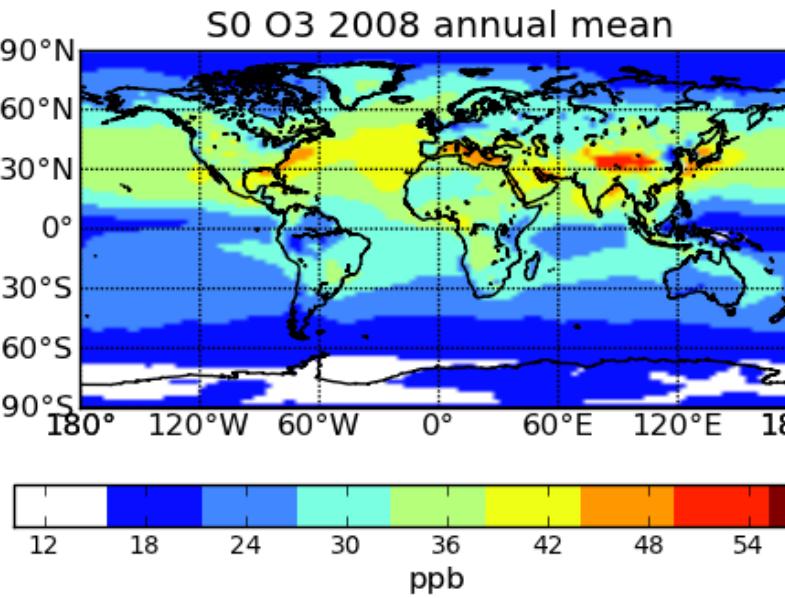


$$(\text{GFEDv3\_IIASA} - \text{DB})/\text{GFEDv3\_IIASA} * 100$$

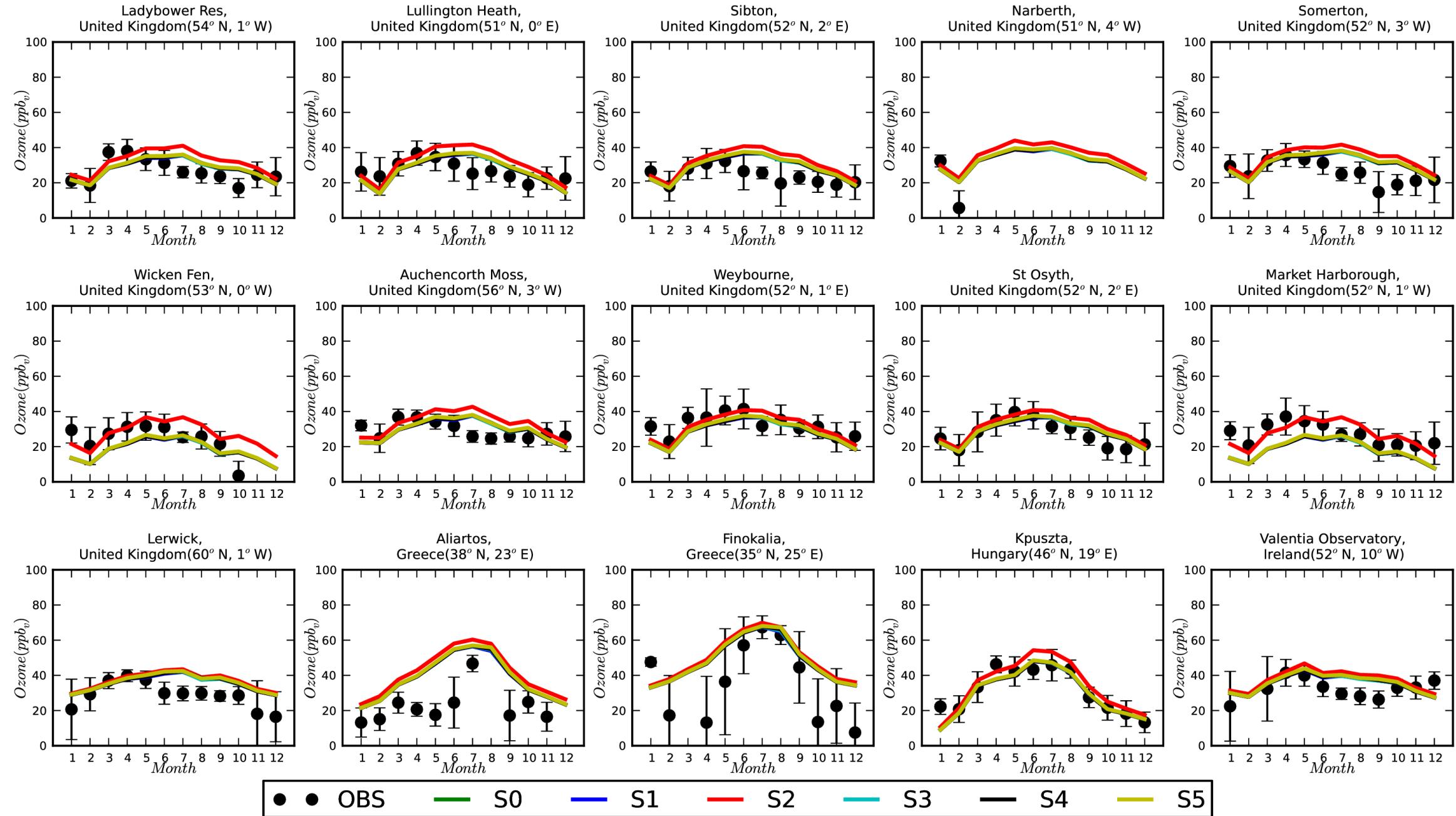
# Experiment Setup

- TM4-ECPL in  $3^{\circ} \times 2^{\circ}$  with 34 hybrid levels
- ERA-Interim meteorology
- MEGAN natural emissions (PEGASOS interannual)
- ECLIPSE anthropogenic emissions (Klimont et al., 2013) (no AWB on S2-S5)
- Biomass Burning emissions
  - S0 → GFEDv3\_IIASA
  - S1 → GFEDv3\_IIASA emitted at surface
  - S2 → ACCMIP
  - S3 → GFEDv2
  - S4 → GFEDv3
  - S5 → PEGAERESS

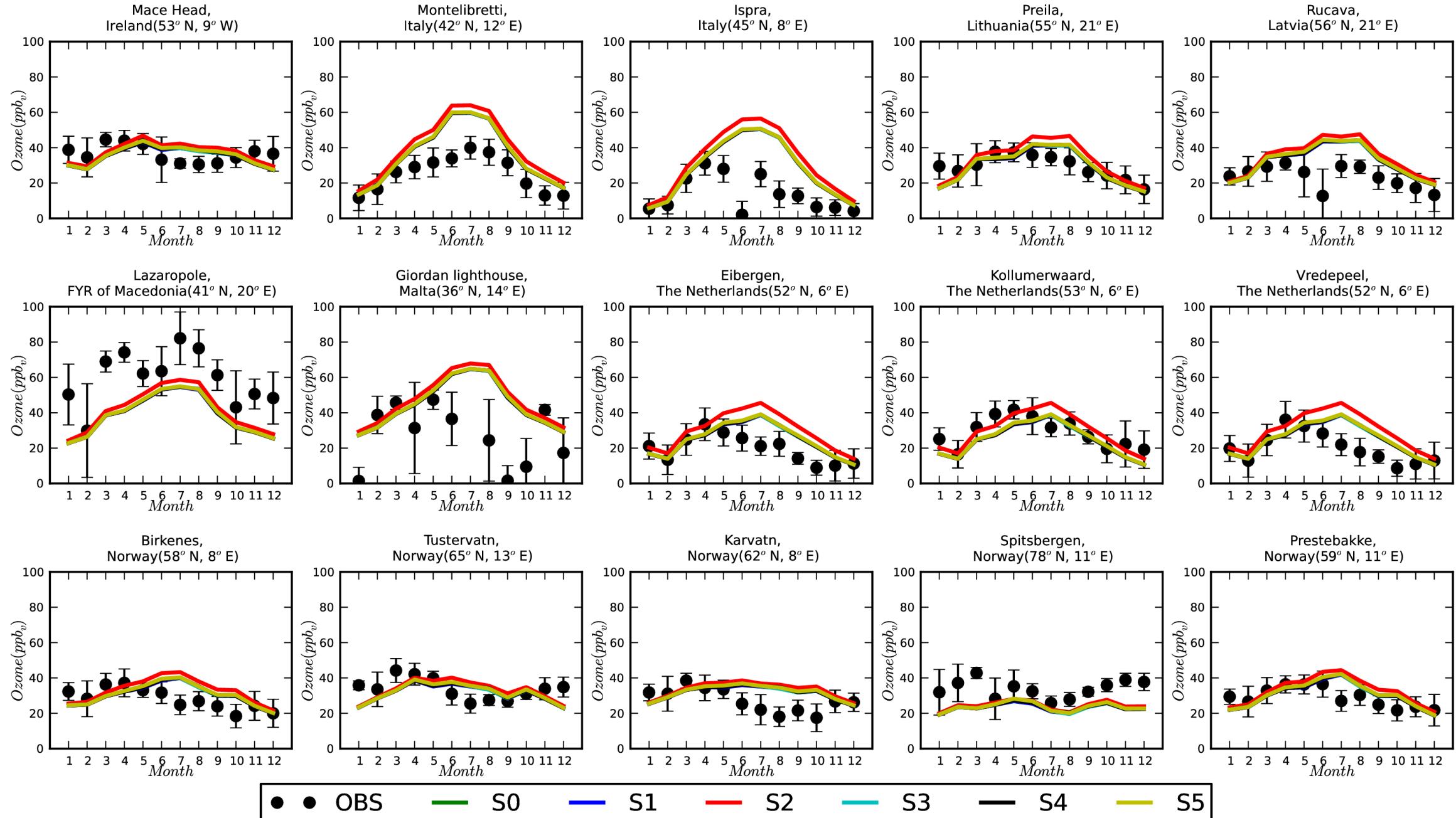
# Simulated Ozone



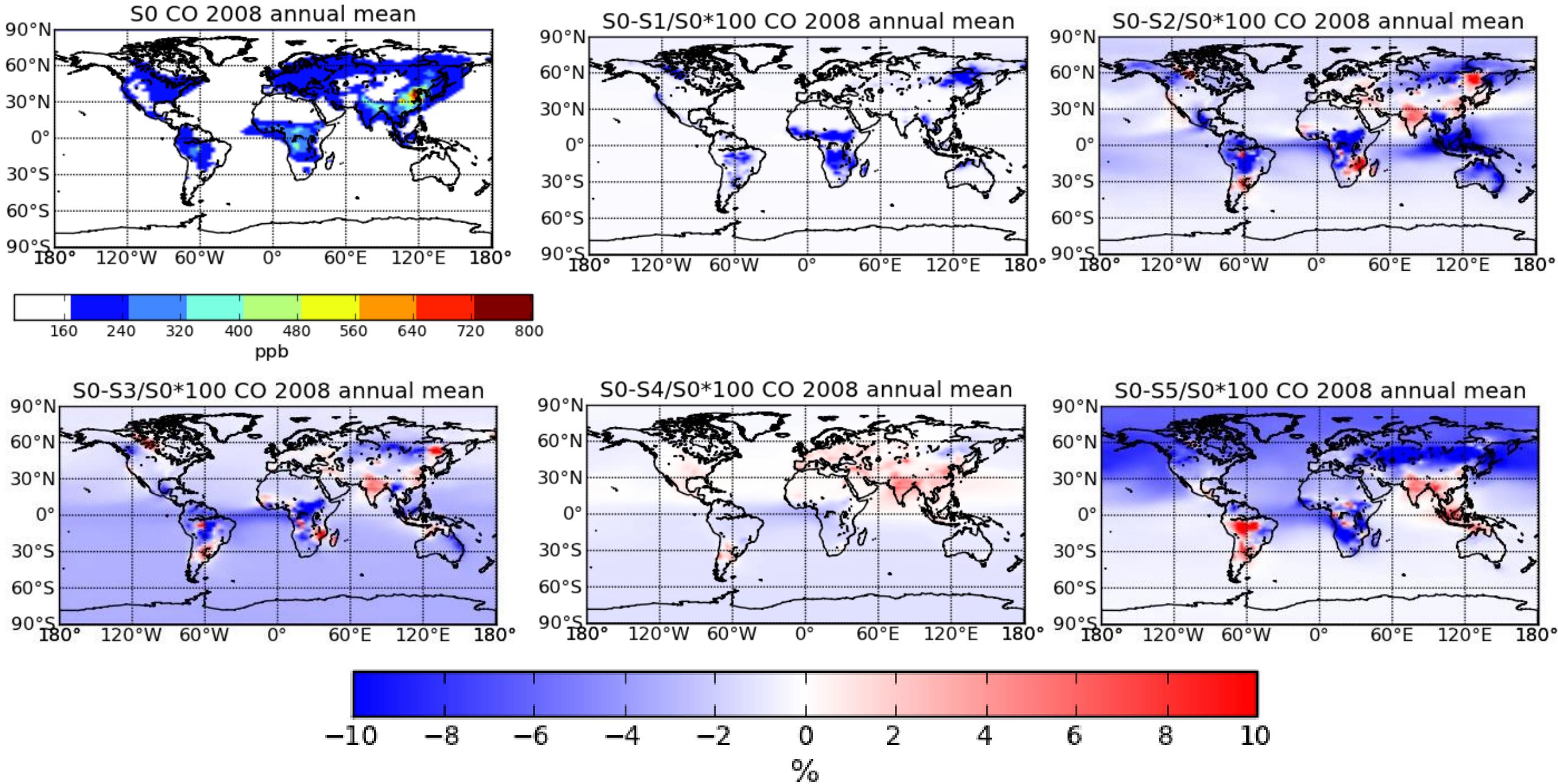
# Comparison with Ozone



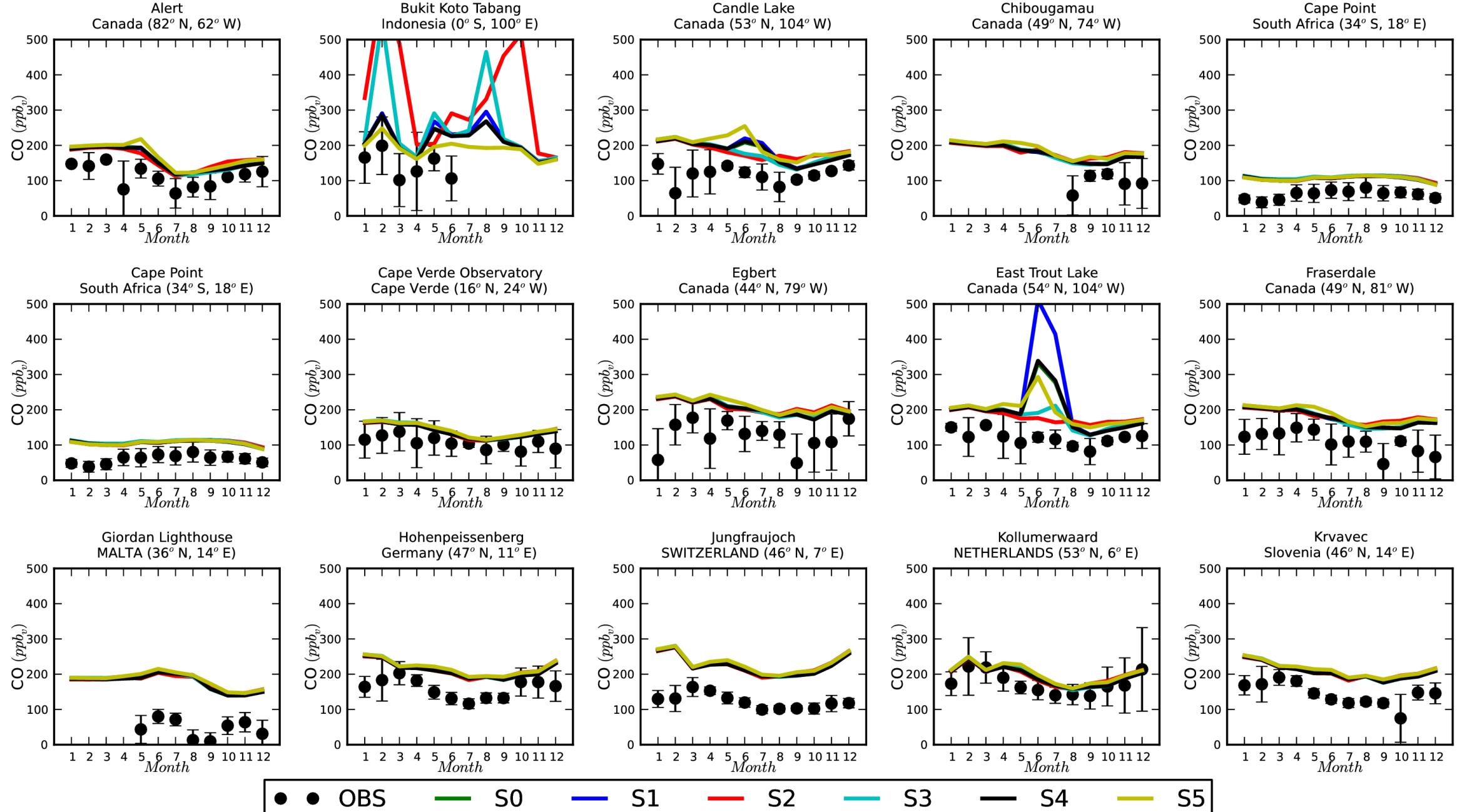
# Comparison with Ozone



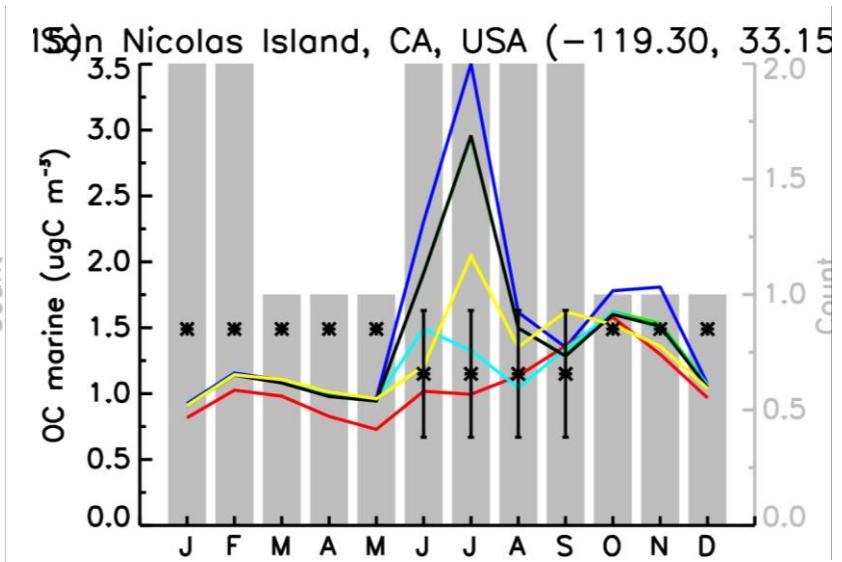
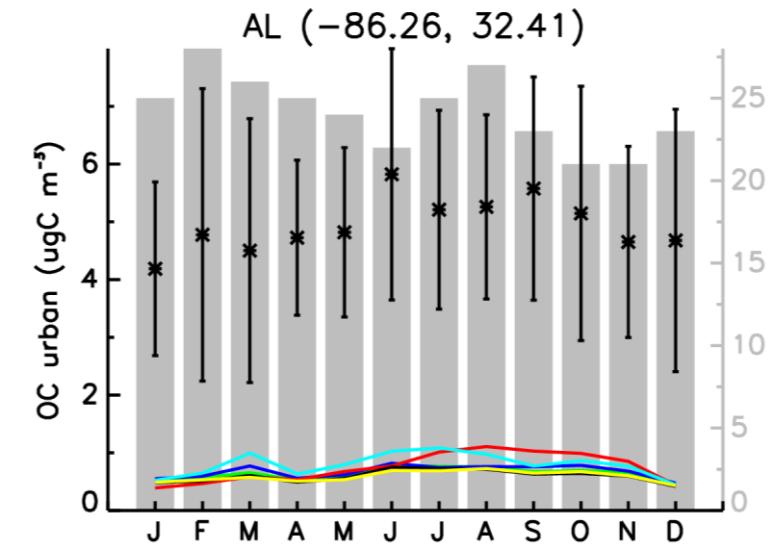
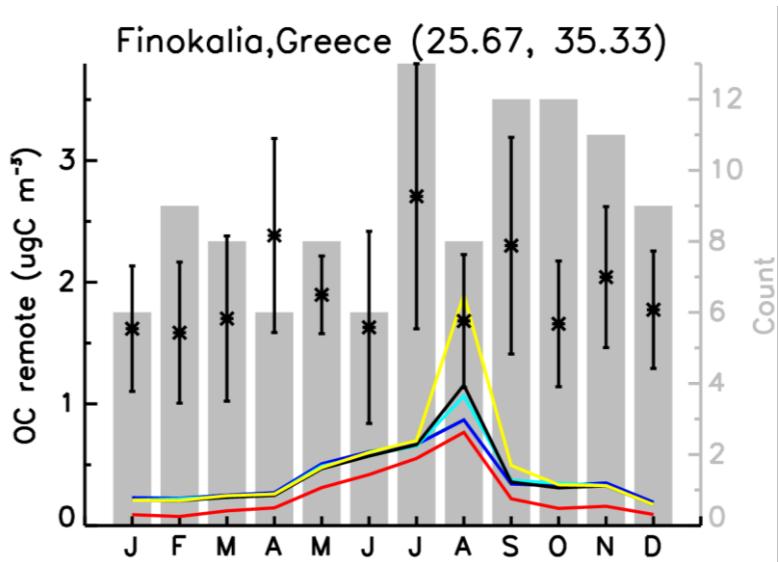
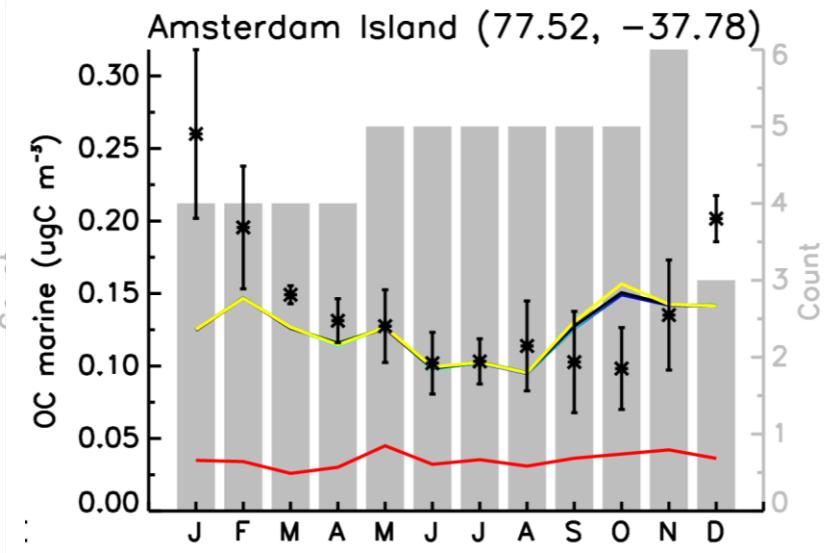
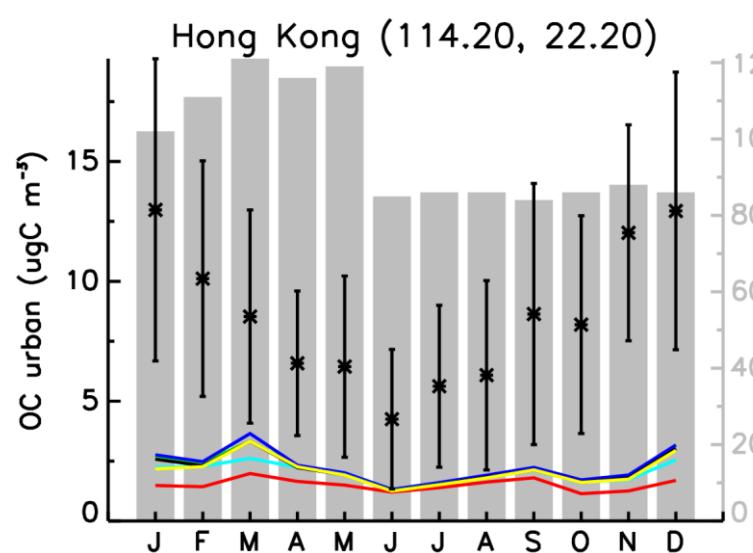
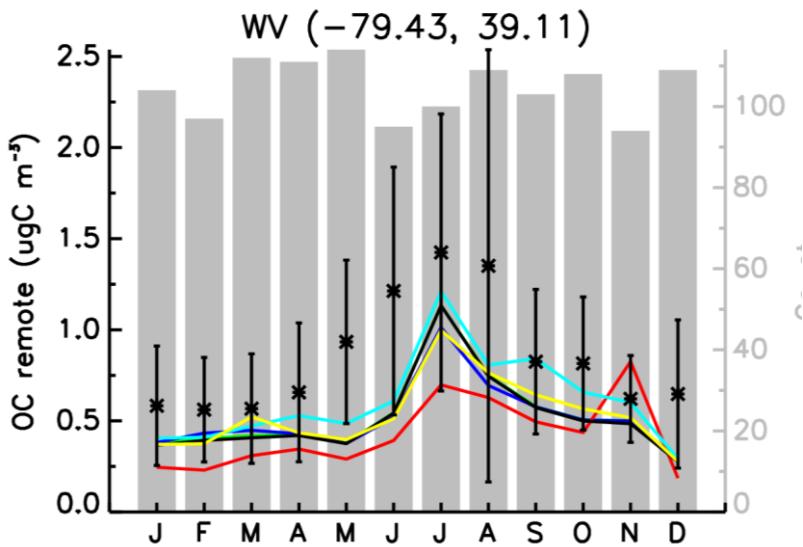
# Simulated CO



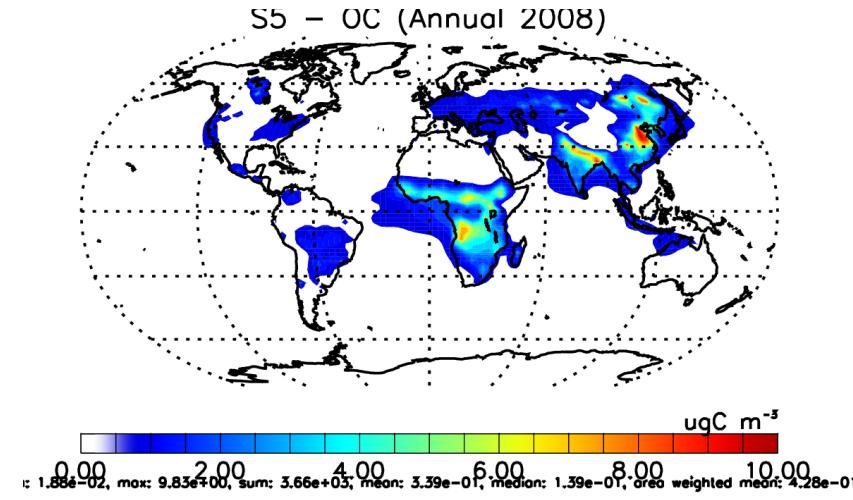
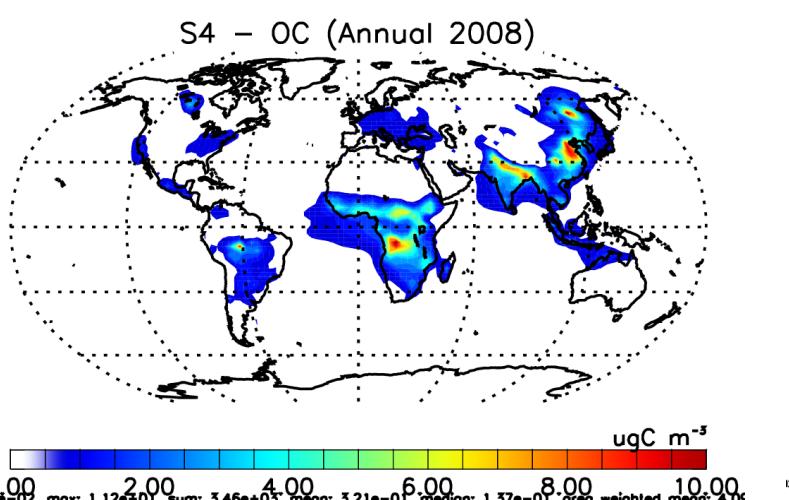
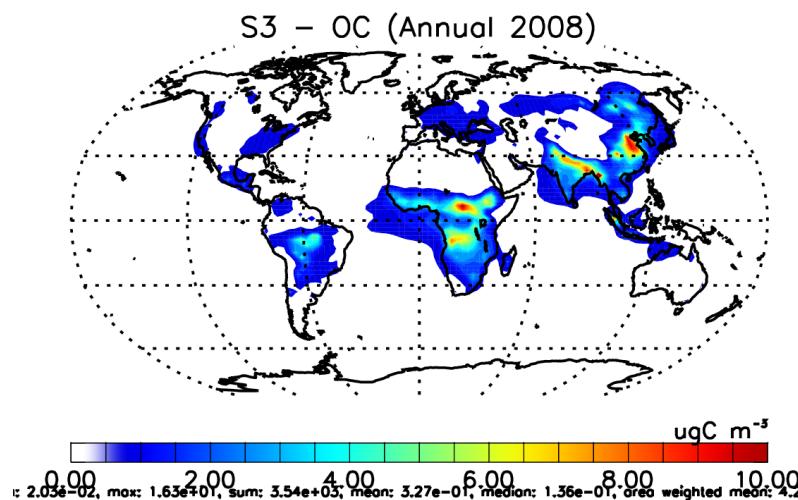
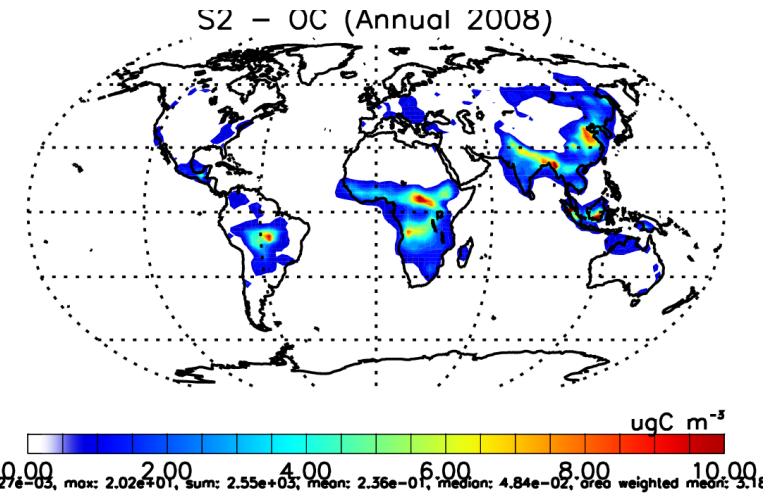
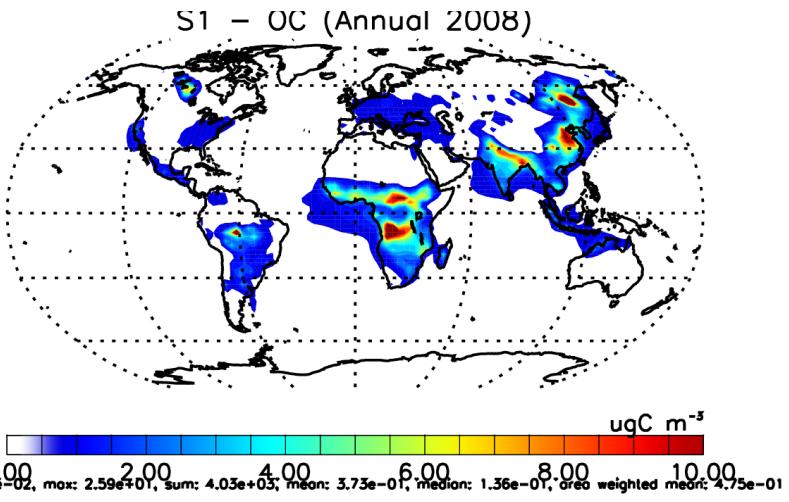
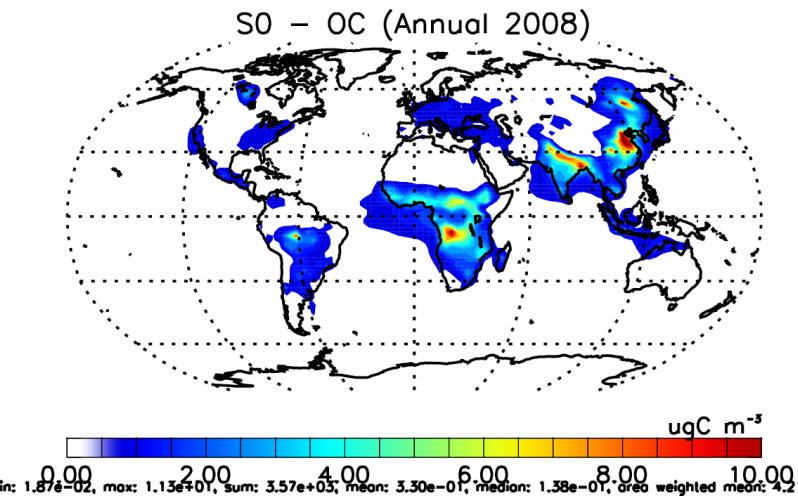
# Comparison with CO

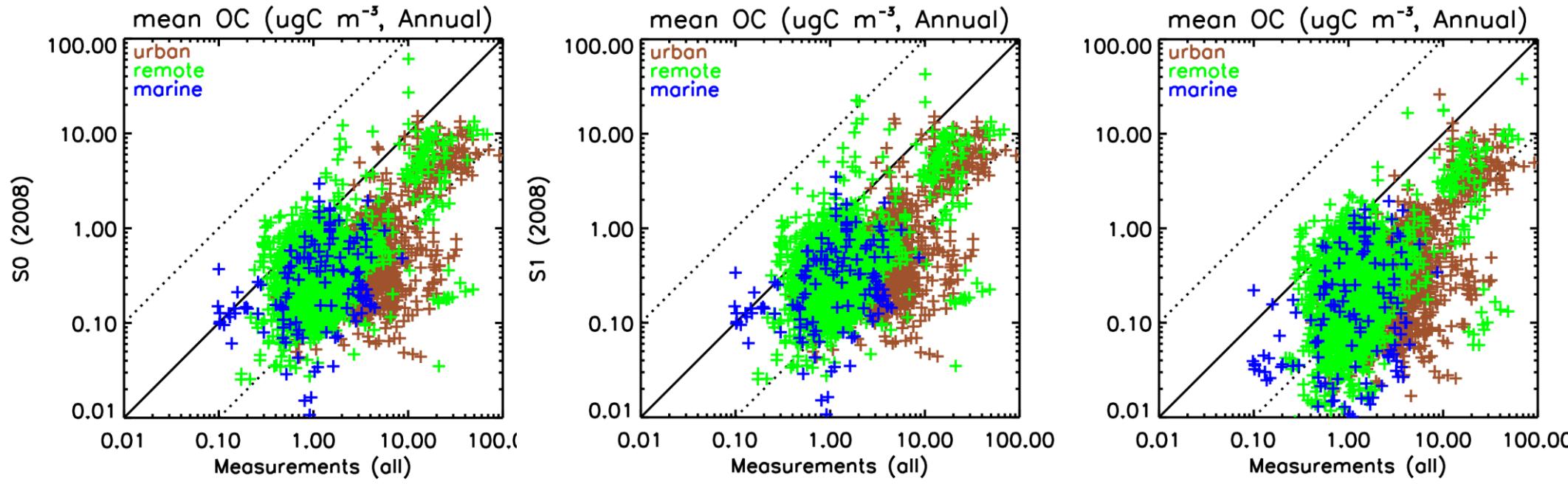


# Comparison with OC

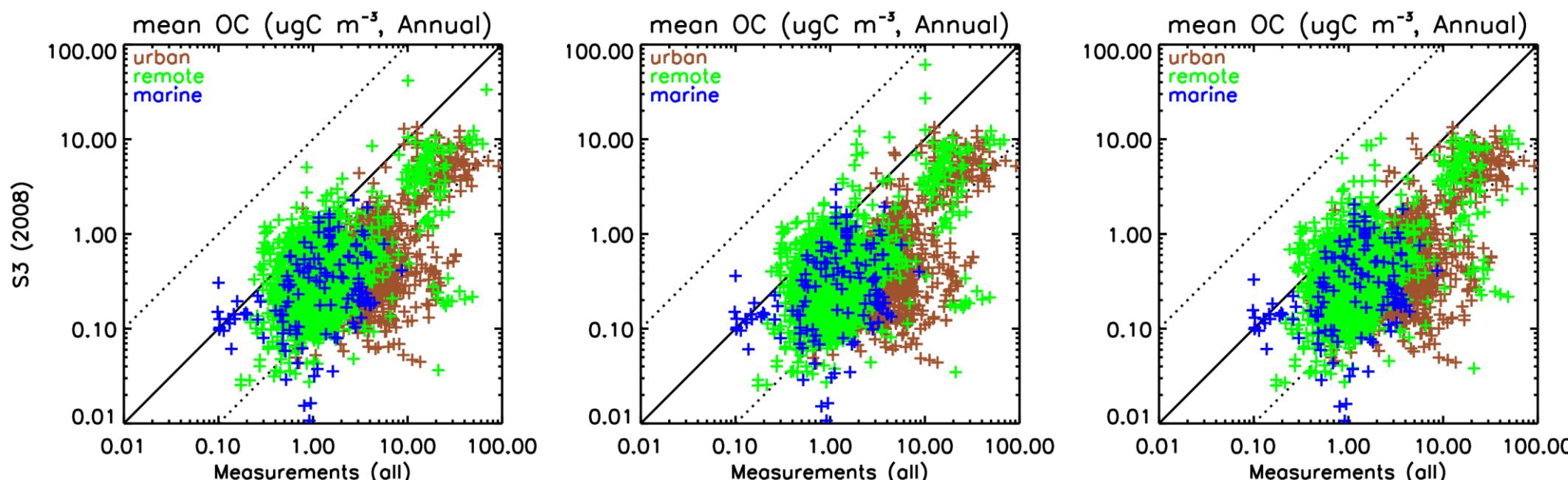


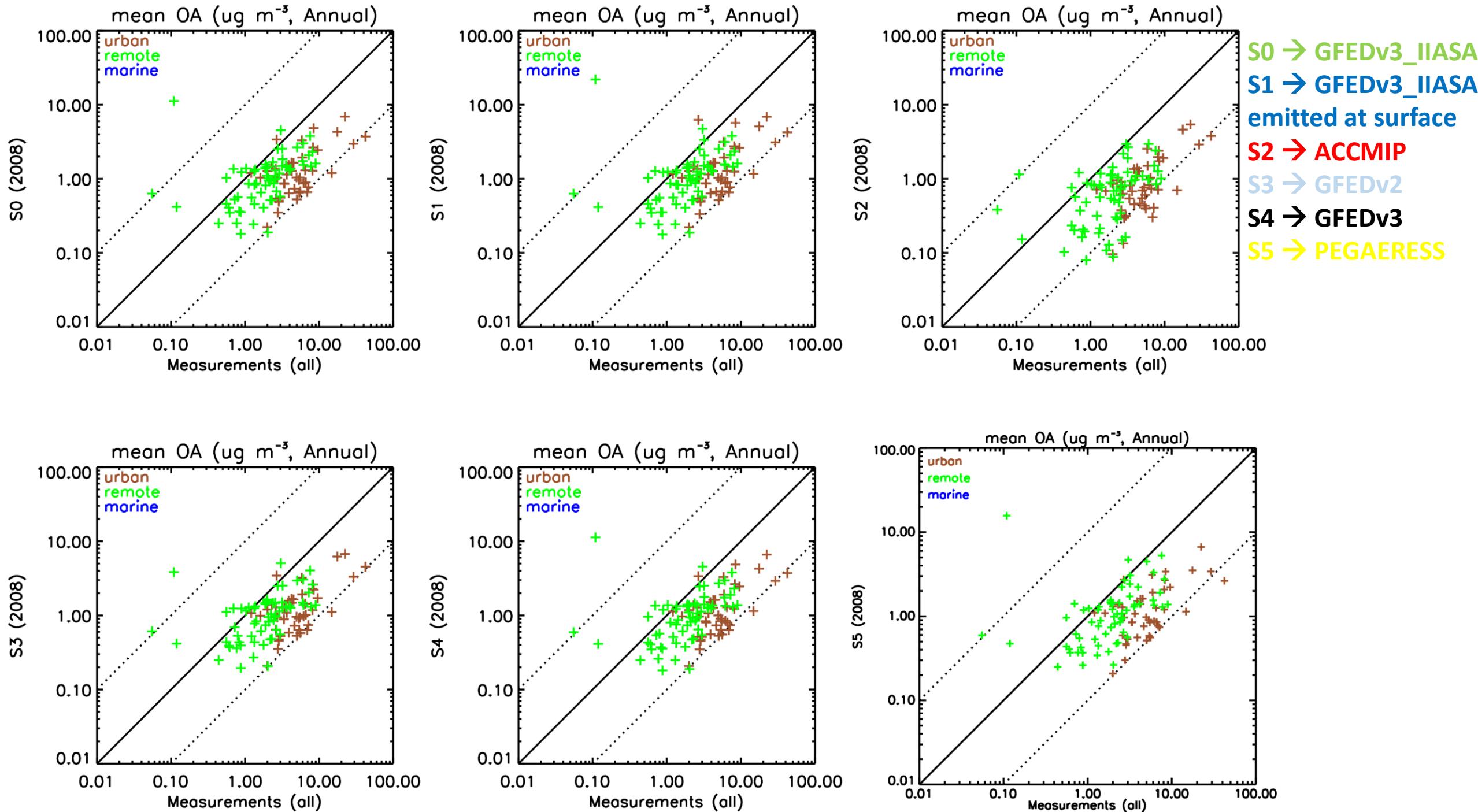
# OC simulated



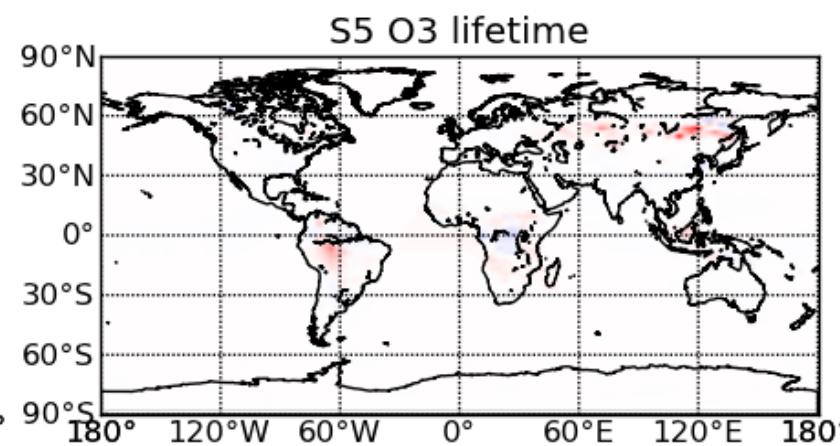
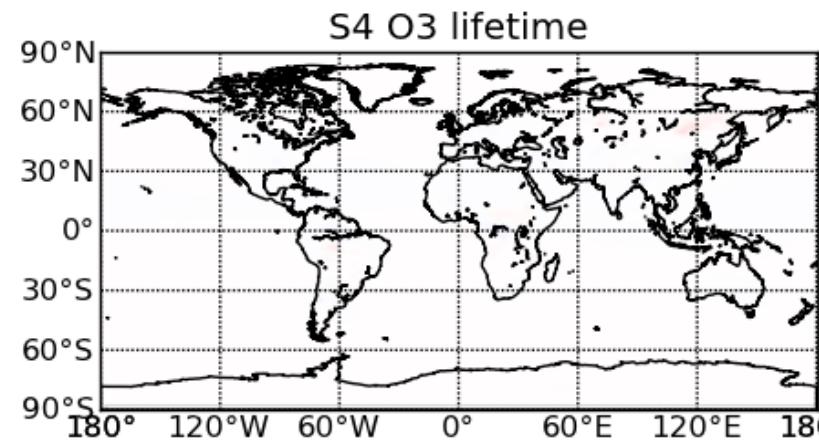
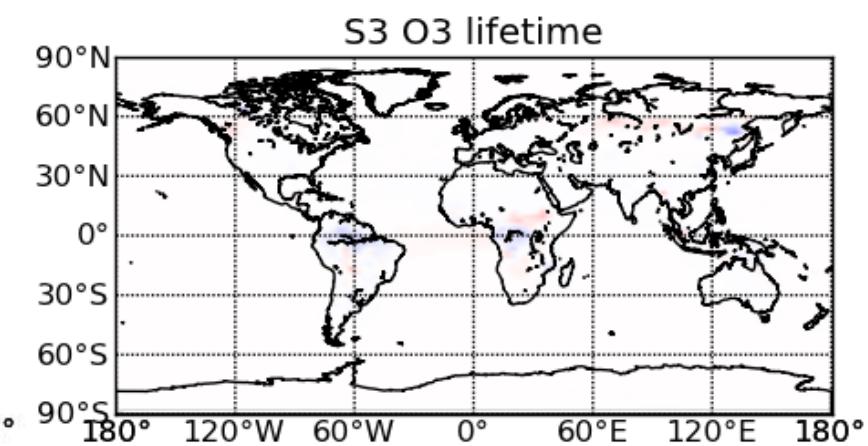
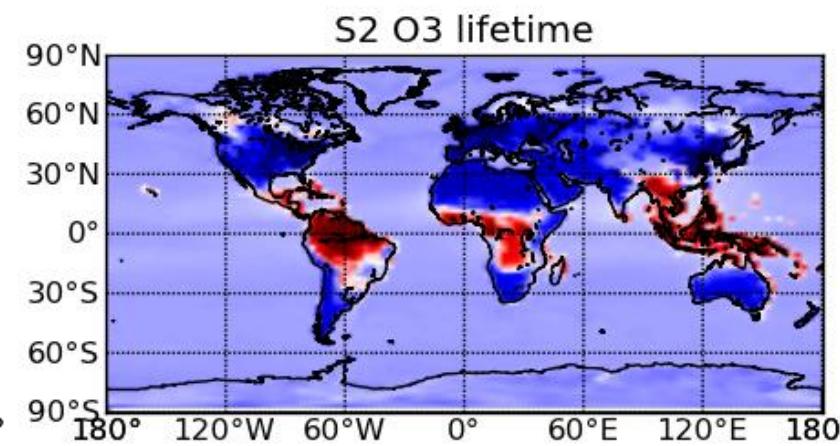
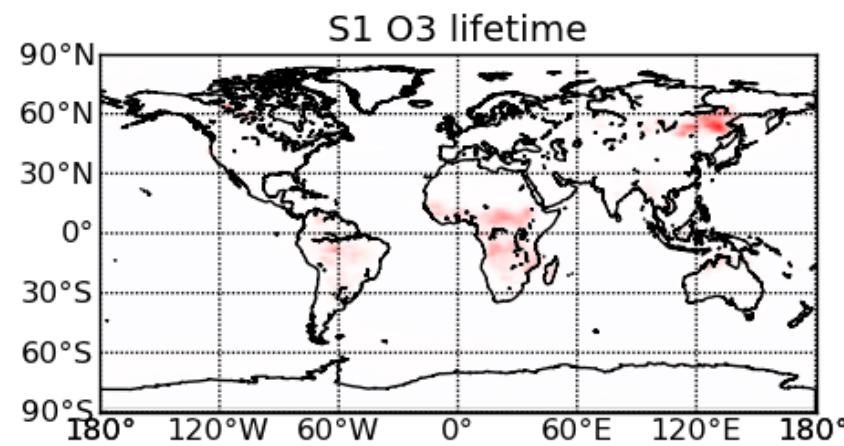


S0 → GFEDv3\_IIASA  
 S1 → GFEDv3\_IIASA emitted at surface  
 S2 → ACCMIP  
 S3 → GFEDv2  
 S4 → GFEDv3  
 S5 → PEGAERESS

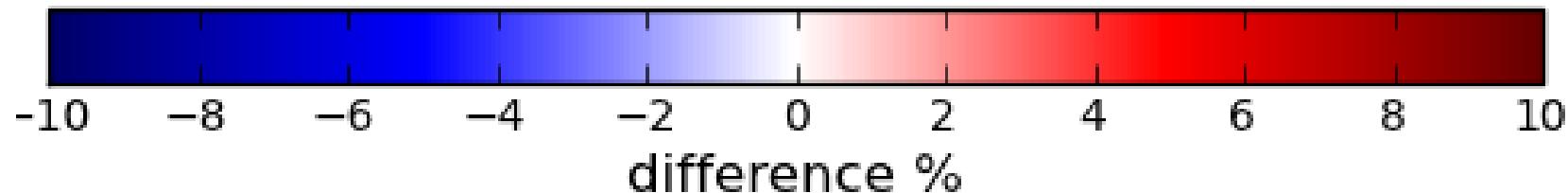




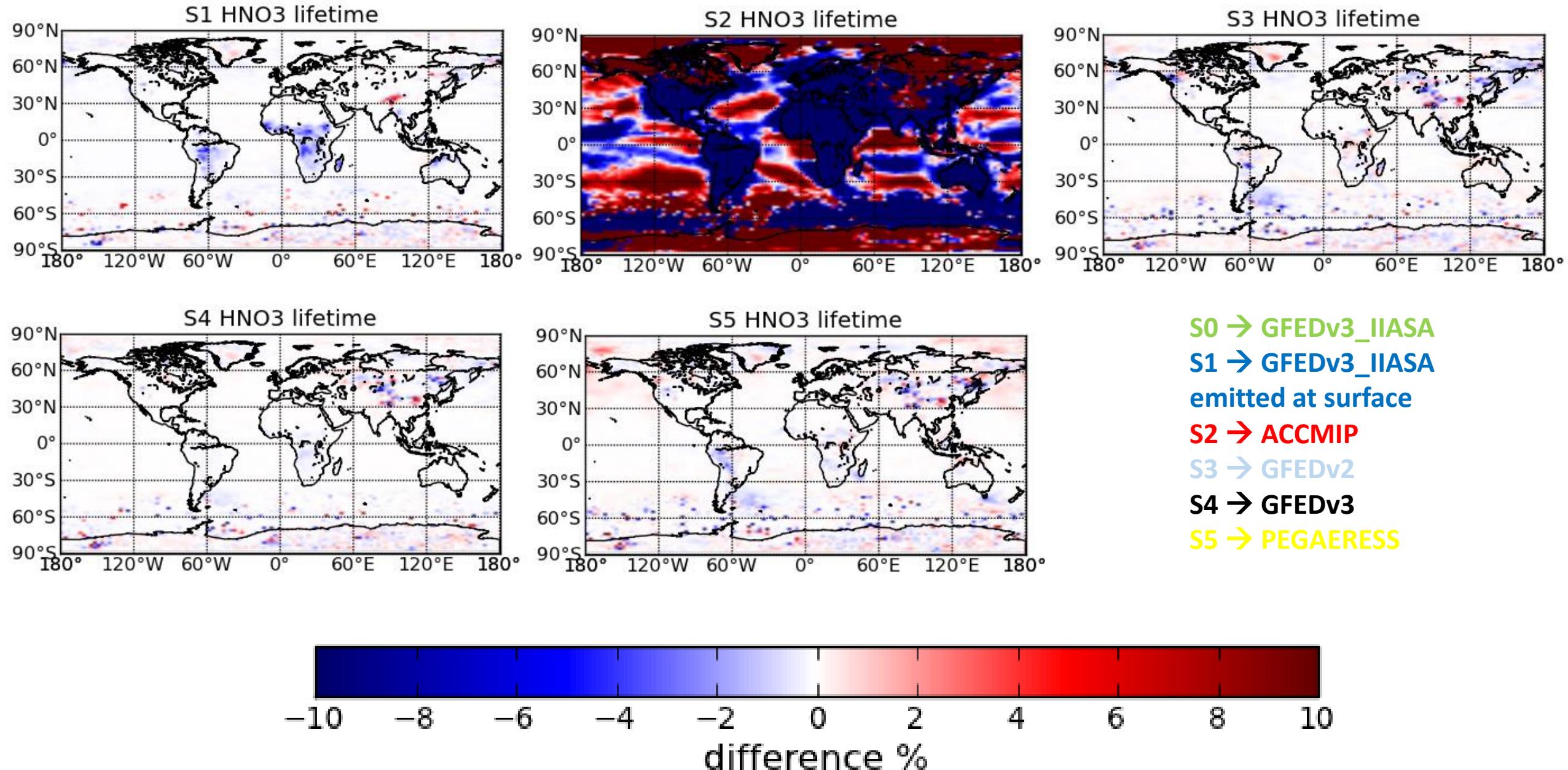
# Lifetimes Ozone



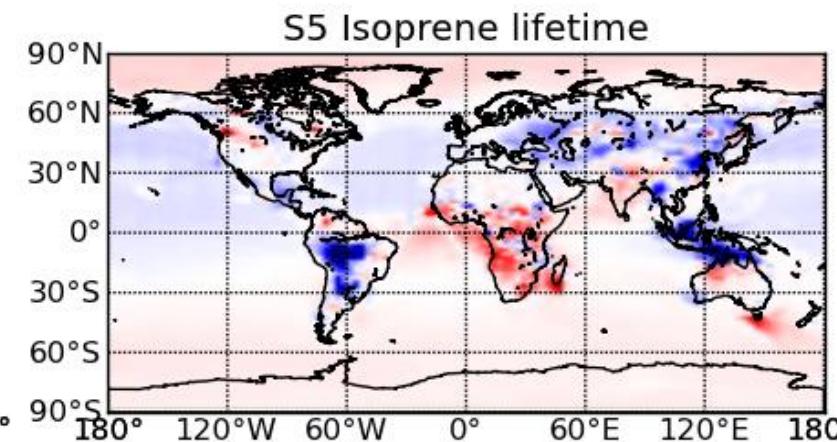
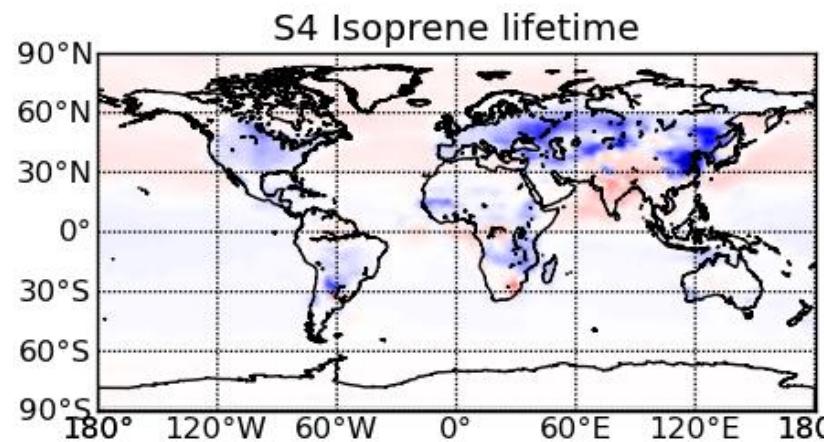
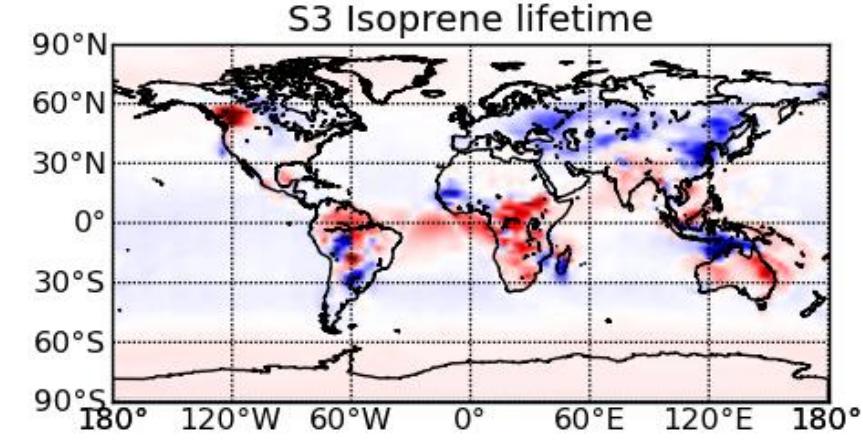
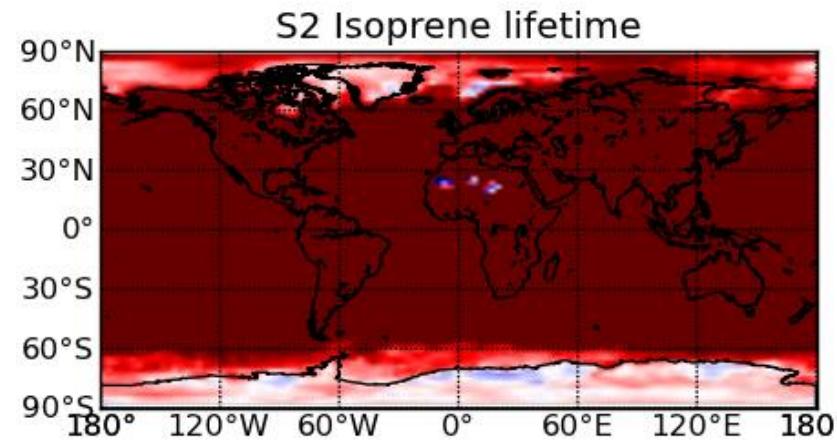
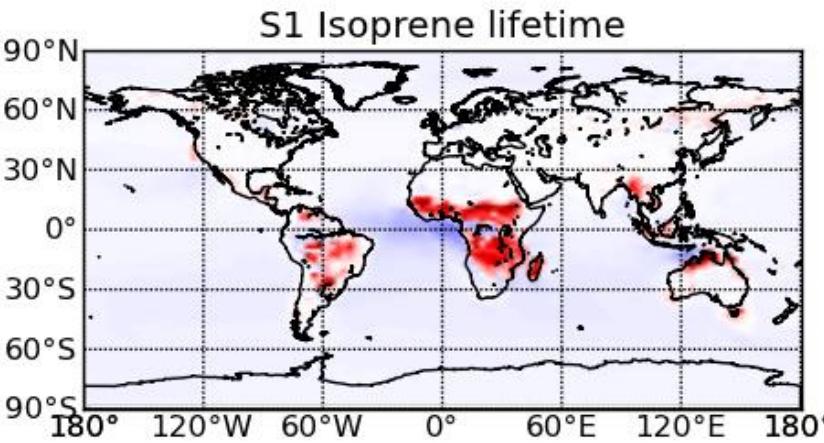
**S0 → GFEDv3\_IIASA**  
**S1 → GFEDv3\_IIASA**  
emitted at surface  
**S2 → ACCMIP**  
**S3 → GFEDv2**  
**S4 → GFEDv3**  
**S5 → PEGAERESS**



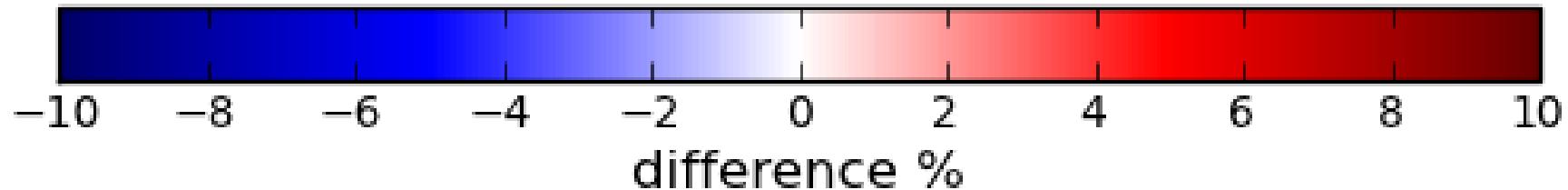
# Lifetimes HNO<sub>3</sub>

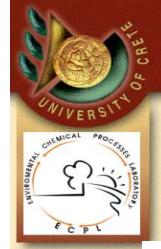


# Lifetimes Isoprene



**S0 → GFEDv3\_IIASA**  
**S1 → GFEDv3\_IIASA**  
**emitted at surface**  
**S2 → ACCMIP**  
**S3 → GFEDv2**  
**S4 → GFEDv3**  
**S5 → PEGAERESS**

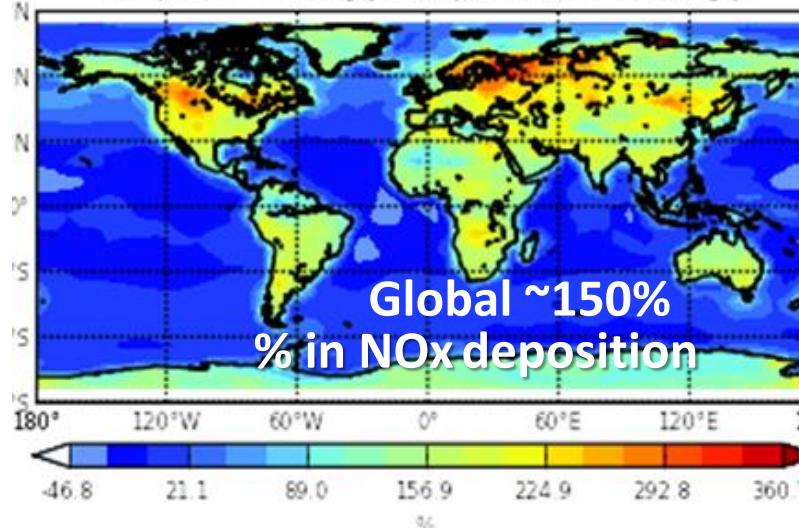




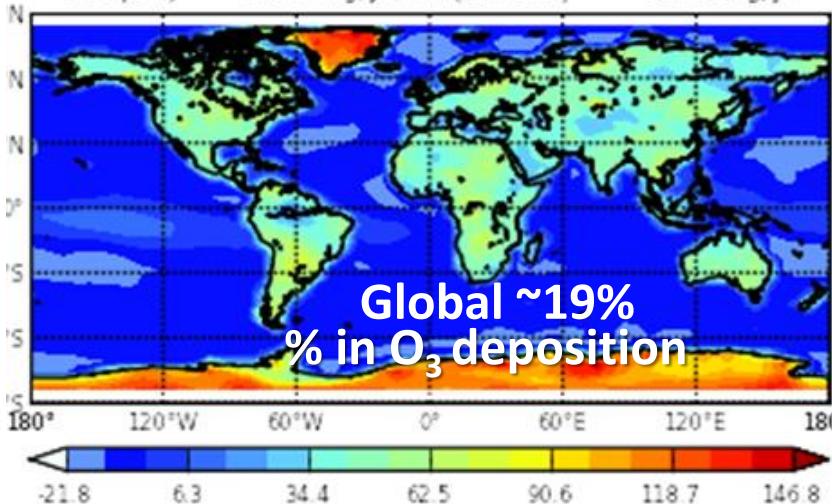
# TM4-ECPL - Comparison of ERA-interim vs Operational ECMWF for 2005 % difference: $(\text{ERA-OD})/\text{OD} \times 100$

*Higher deposition & Lower surface  $O_3$  in ERA-interim simulations*

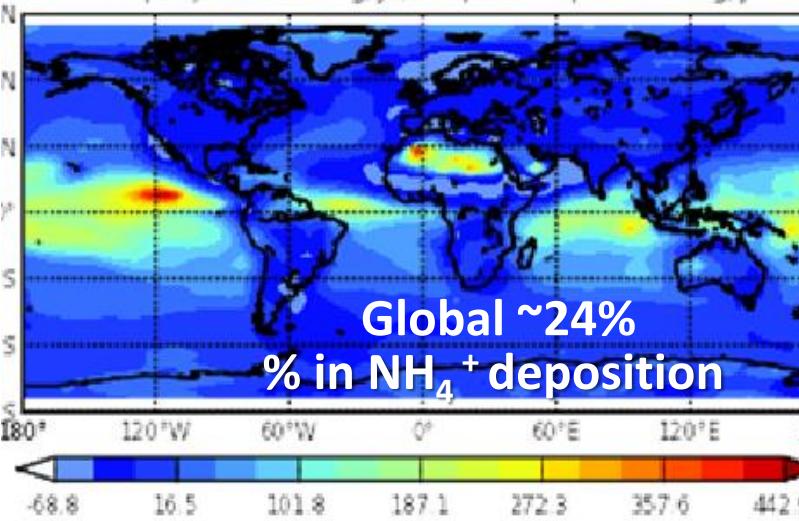
%Difference NOx DEPOSITION, Surface, Annual, 2005  
DEP(OD) = ~3.60Tg/yr, DIF(OD-ERA) = ~-5.47Tg/yr



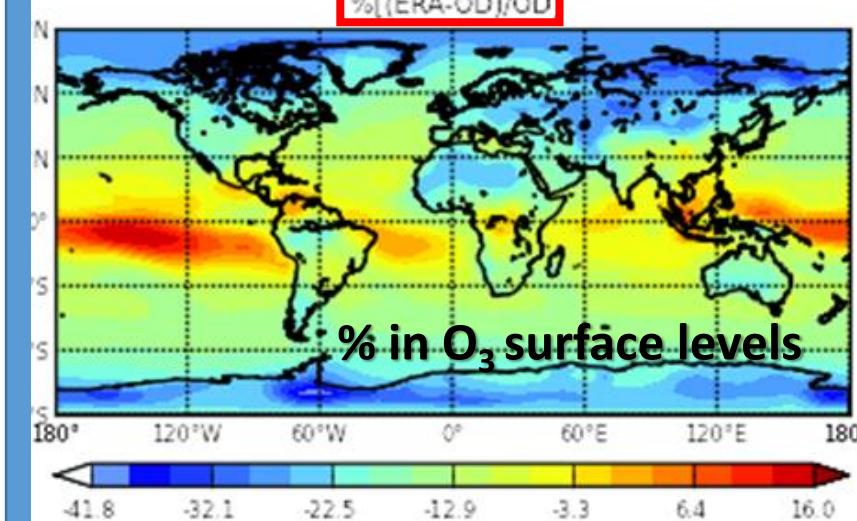
%Difference O3 DEPOSITION, Surface, Annual, 2005  
DEP(OD) = ~548.44Tg/yr, DIF(OD-ERA) = ~-104.59Tg/yr



%Difference NH4 DEPOSITION, Surface, Annual, 2005  
DEP(OD) = ~15.41Tg/yr, DIF(OD-ERA) = ~-3.61Tg/yr



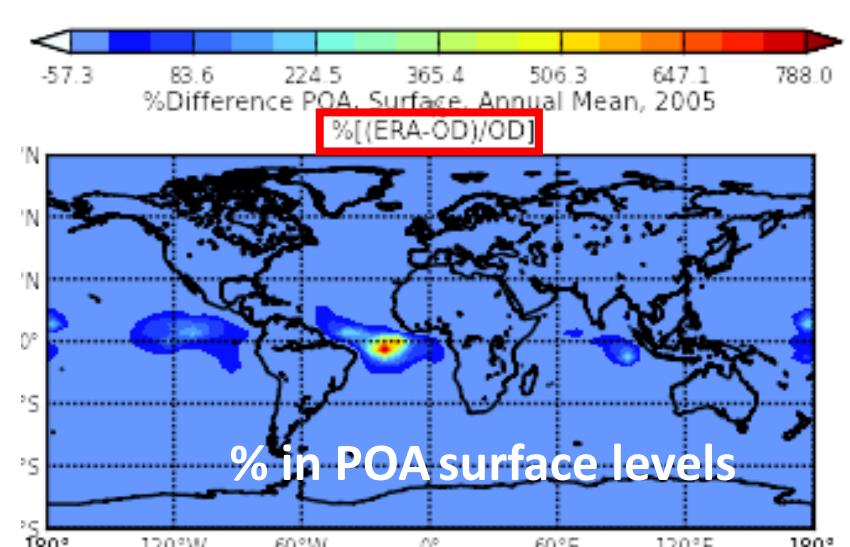
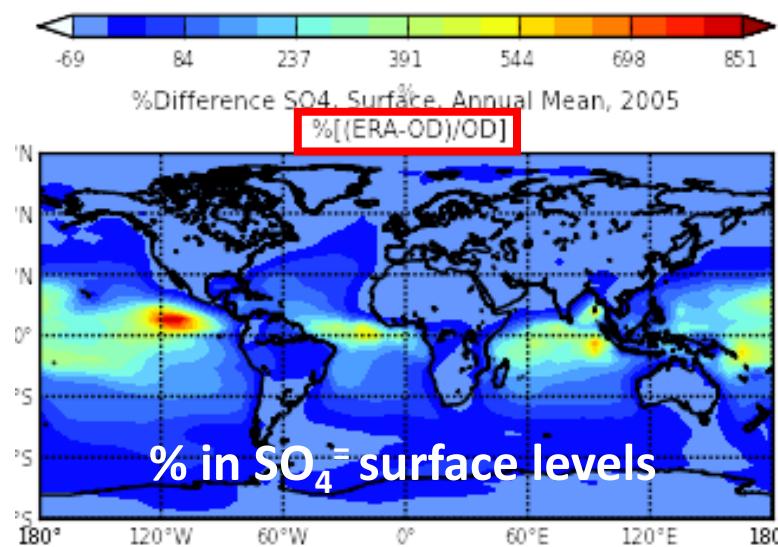
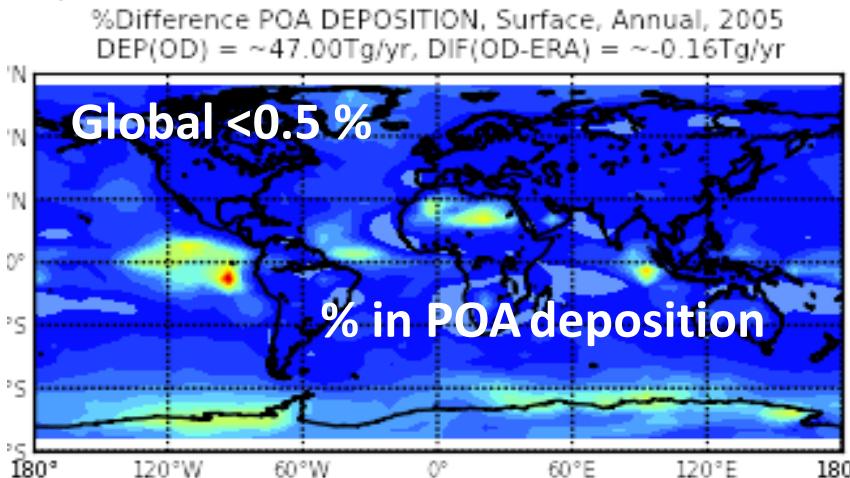
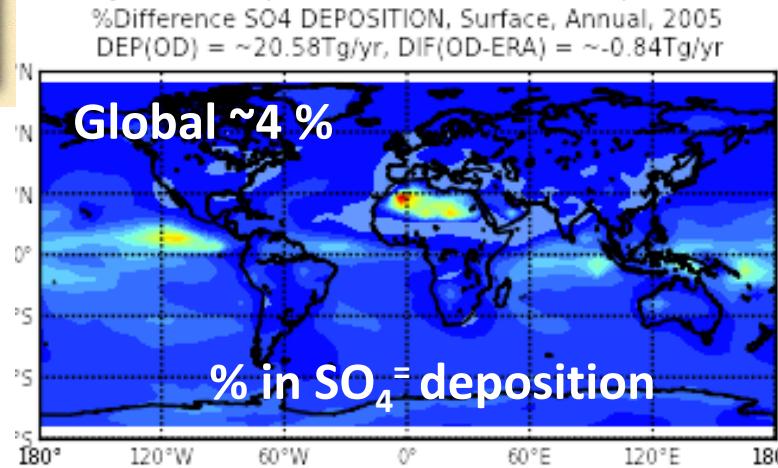
%Difference O3, Surface, Annual Mean, 2005  
 $\%[(\text{ERA-OD})/\text{OD}]$





# TM4-ECPL - Comparison of ERA-interim vs Operational ECMWF for 2005 % difference: $(\text{ERA-OD})/\text{OD} \times 100$

*Higher deposition & mainly Lower surface levels in ERA-interim simulations*

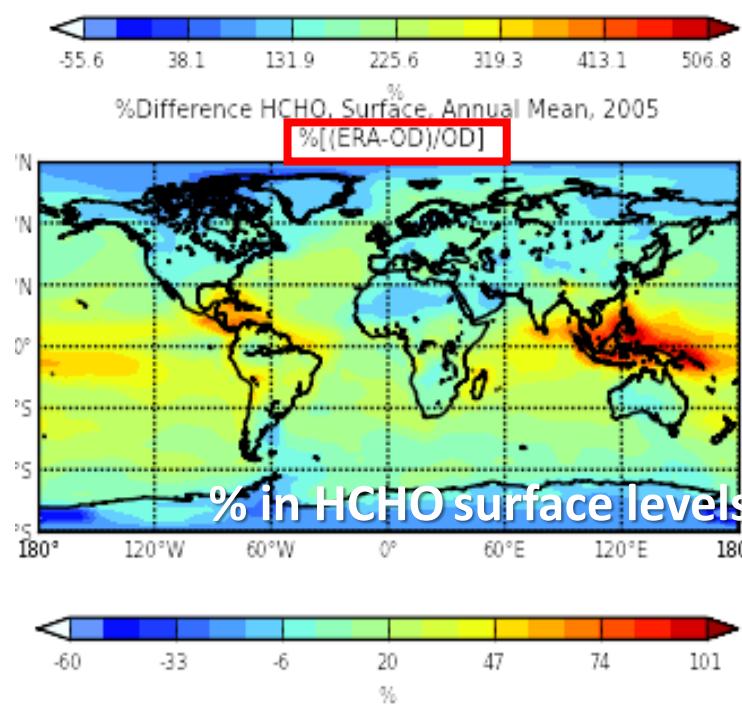
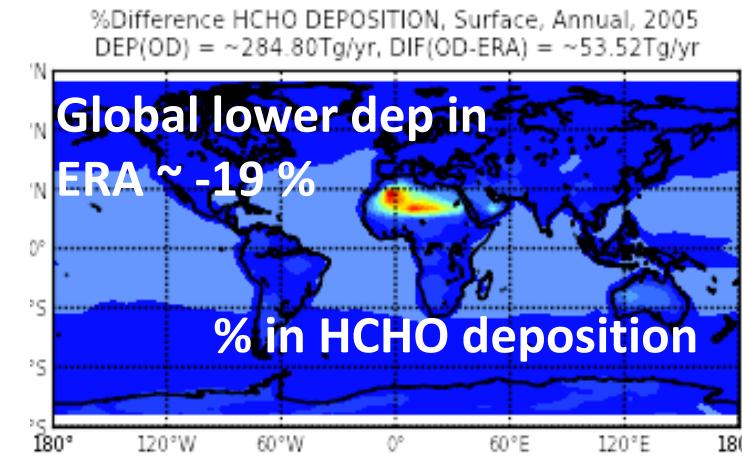
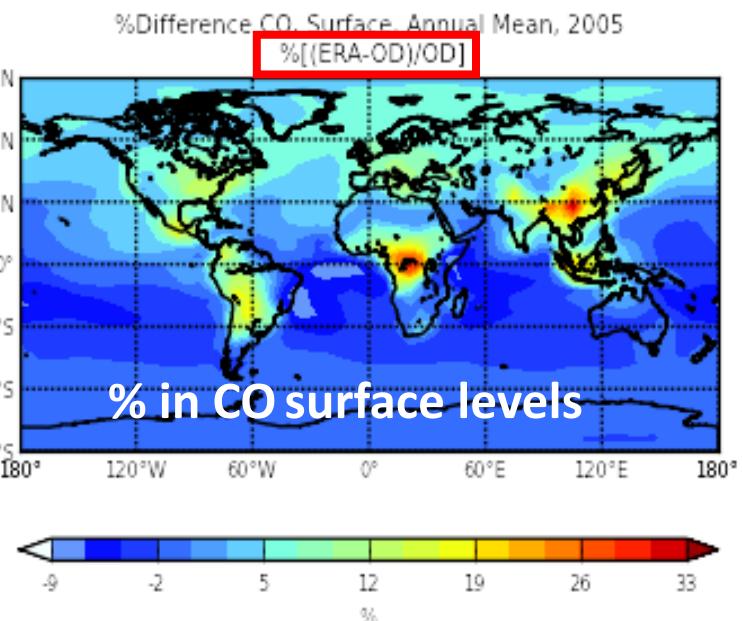
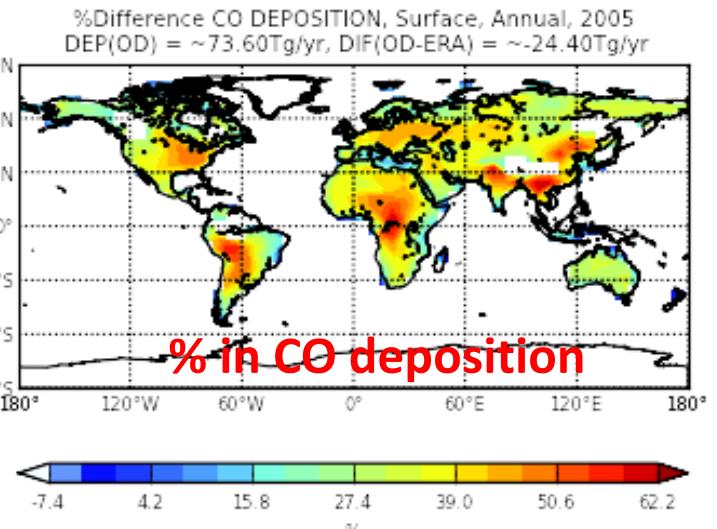




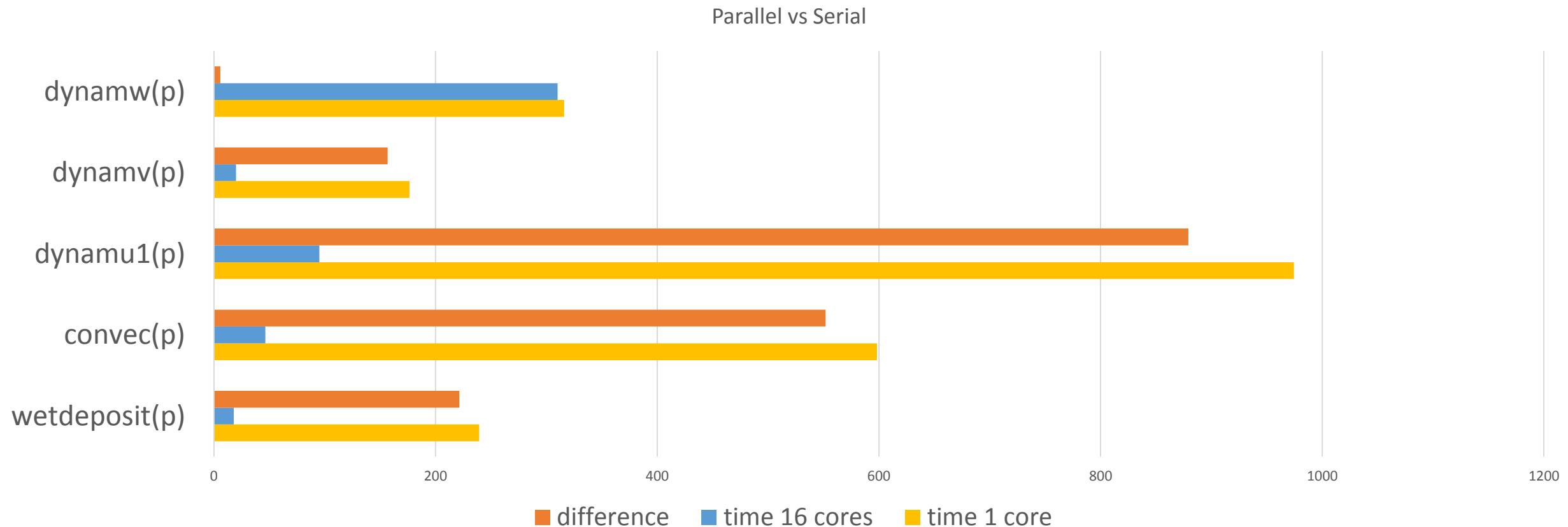
# TM4-ECPL - Comparison of ERA-interim vs Operational ECMWF for 2005 % difference: $(\text{ERA-OD})/\text{OD} \times 100$

*Higher deposition & mainly higher surface levels in ERA-interim simulations*

**Global  
higher  
dep in  
ERA ~  
+33 %**



# TM4 parallelization



	With chemistry	No chemistry
1 core	5945.804	3520.679
16 cores	4818.731	1643.799
gain	1127.073(18.96%)	1876.88 (53.31%)