HINDCAST SIMULATIONS WITH TM4-ECPL

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OUTLINE

- Motivation-Aim
- Experiment setup
- The "CPC" emissions
- Emission trends
- Comparison with measurements
- Global trends
- Conclusions

MOTIVATION - AIM

- Evaluate the ability of models to simulate global variability for prescribed meteorology
- Evaluate the interannual variations and trends in the oxidizing capacity of the atmosphere
- Evaluate effectiveness of applied emission restrictions in reducing air pollution

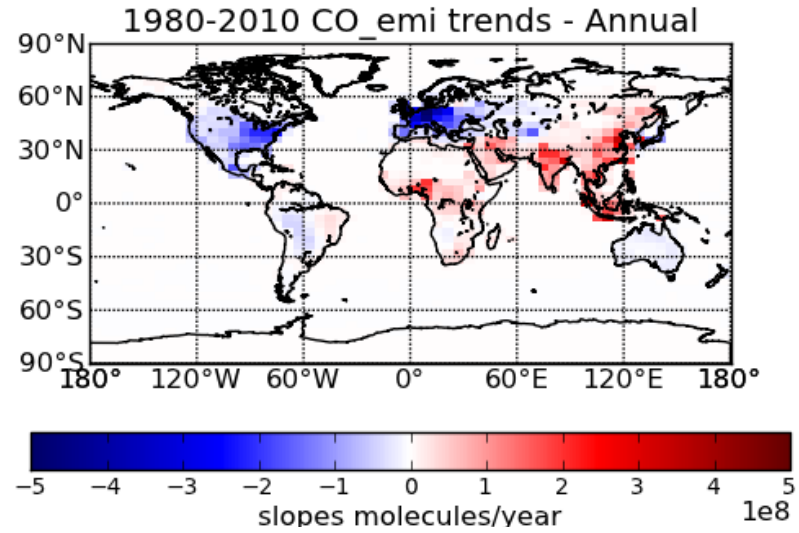
EXPERIMENT SETUP

- TM4-ECPL in 6°x4° with 34 hybrid levels (up to 0.1 hPa)
- ERA-Interim meteorology
- MEGAN-MACC natural emissions (PEGASOS interannual)
- **Anthropogenic emissions:**
  - **MACCity (ACCMIP)**
  - **Constant per capita - CPC (made 'in-house' as explained later)**
- MACCity (ACCMIP) biomass burning emissions (Lamarque et al., 2012)
- On line sea-salt emissions calculation (Vignatti et al 2010)
- Chlorophyll (MODIS) kept constant as of year 2005
- Ocean emissions distribution of 2000-2009 applied to previous years
- Dust emissions of 2000-2010 applied to previous years
- Ozone and CH_4 boundaries are taken from MSR satellite interannually and applied at 50 hPa.

THE "CPC" EMISSIONS

- Based on:
  - ACCMIP anthropogenic land emissions of 1980
  - High resolution population maps for years 1990 – 2010 per 5 years (World Bank)
  - Global and regional population information (U.N.)
  - HTAP socioeconomic regions
- All the above combined resulted in relatively accurate population information → land emissions

EMISSION TRENDS (CO)



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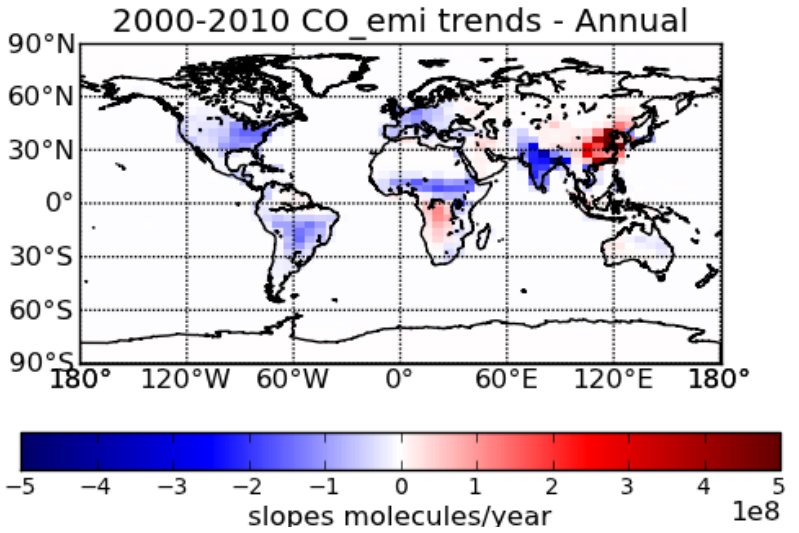
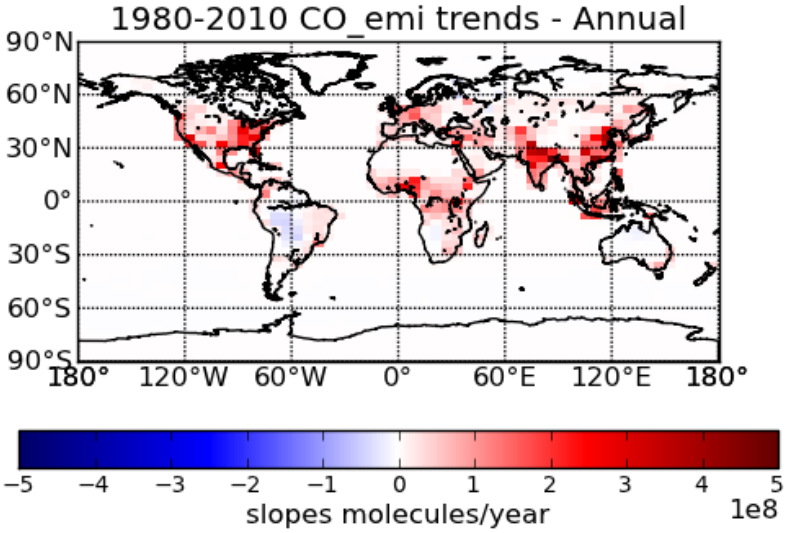
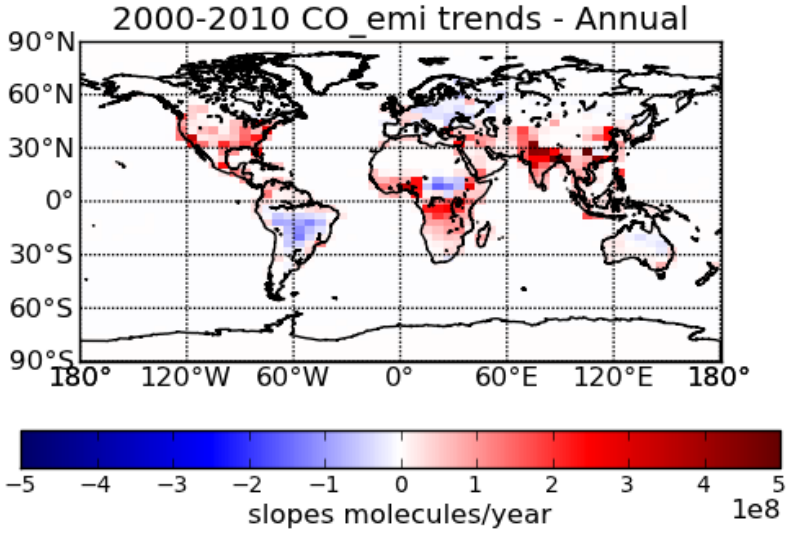
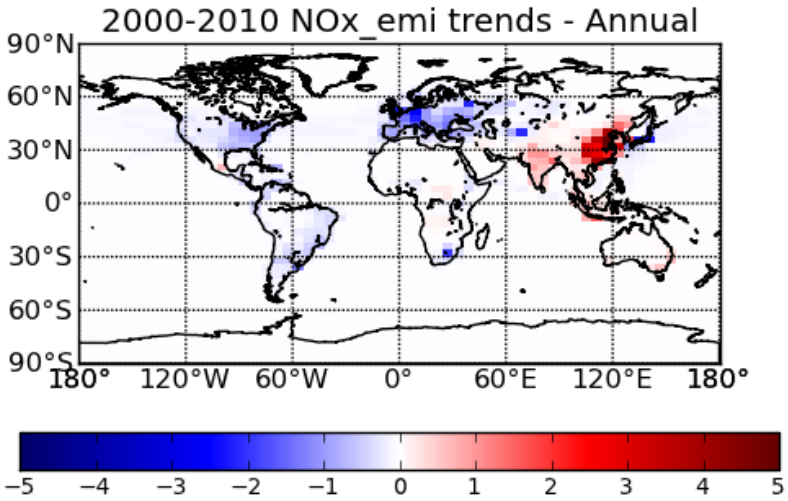




CPC



EMISSION TRENDS (NO_x)



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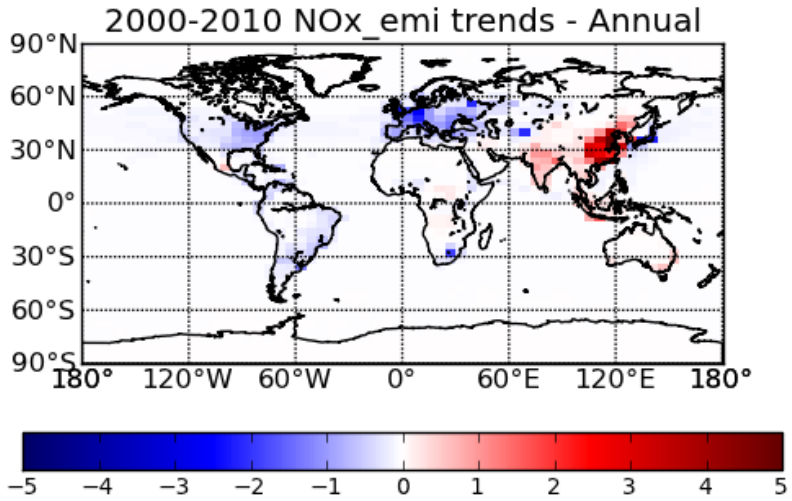

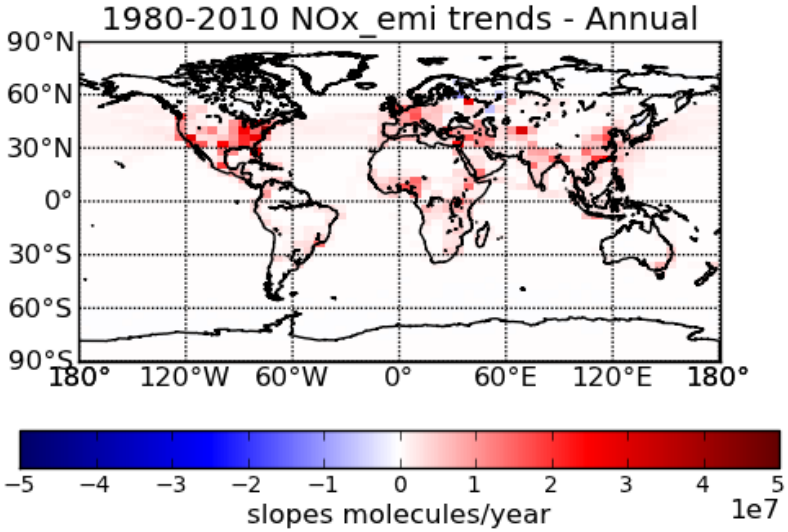

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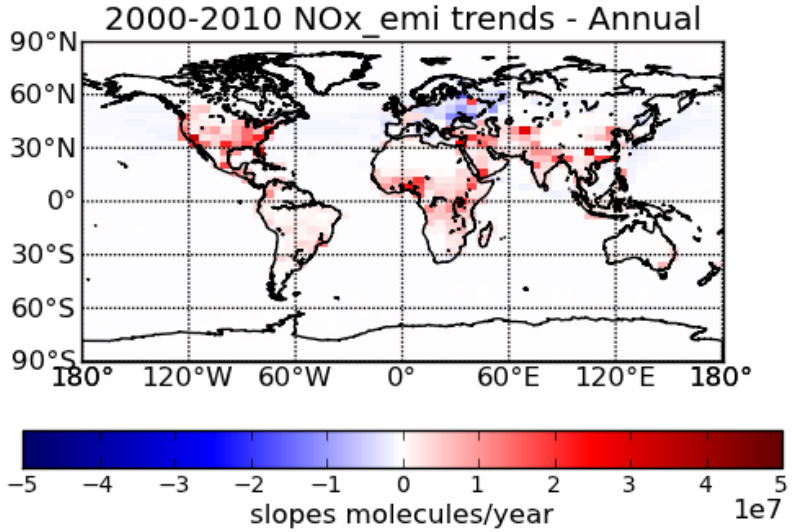
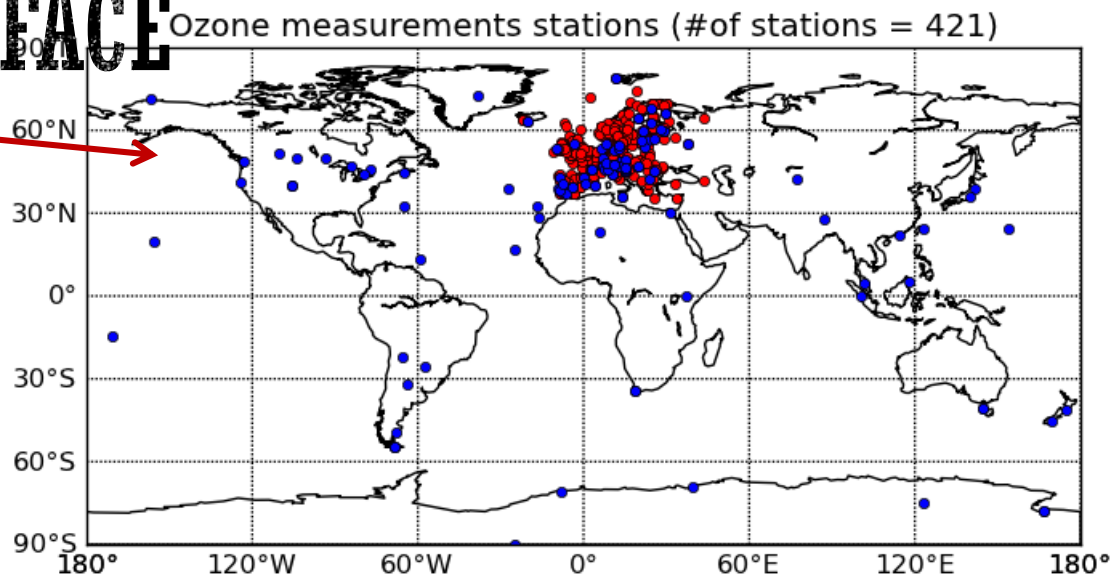
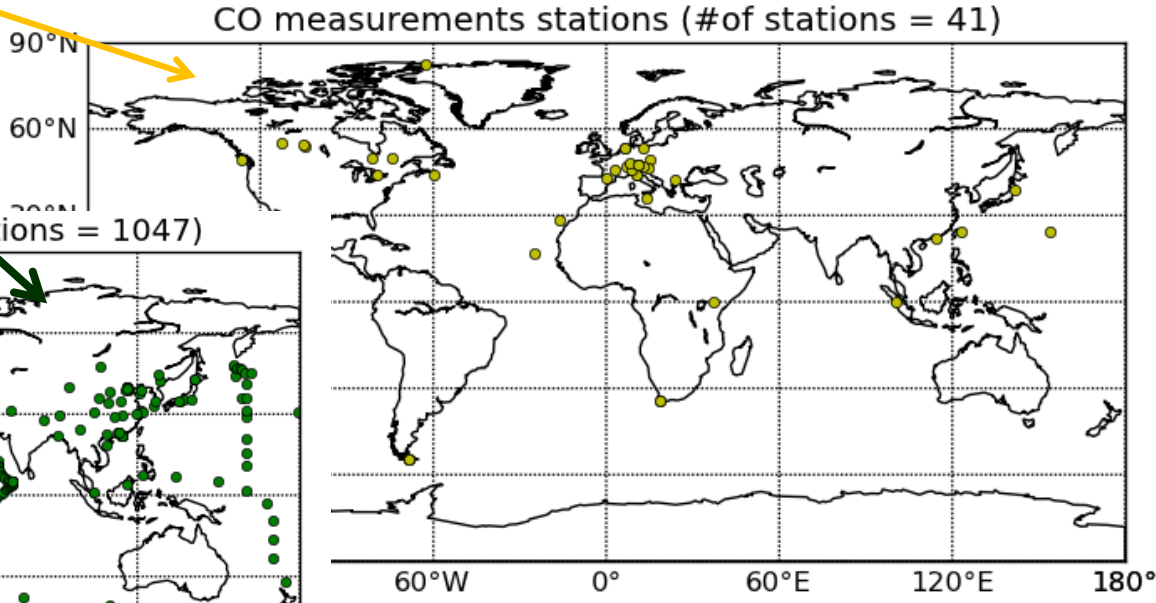
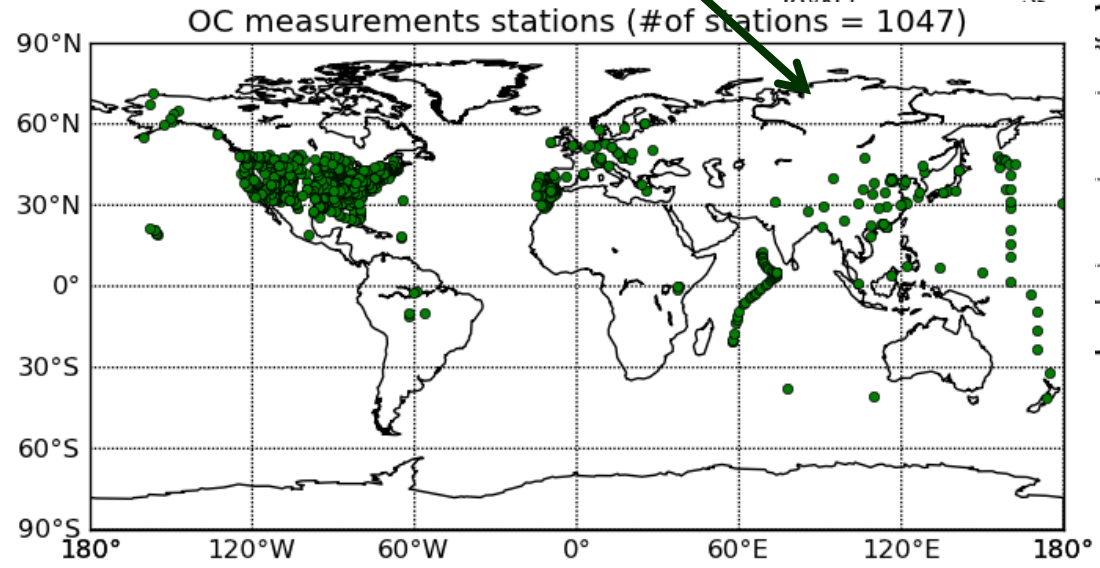


MEASUREMENTS-SURFACE

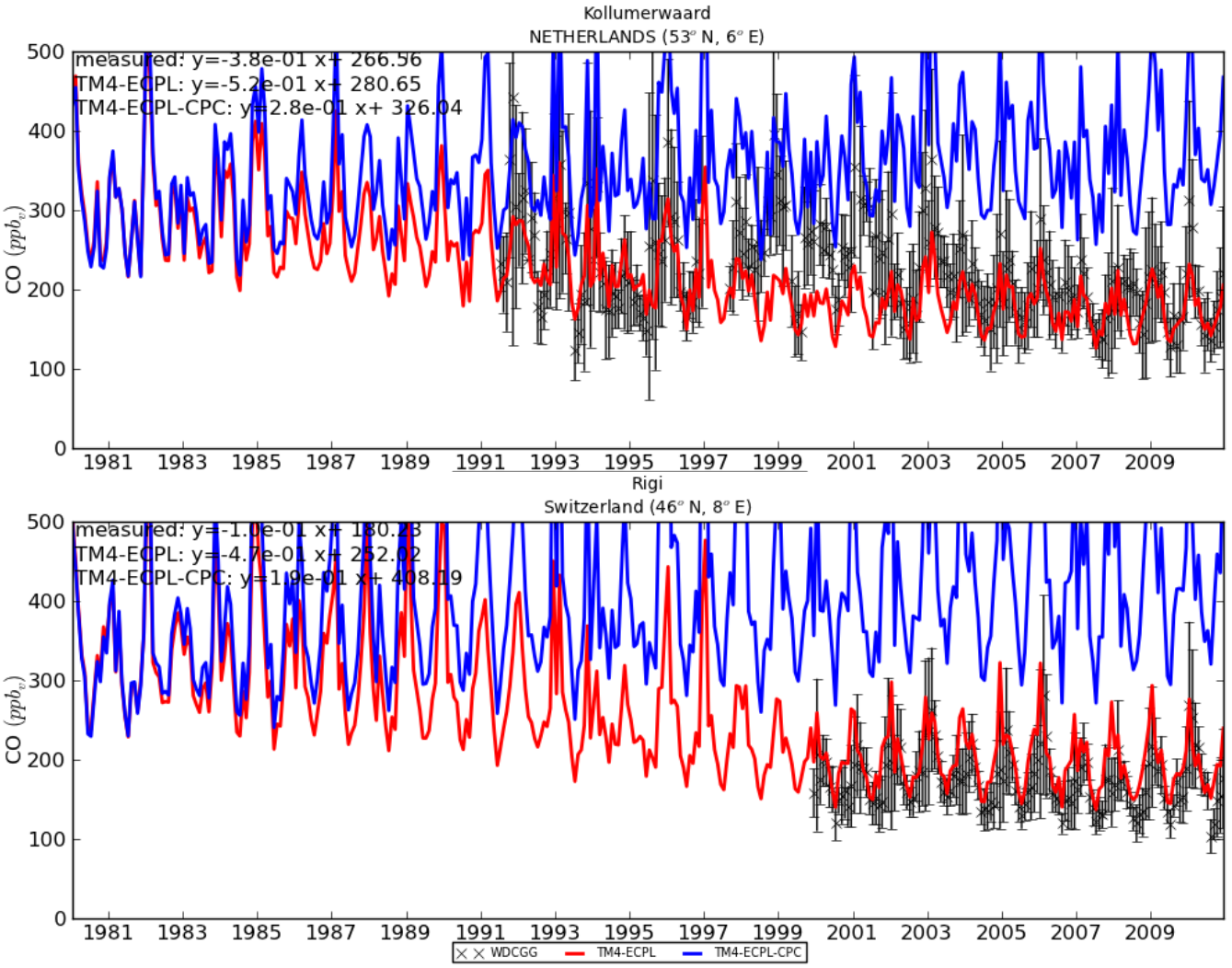
- **Ozone**
  - EMEP monitoring network (314 monitoring stations in Europe)
  - WCDGG measurements database (global)
- **CO**
  - WCDGG (global)
- **Organic Carbon**
  - AEROCOM phase II database (global)





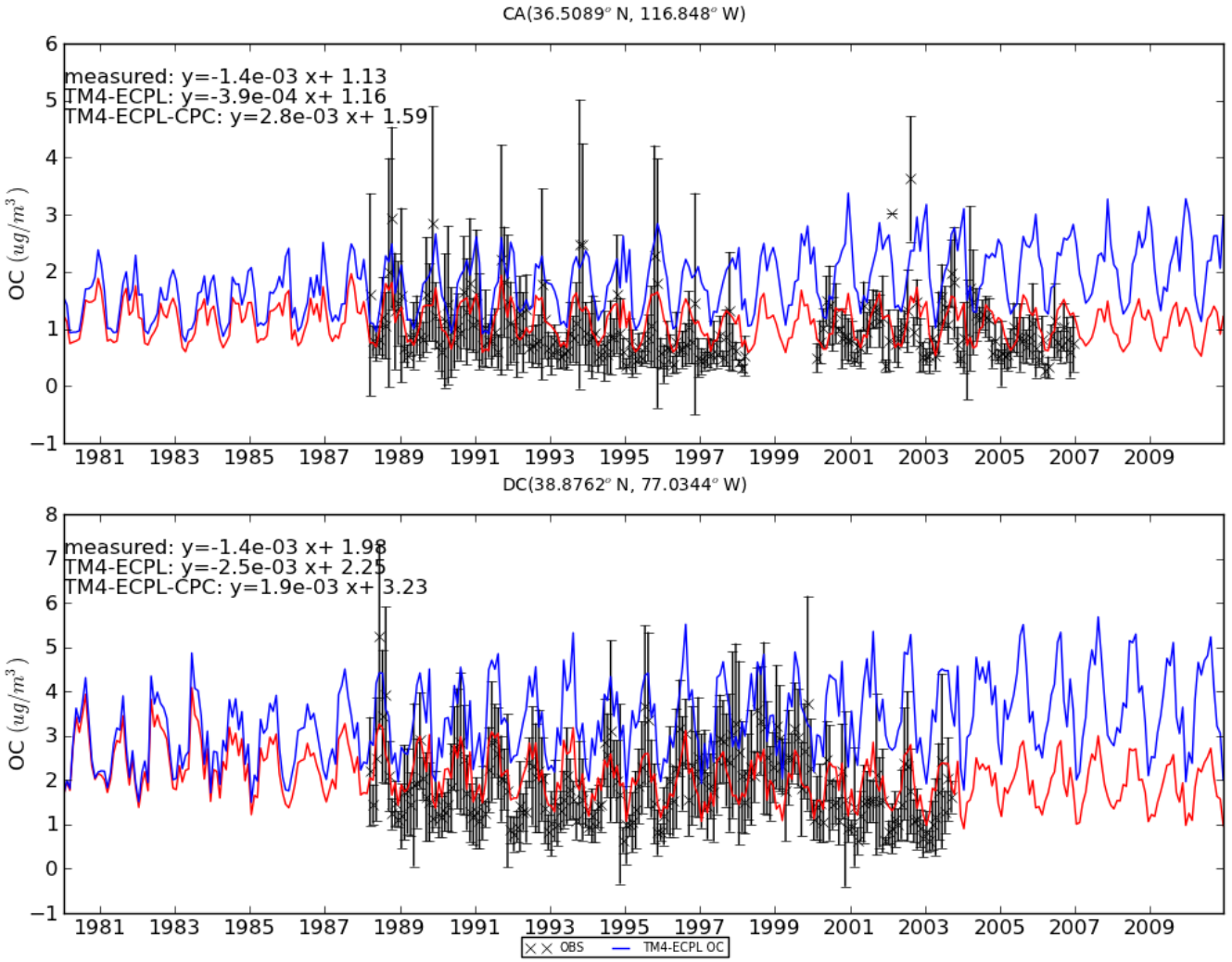


COMPARISON WITH MEASUREMENTS (CO)



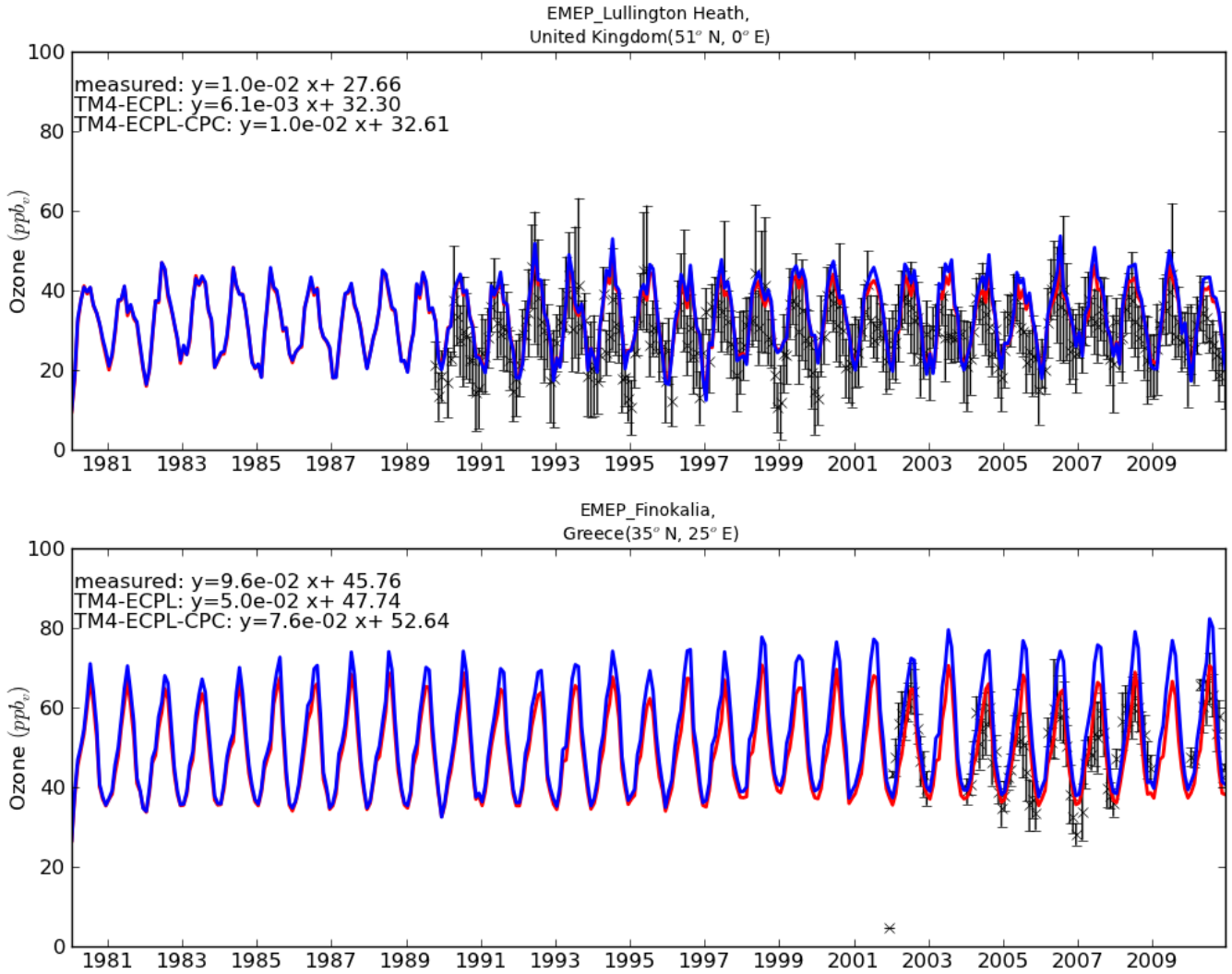
Measurements TM4-ECPL-BAU TM4-ECPL-CPC

COMPARISON WITH MEASUREMENTS (OC)



Measurements TM4-ECPL-BAU TM4-ECPL-CPC

COMPARISON WITH MEASUREMENTS (O_3)

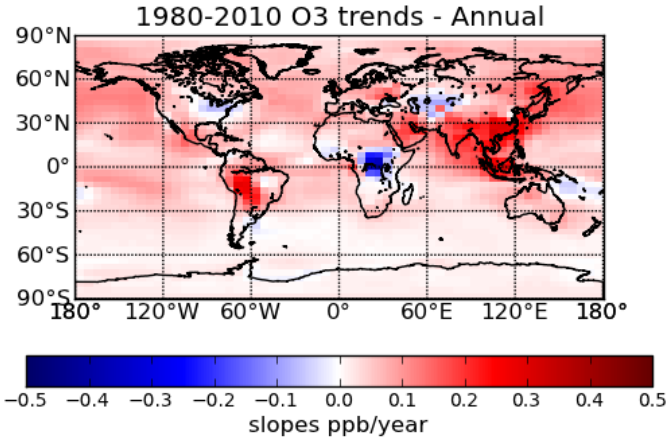


Measurements TM4-ECPL-BAU TM4-ECPL-CPC

30 YEAR GLOBAL TRENDS –O3

BAU

CPC



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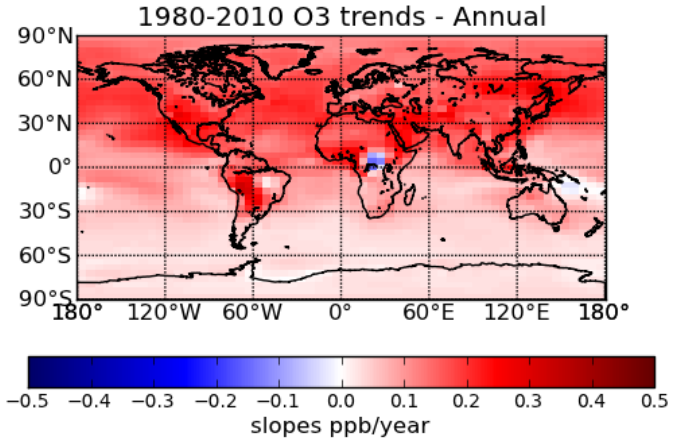
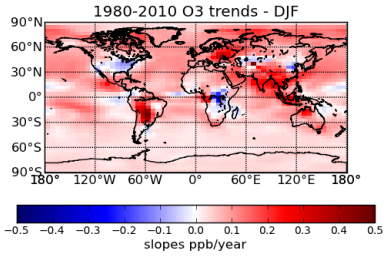
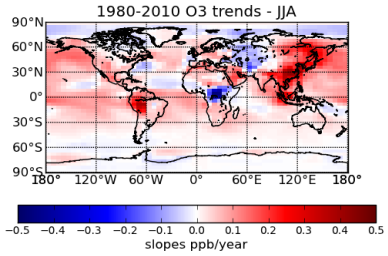




winters



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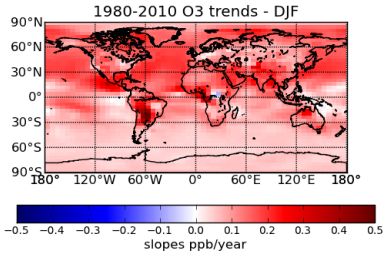

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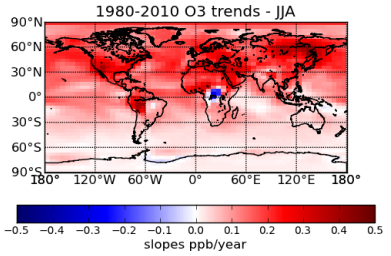
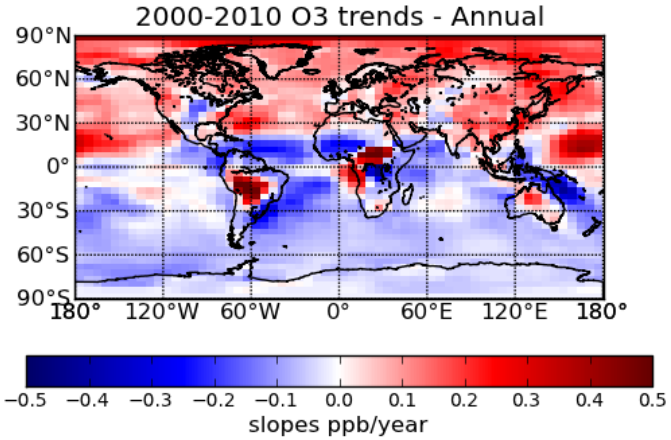


summers

10 YEAR GLOBAL TRENDS – O3

BAU

CPC



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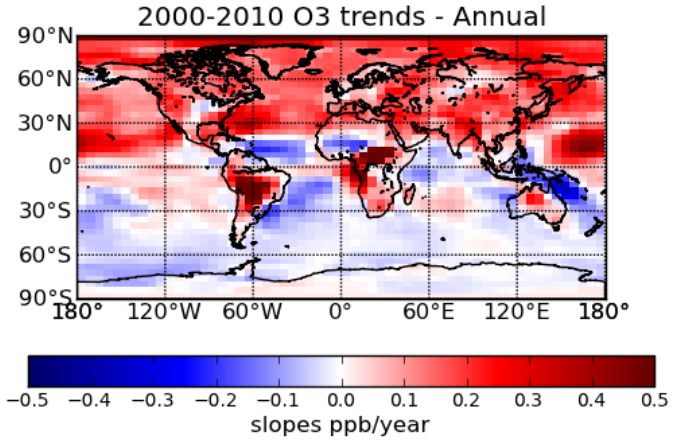

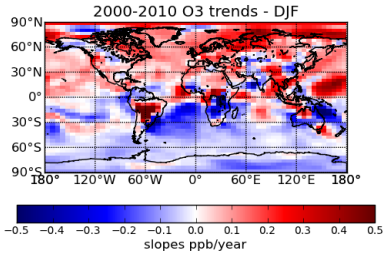

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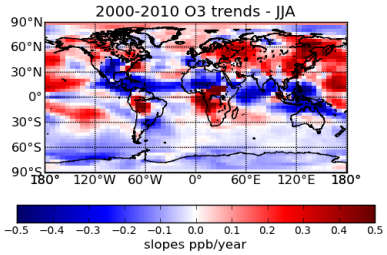

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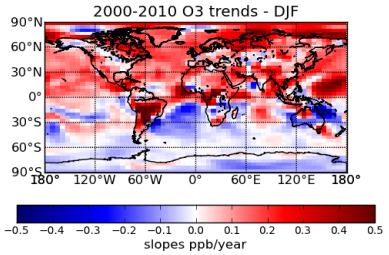

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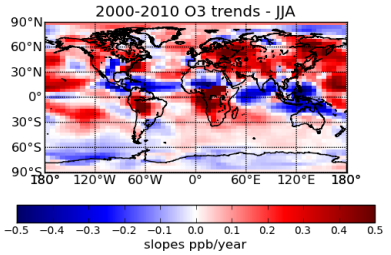
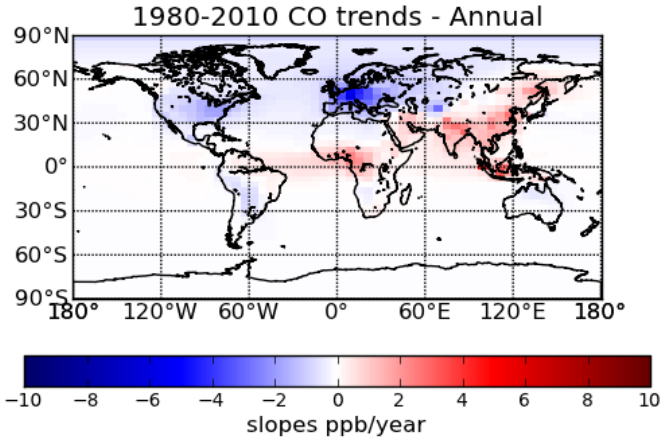


summers

30 YEAR GLOBAL TRENDS - CO

BAU

CPC



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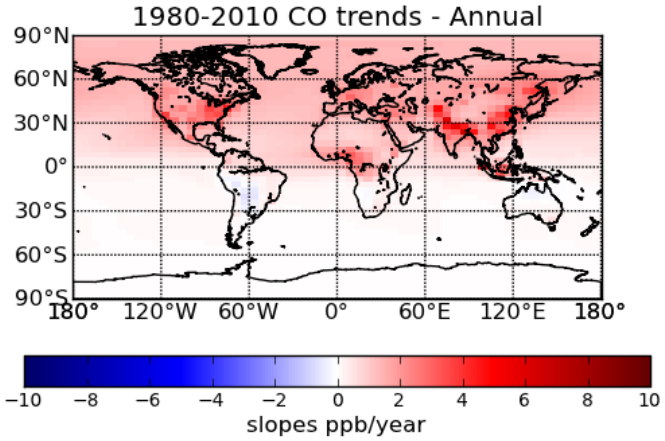

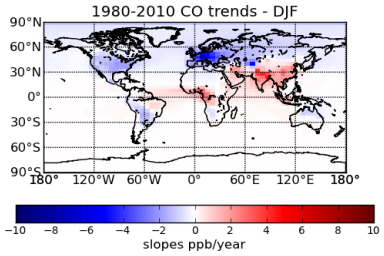

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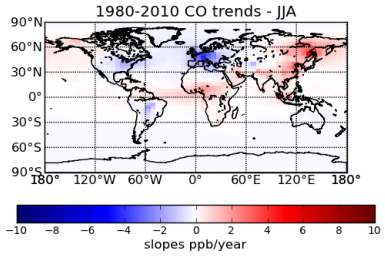

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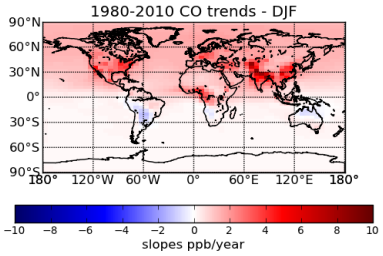

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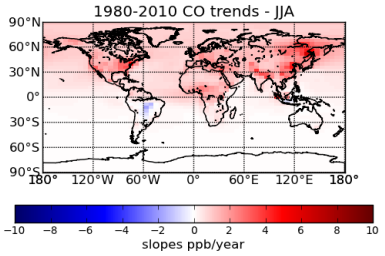
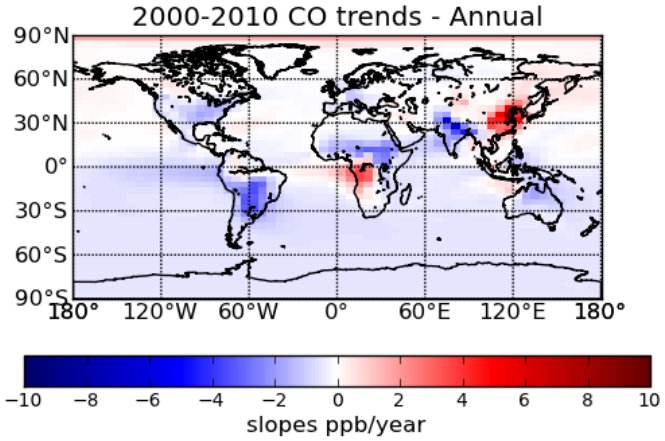


summers

10 YEAR GLOBAL TRENDS - CO

BAU

CPC



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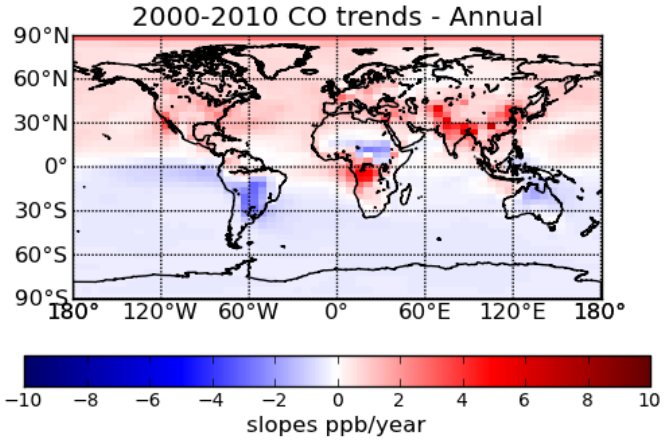

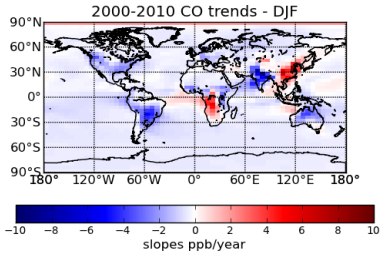

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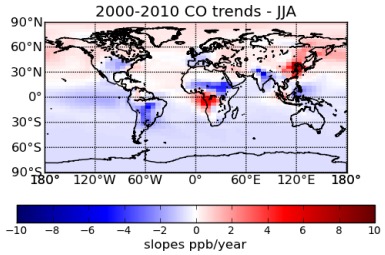

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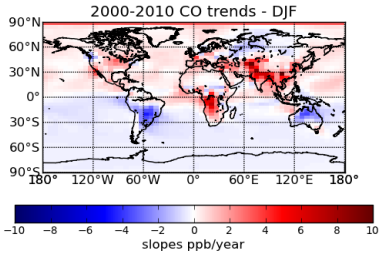

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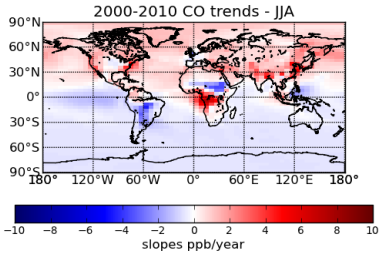
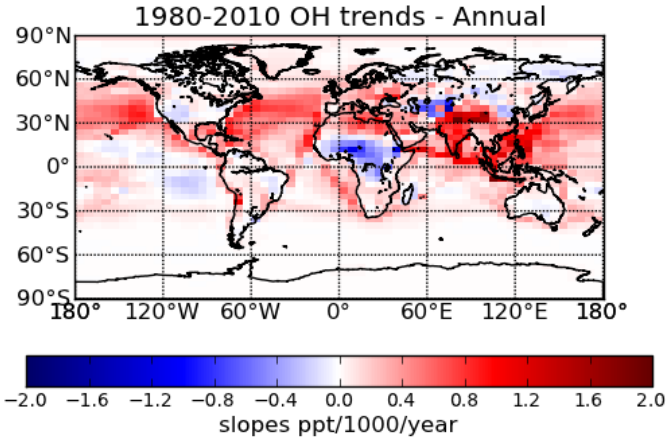


summers

30 YEAR GLOBAL TRENDS - OH

BAU

CPC



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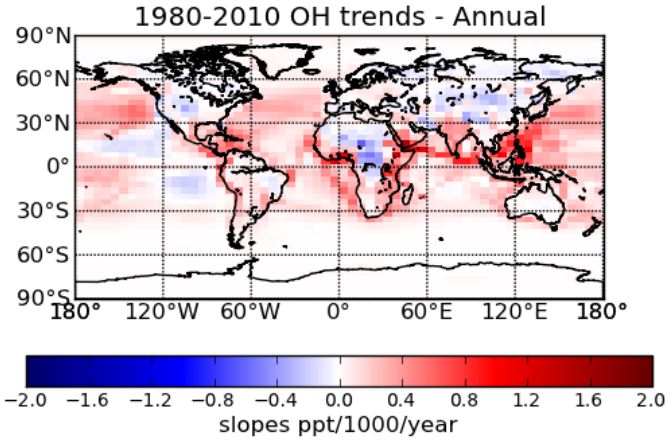

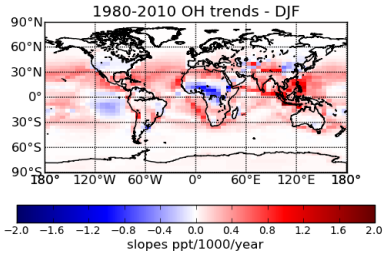

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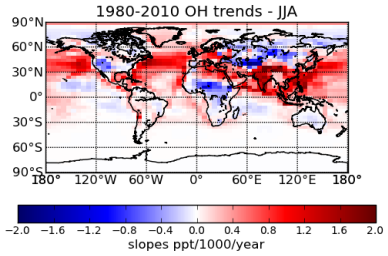

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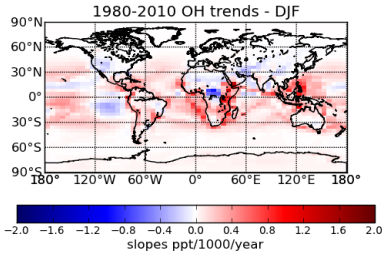

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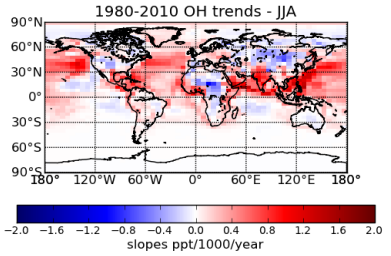
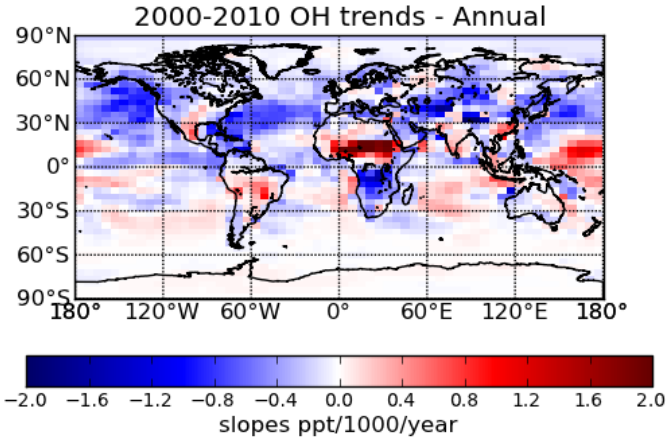


summers

10 YEAR GLOBAL TRENDS - OH

BAU

CPC



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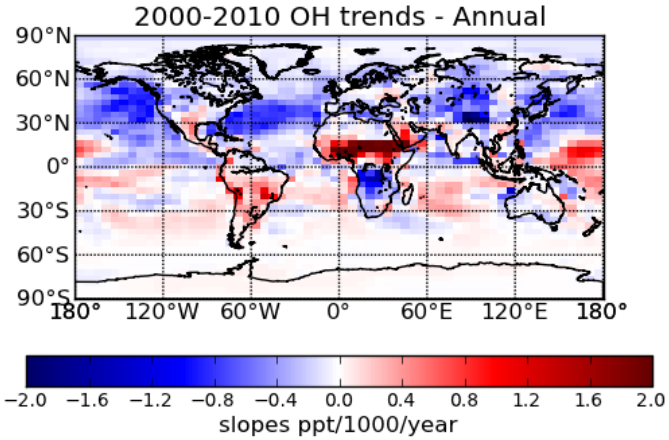

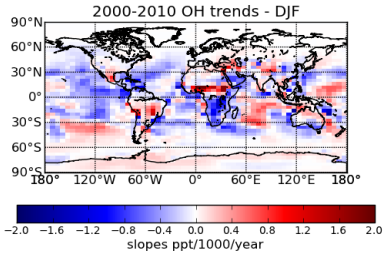

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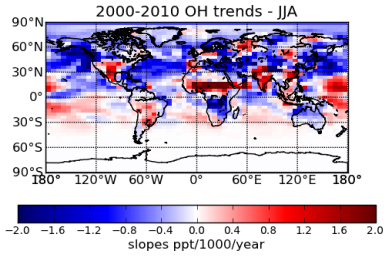

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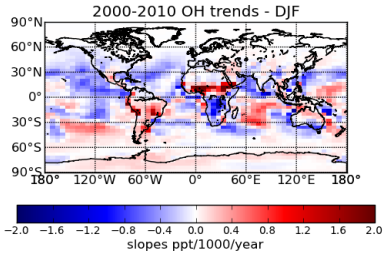

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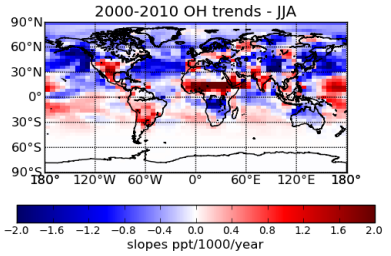

summers

CONCLUSIONS – FUTURE WORK

- Obvious concentration differences over the past 10-15 years between the scenaria for:
  - OC
  - CO
- Ozone has minimal differences triggered by the emissions
- OH trends dominated by N.H. summertime changes
- CO trends dominated by N.H. wintertime changes

Future work:

- Constant meteorology of 1980 run to eliminate the climatic influence
- publication