Coupling between photolysis and M7 in TM5 – first results

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Motivation

- Impact of time-dependent, emission-driven aerosols on chemistry
- Effect of aerosol pollution

- Modelling the effect of a volcano eruption on tropospheric chemistry

- Currently (new photolysis): aerosol optical properties (scattering, absorption, asymmetry factor) based on lookup tables from Shettle & Fenn (1979)
  - Distinguishes between rural and marine aerosols in the first 5 layers
  - Dependent on relative humidity
  - High & low angle properties

- with_optics: aerosol optical properties are calculated from M7 via the optics module

Setup
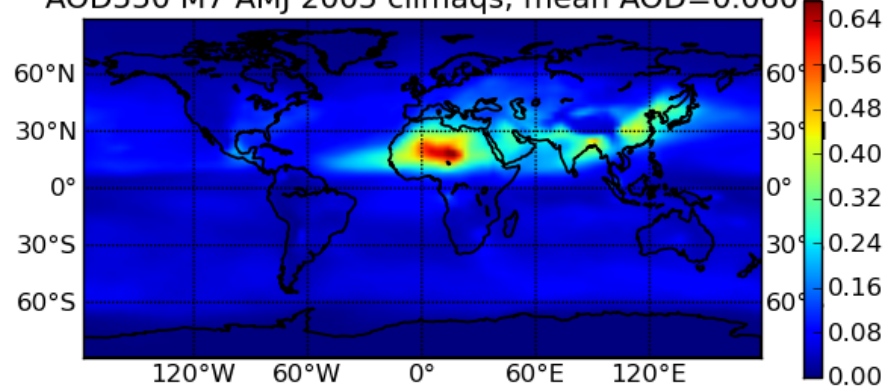
▸ TM5 'Release 4'

▸ One year spin-up 1990 without M7

▸ 6 months runs for Jan-Jun 1990 with M7 (analysis for AMJ)

  ▸ Uncoupled, zero aerosols in the photolysis

  ▸ Uncoupled, aerosols based on Shettle & Fenn

  ▸ Coupled, aerosols from M7

M7 AODs

AOD550 M7 AMJ 2005 climaqs, mean AOD=0.060
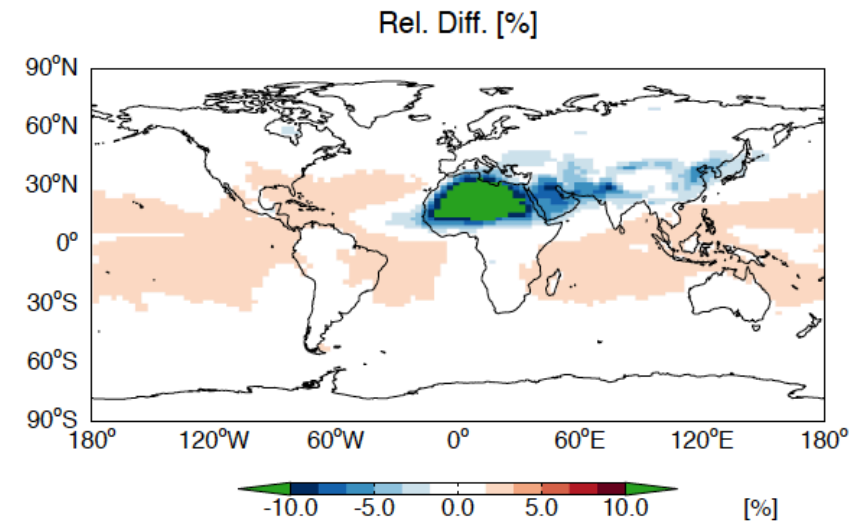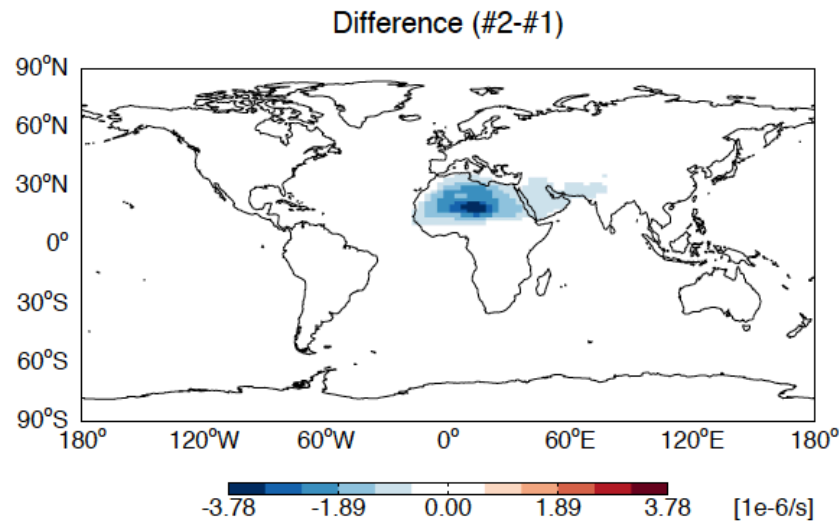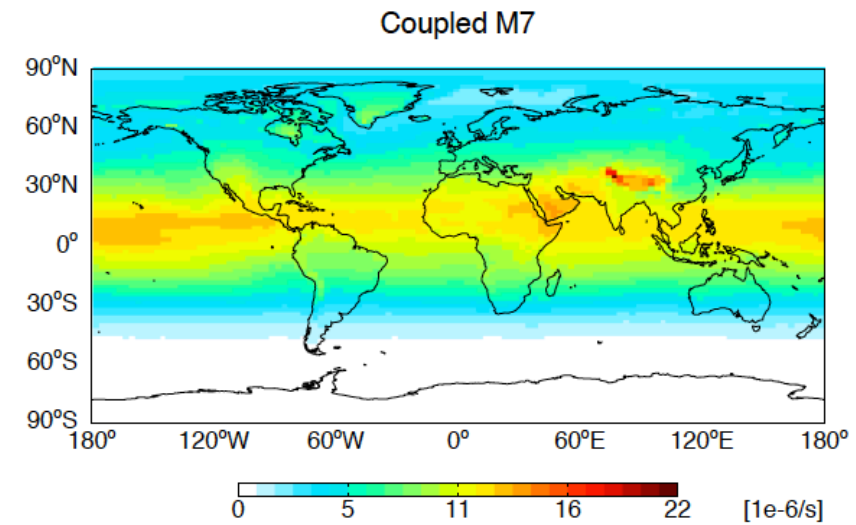
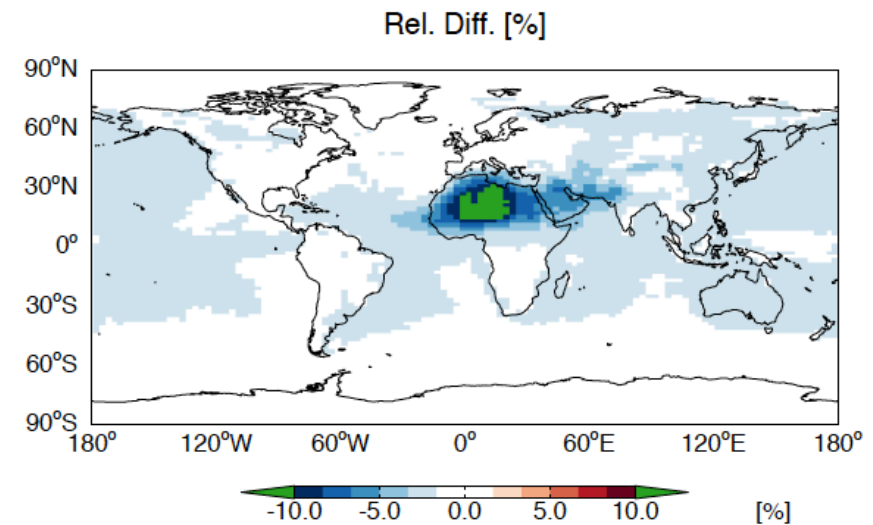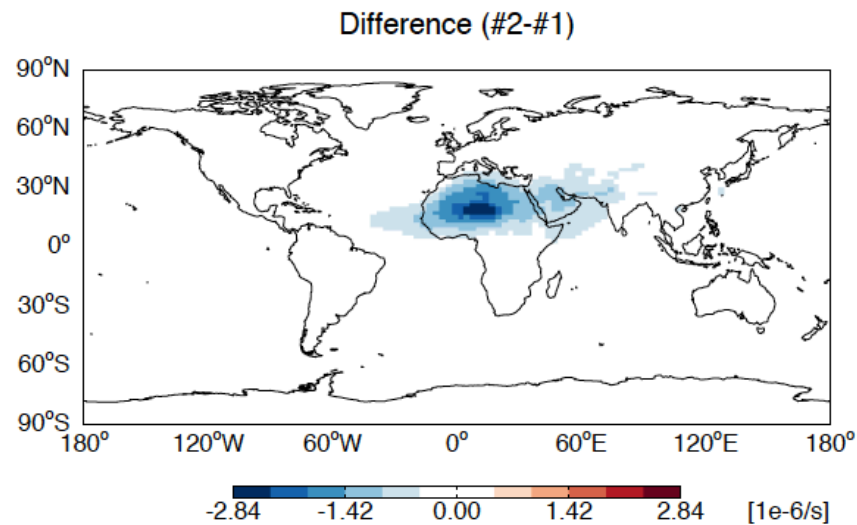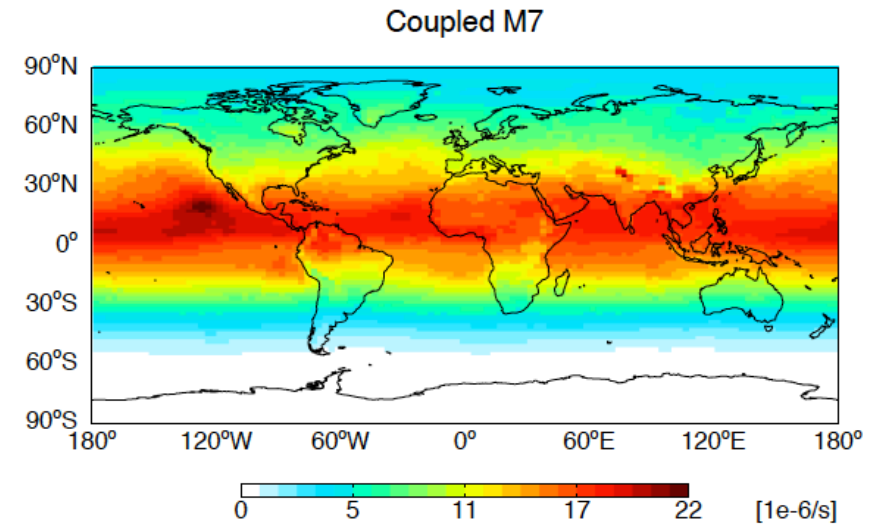AOD550 M7 AMJ 1990, mean AOD=0.066
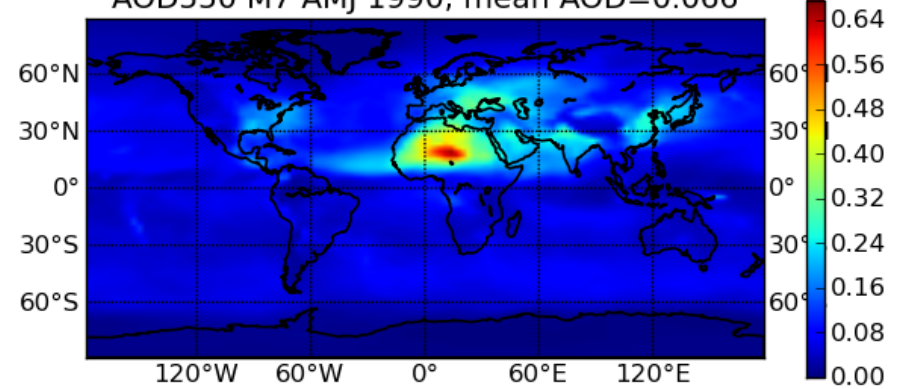
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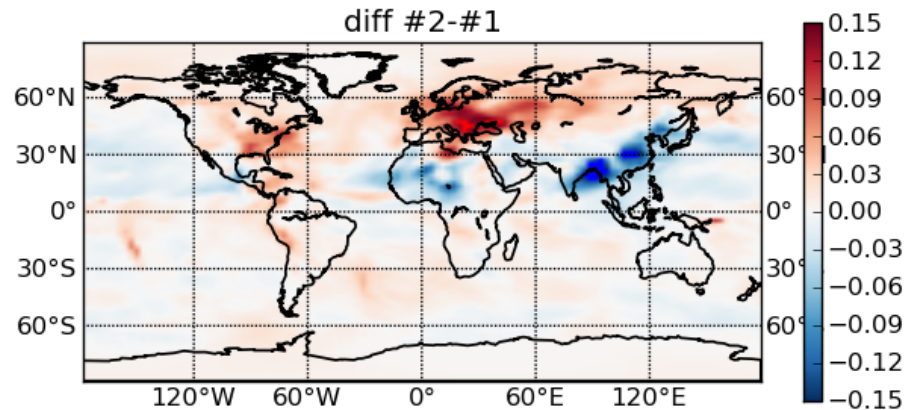
rel diff #2/#1
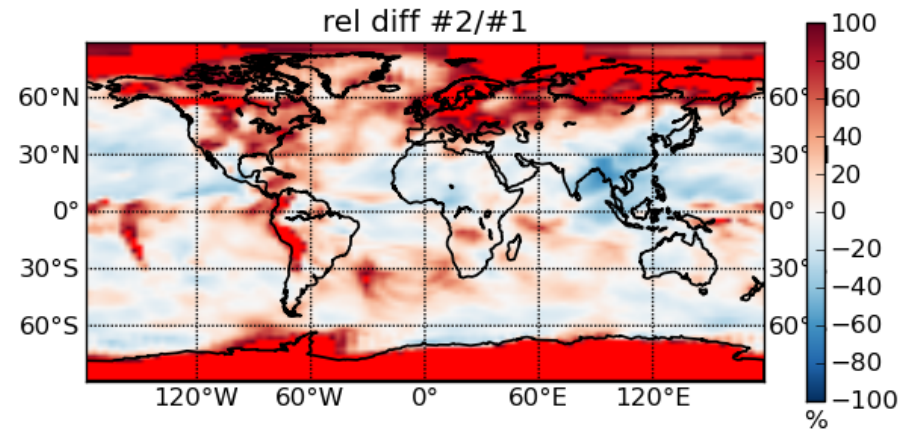
Effect of M7 aerosols on JO3
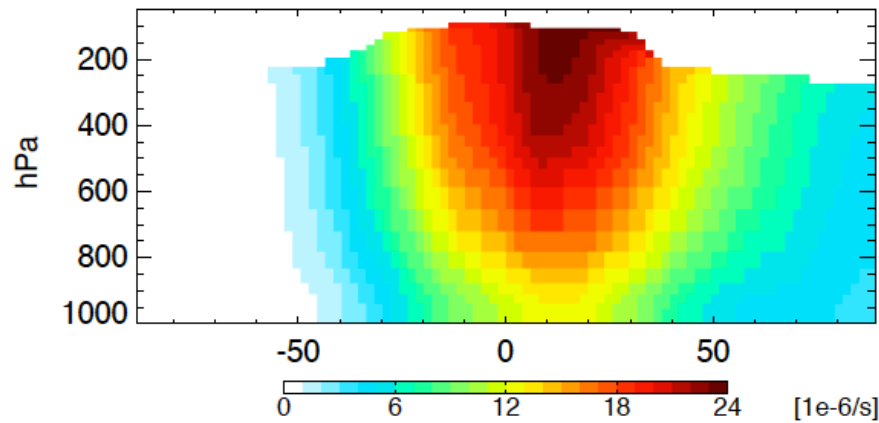

Surface JO3_AV (spring)
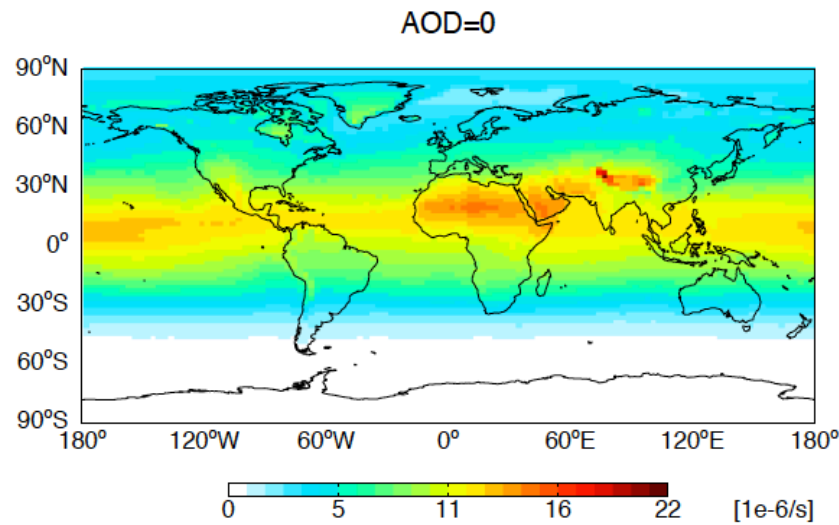
Effect of M7 aerosols on JO3

JO3_AV @ 700 hPa (spring)
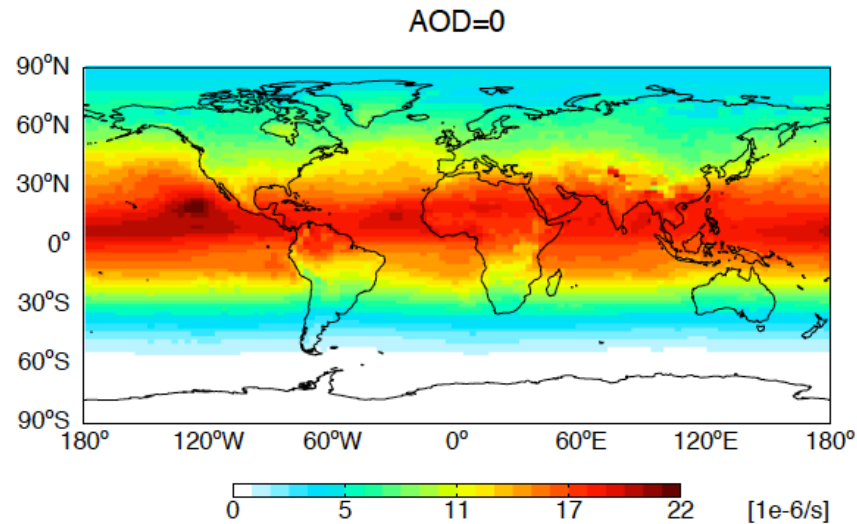
Effect of M7 aerosols on JO3
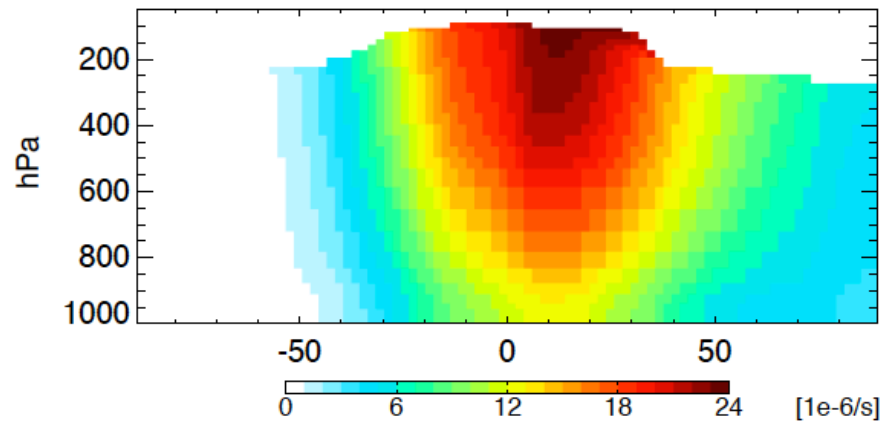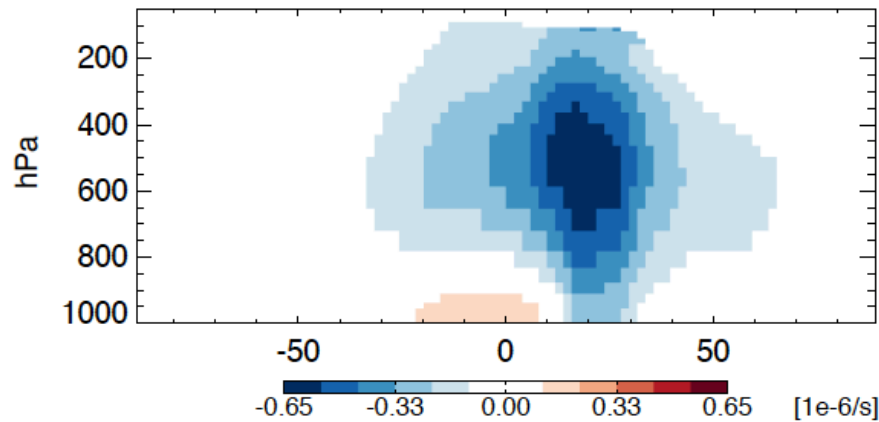
JO3_AV ZONAL MEAN (spring)

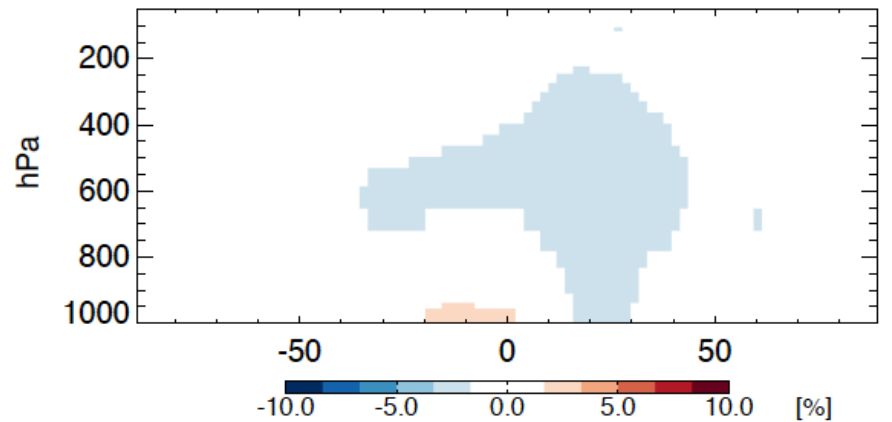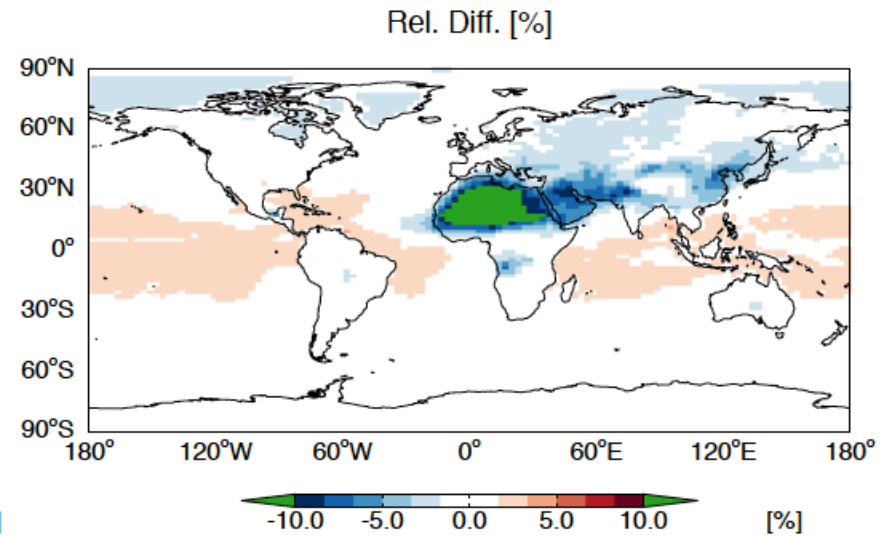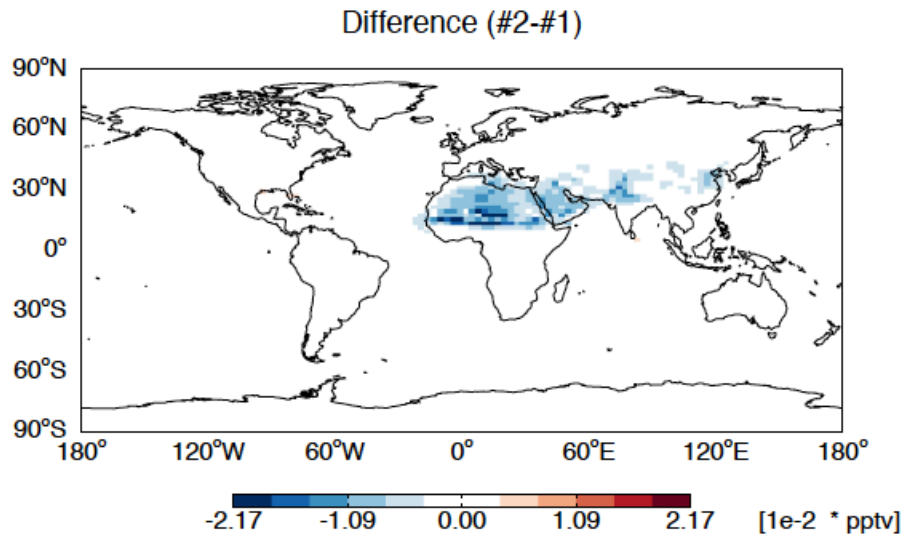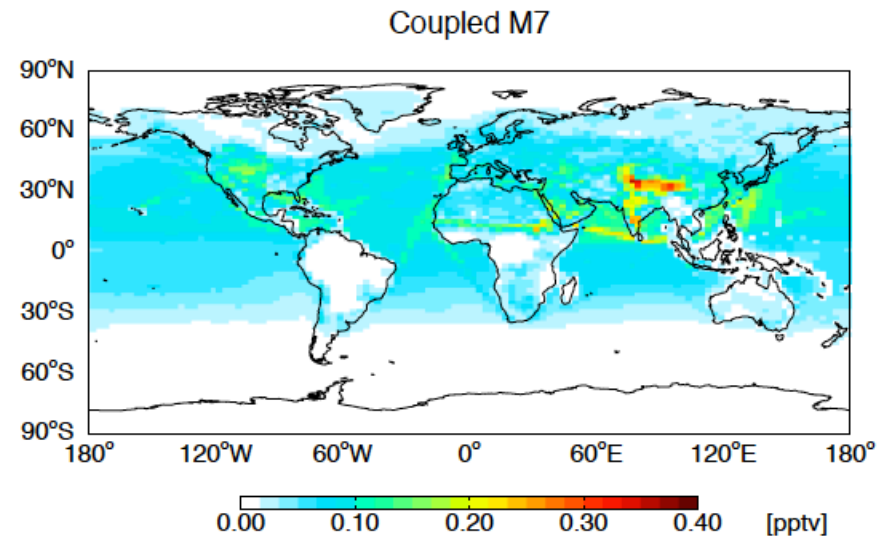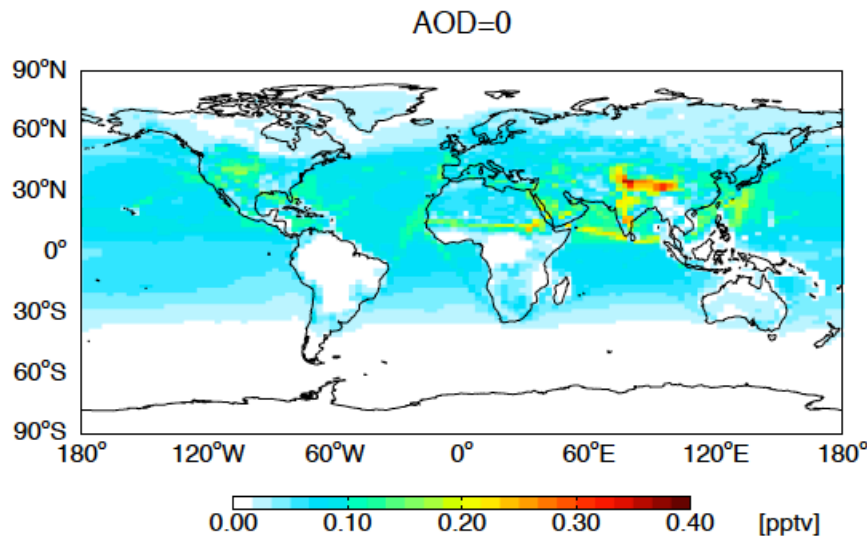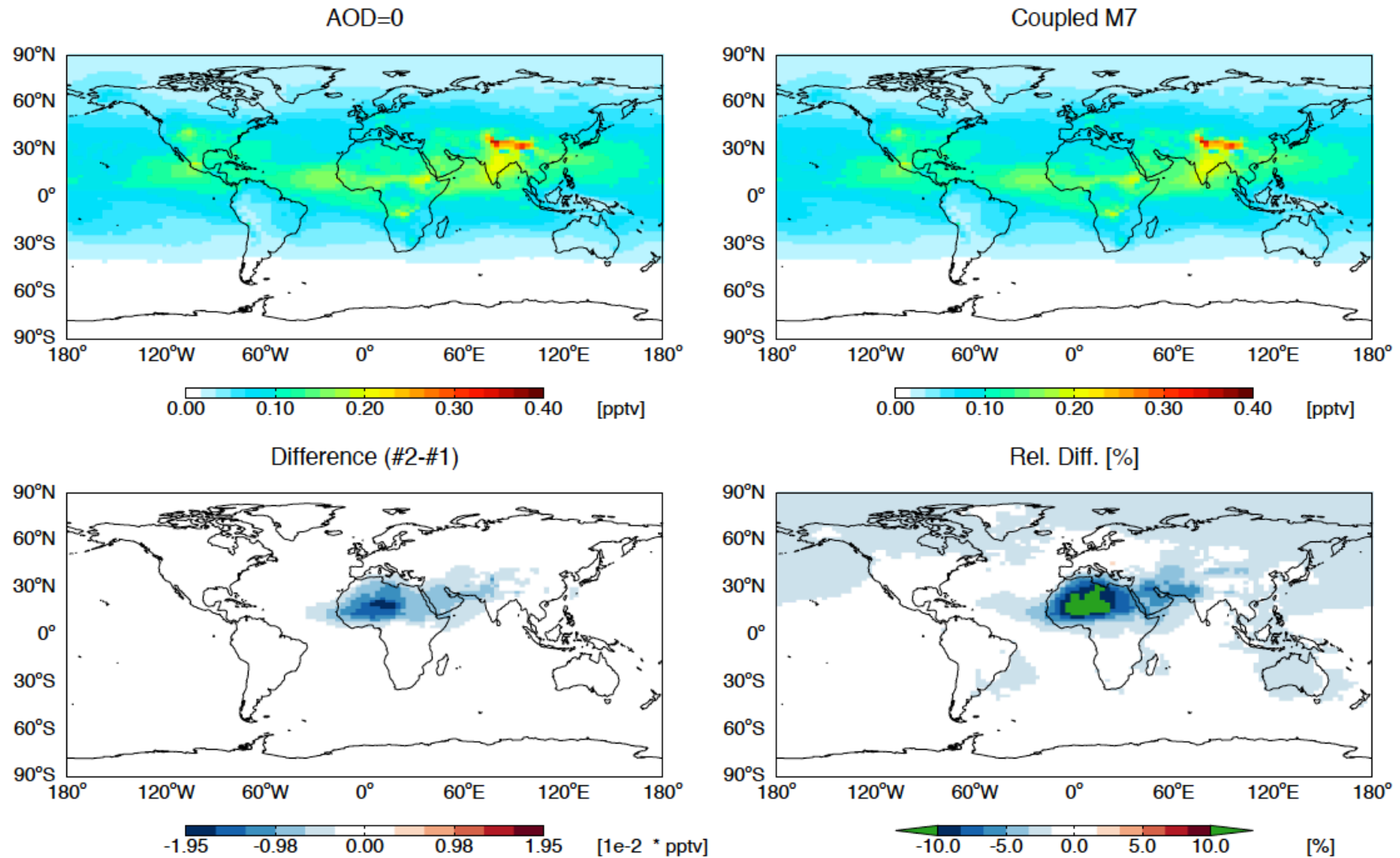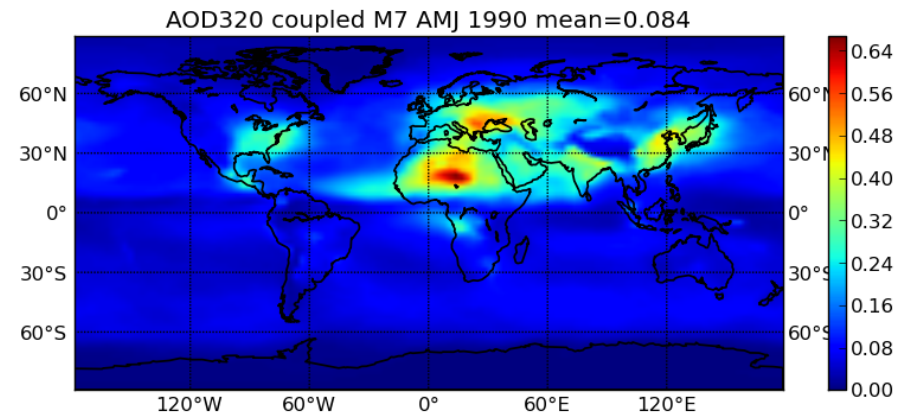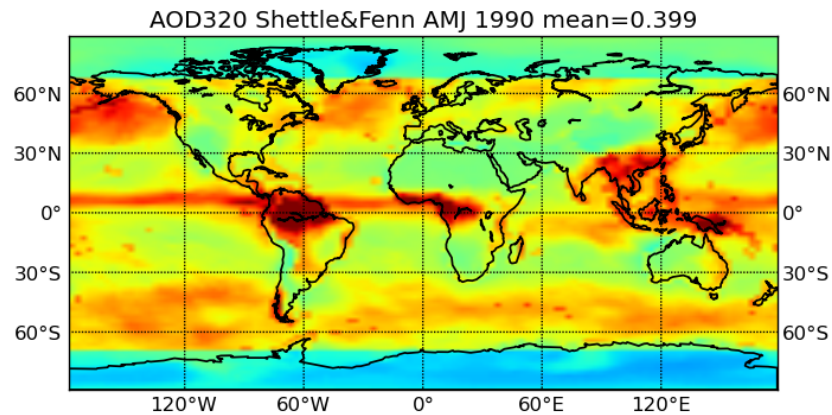# Effect of M7 aerosols on JNO2

JNO2_AV ZONAL MEAN (spring)
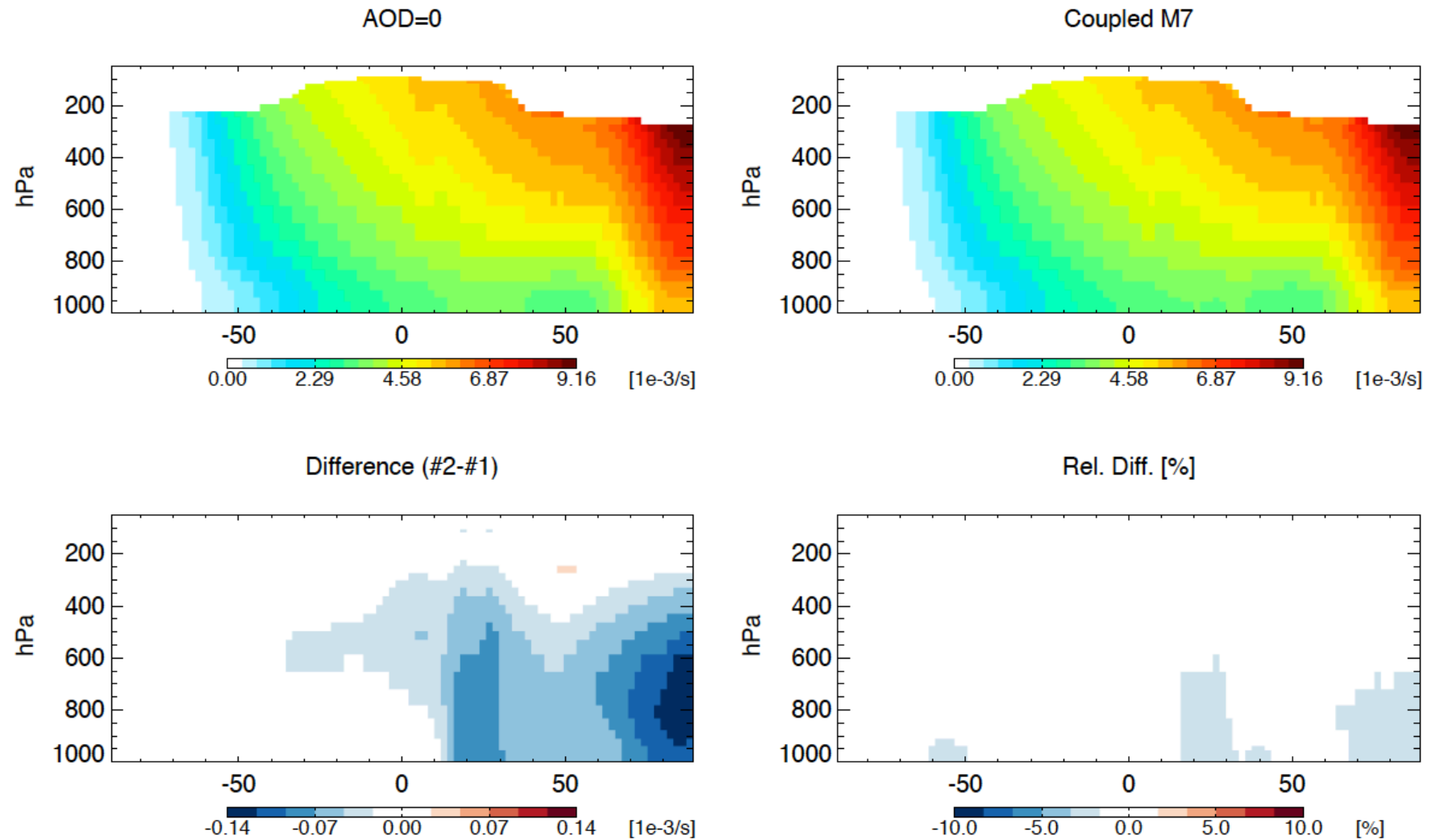
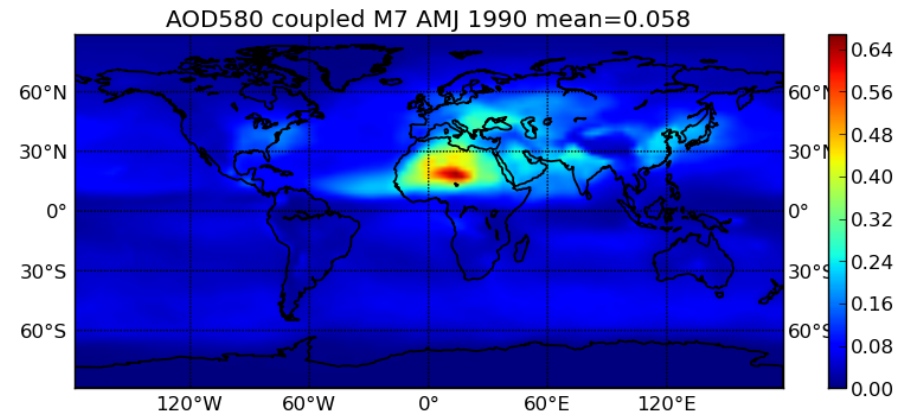# Effect of M7 aerosols on OH
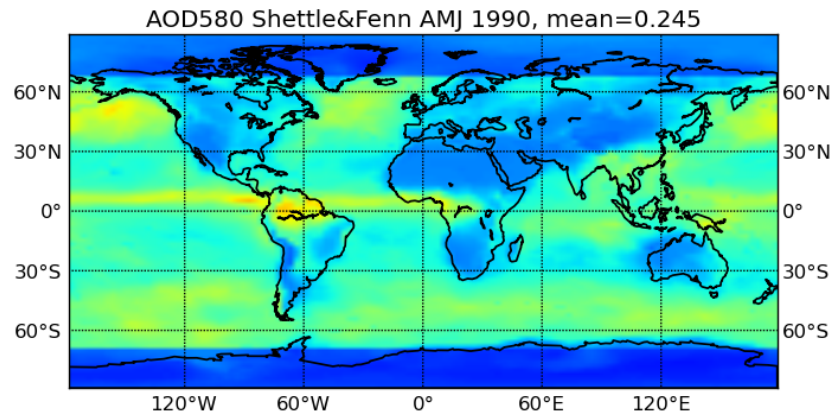

Surface OH (spring)

Effect of M7 aerosols on OH
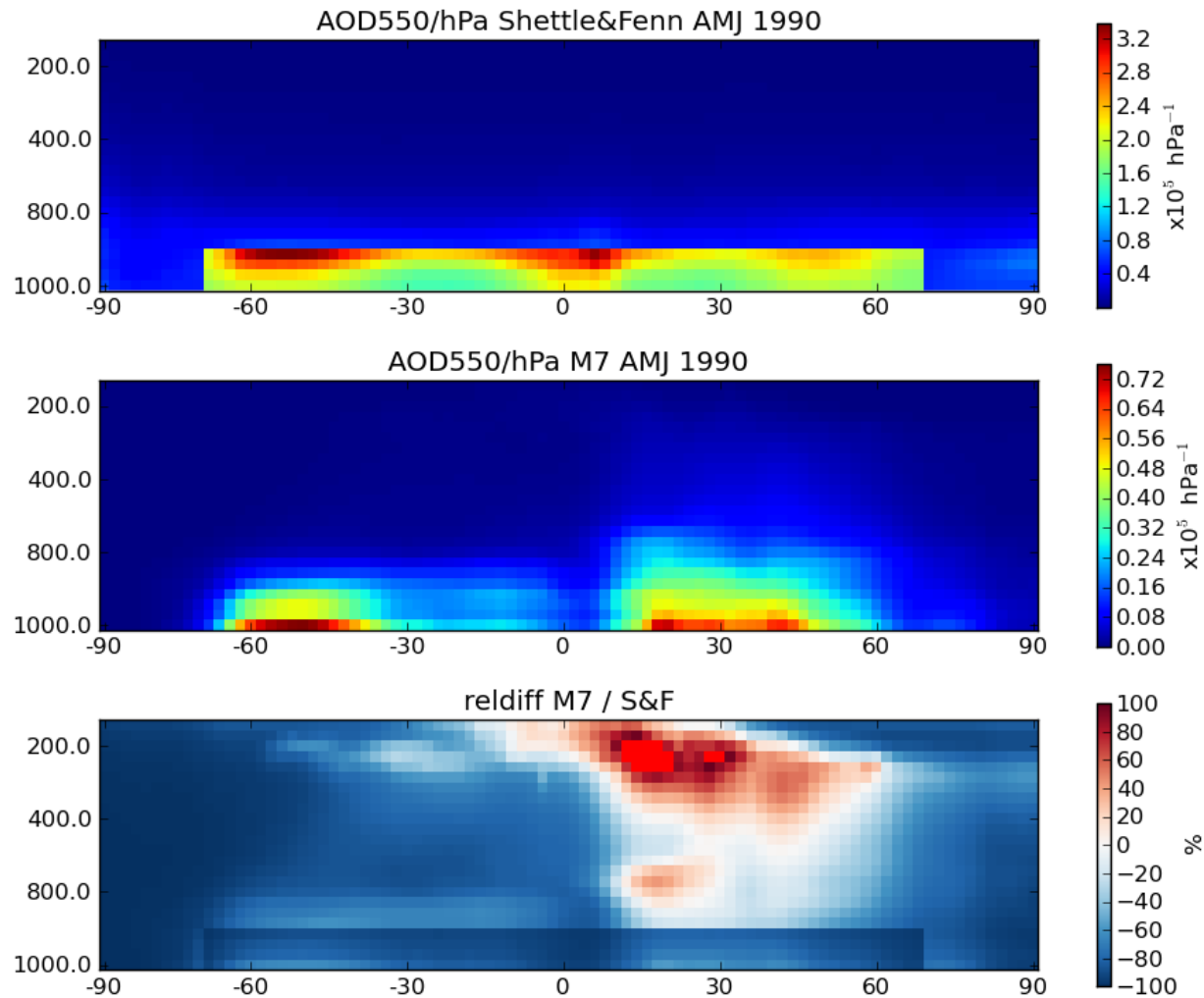

OH @ 700 hPa (spring)

M7 vs Shettle&Fenn AODs

M7 vs Shettle&Fenn AODs

AOD580 Shettle&Fenn AMJ 1990, mean=0.245

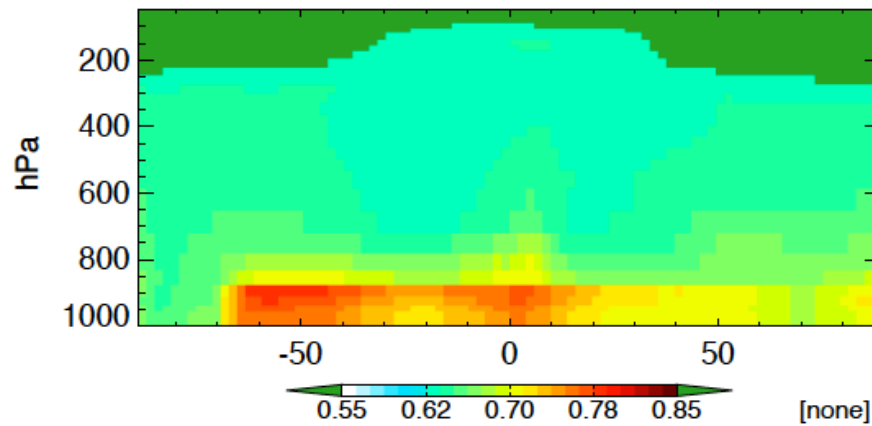Cloud OD AMJ 1990
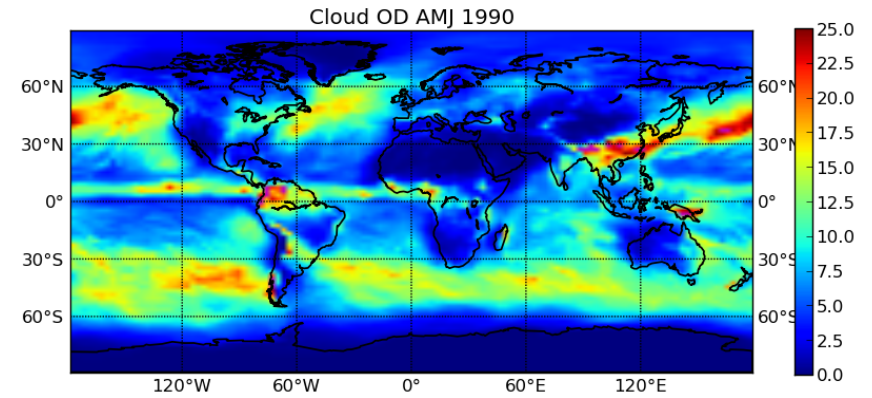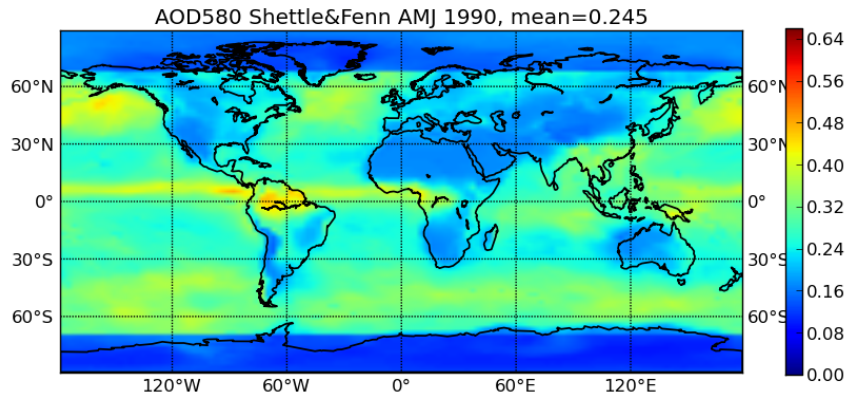
▸ High AOD generally correlated to cloudiness

M7 vs Shettle&Fenn AODs (zonal means)

M7 vs Shettle&Fenn asymmetry factor
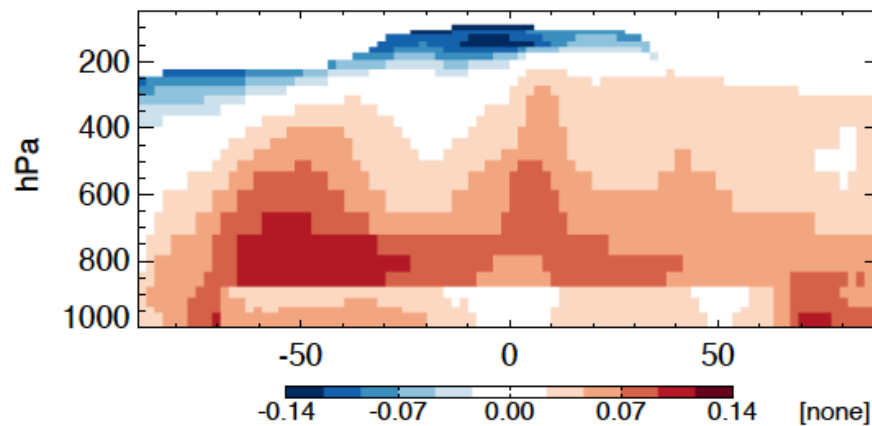
PMAER_AV ZONAL MEAN (spring)
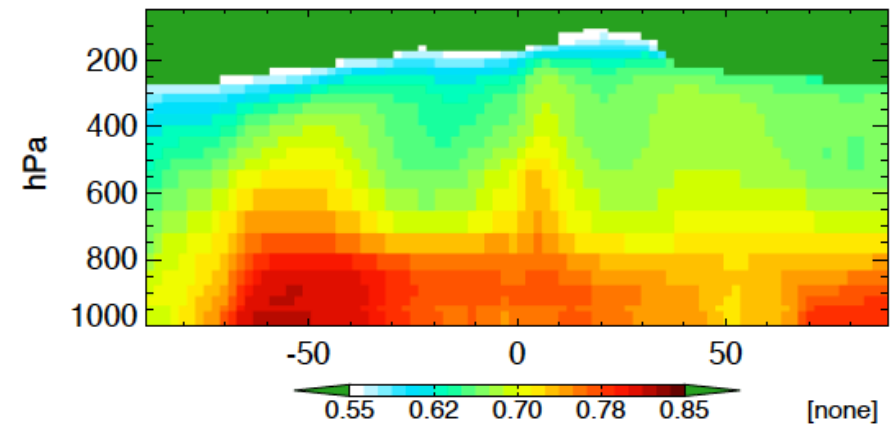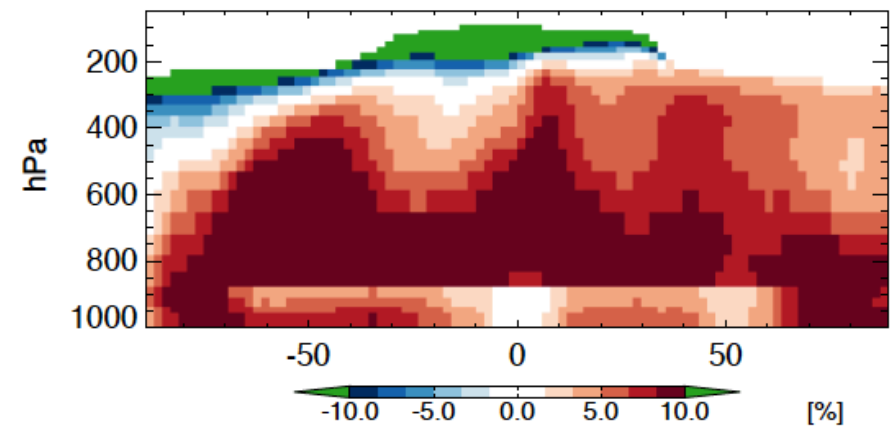
M7 vs Shettle&Fenn JO3

Surface JO3_AV (spring)
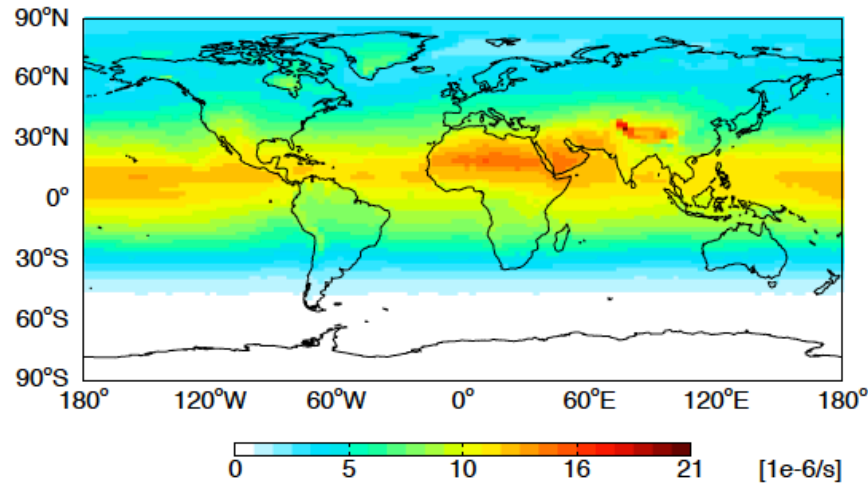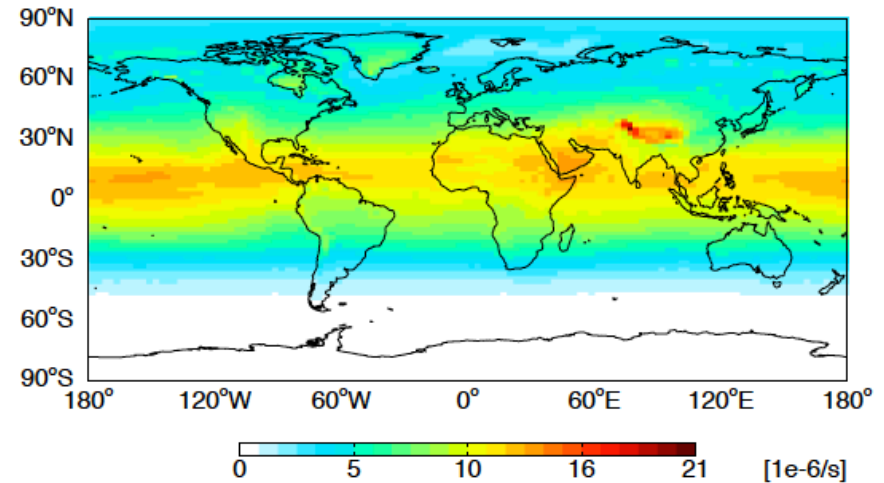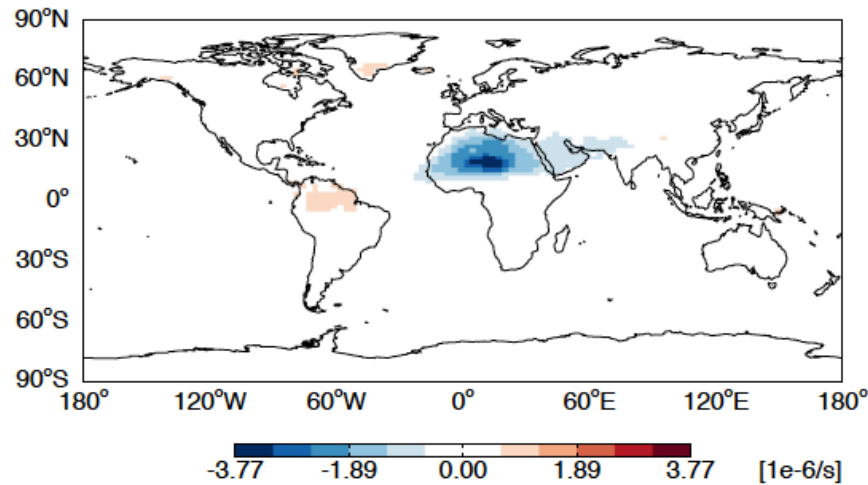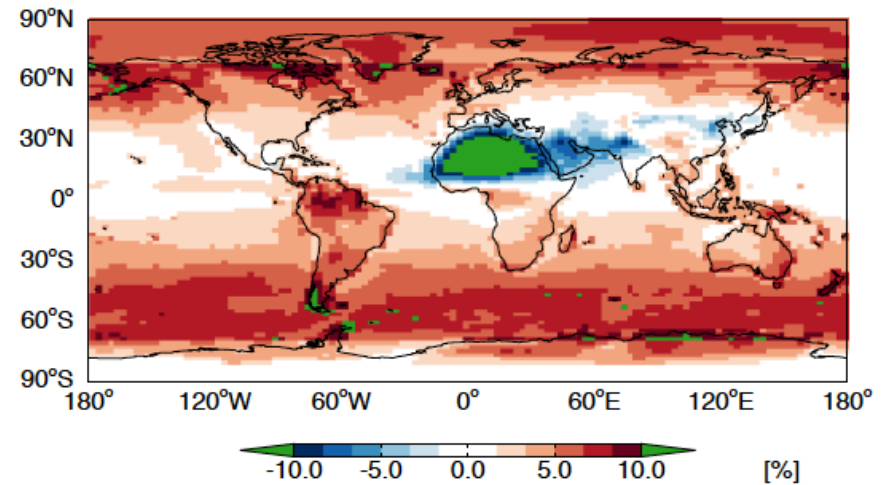
M7 vs Shettle&Fenn JO3

JO3_AV @ 700 hPa (spring)
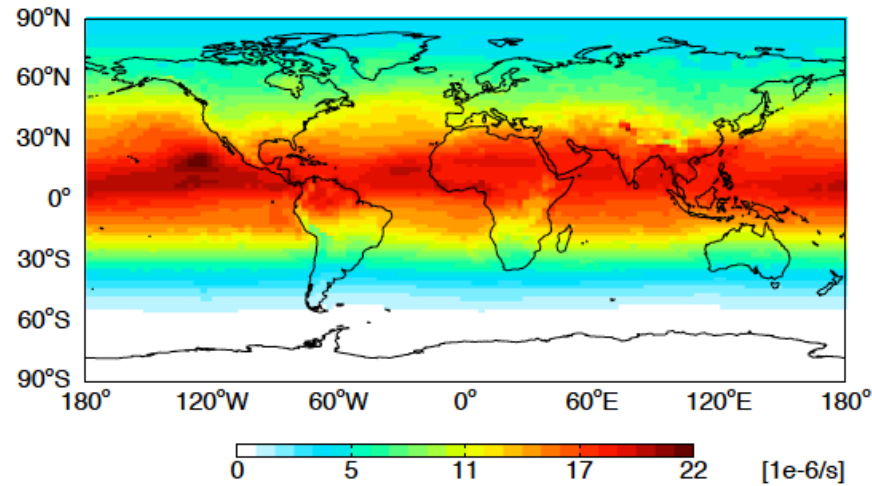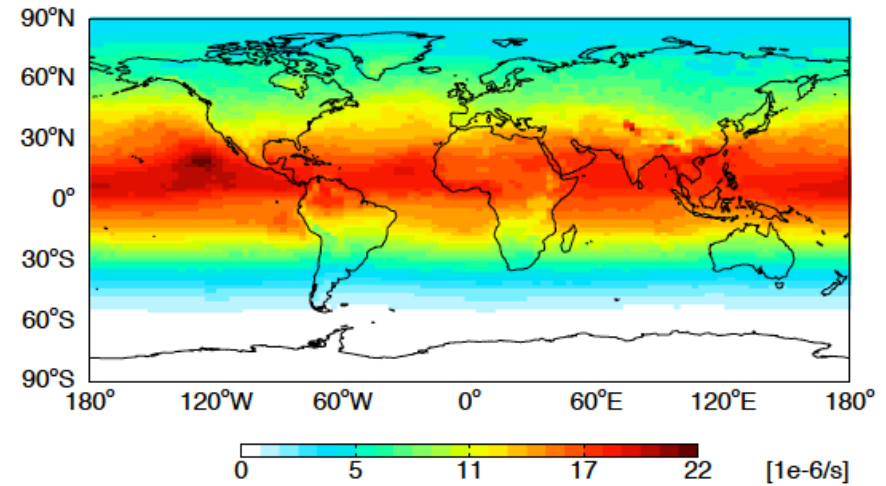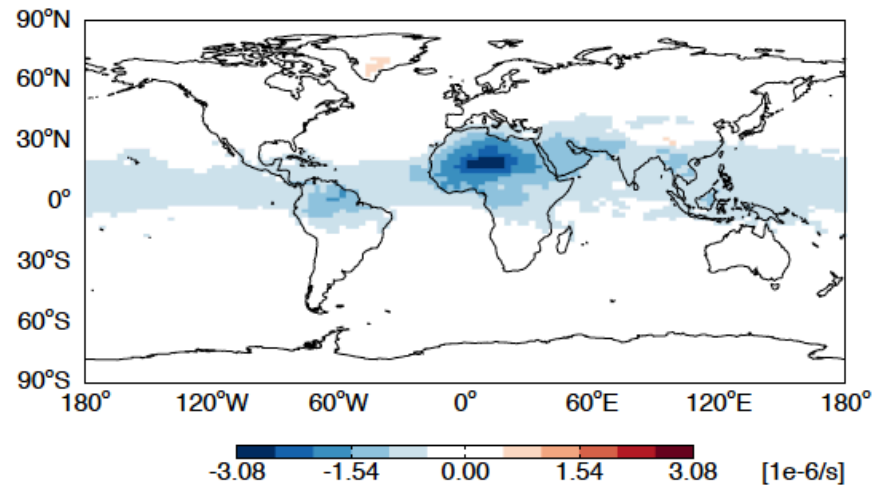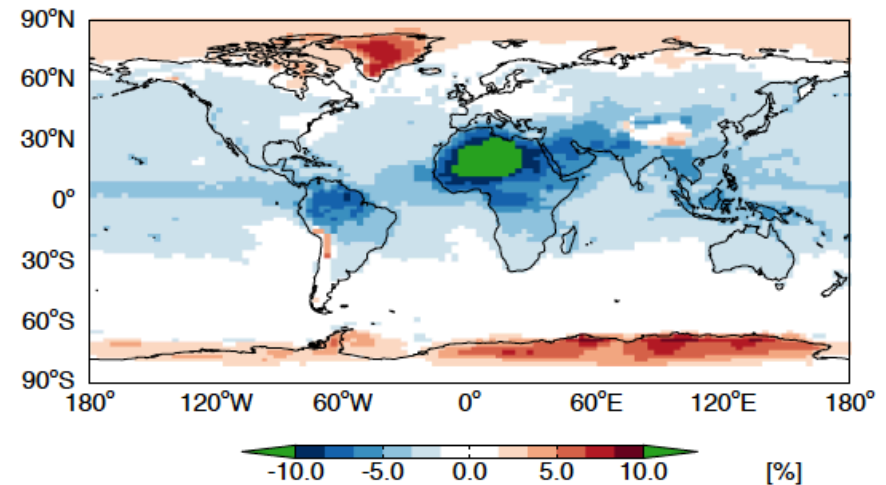
M7 vs Shettle&Fenn JO3

JO3_AV ZONAL MEAN (spring)
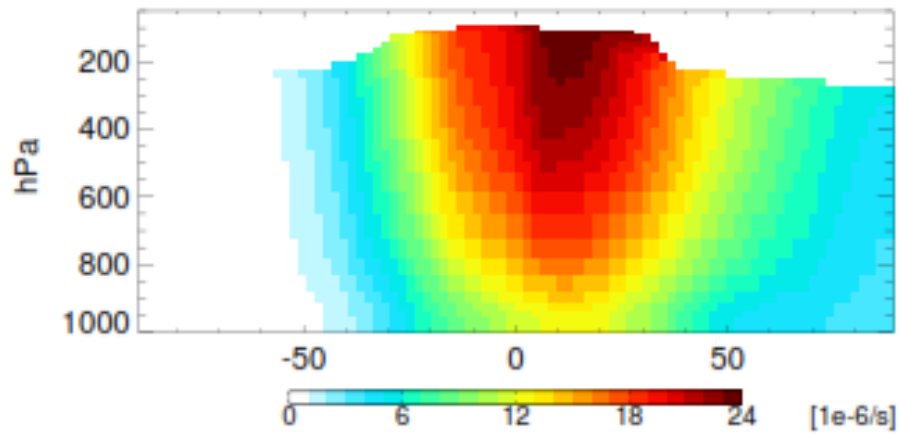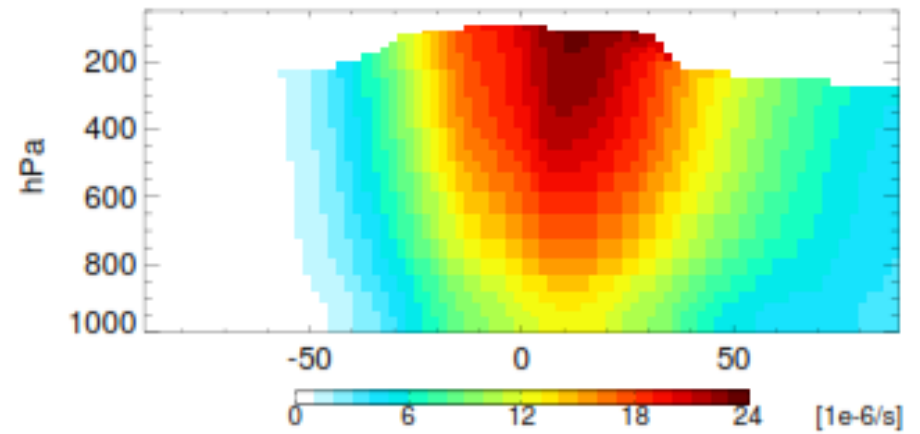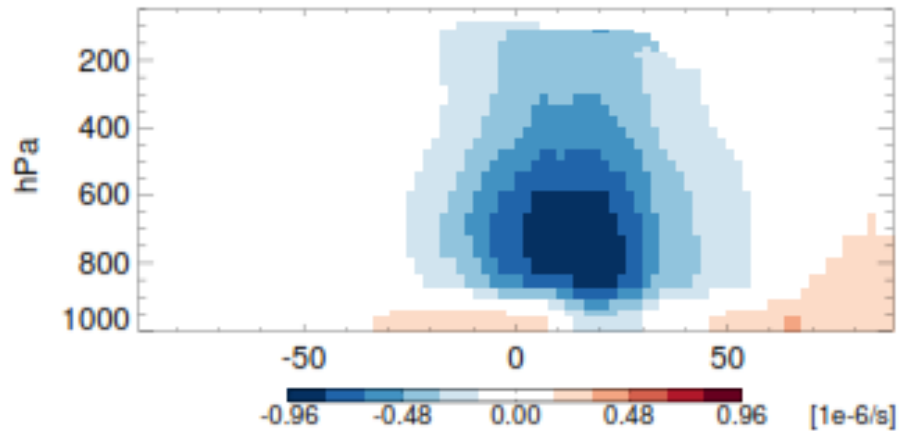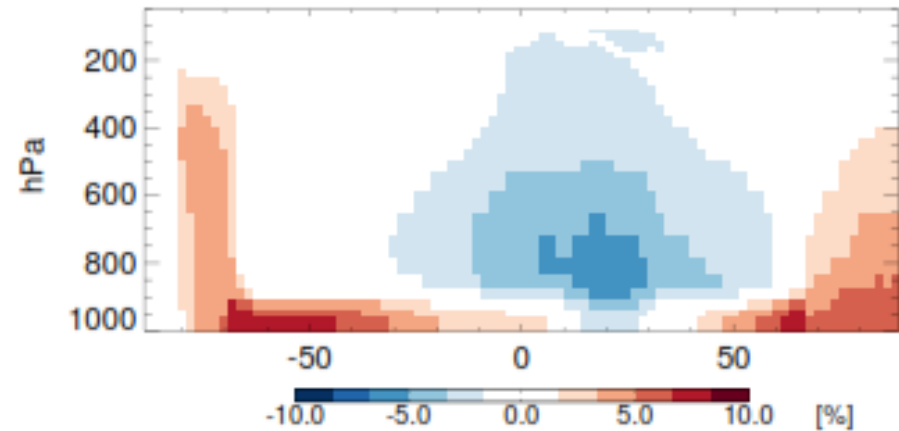
M7 vs Shettle&Fenn JNO2

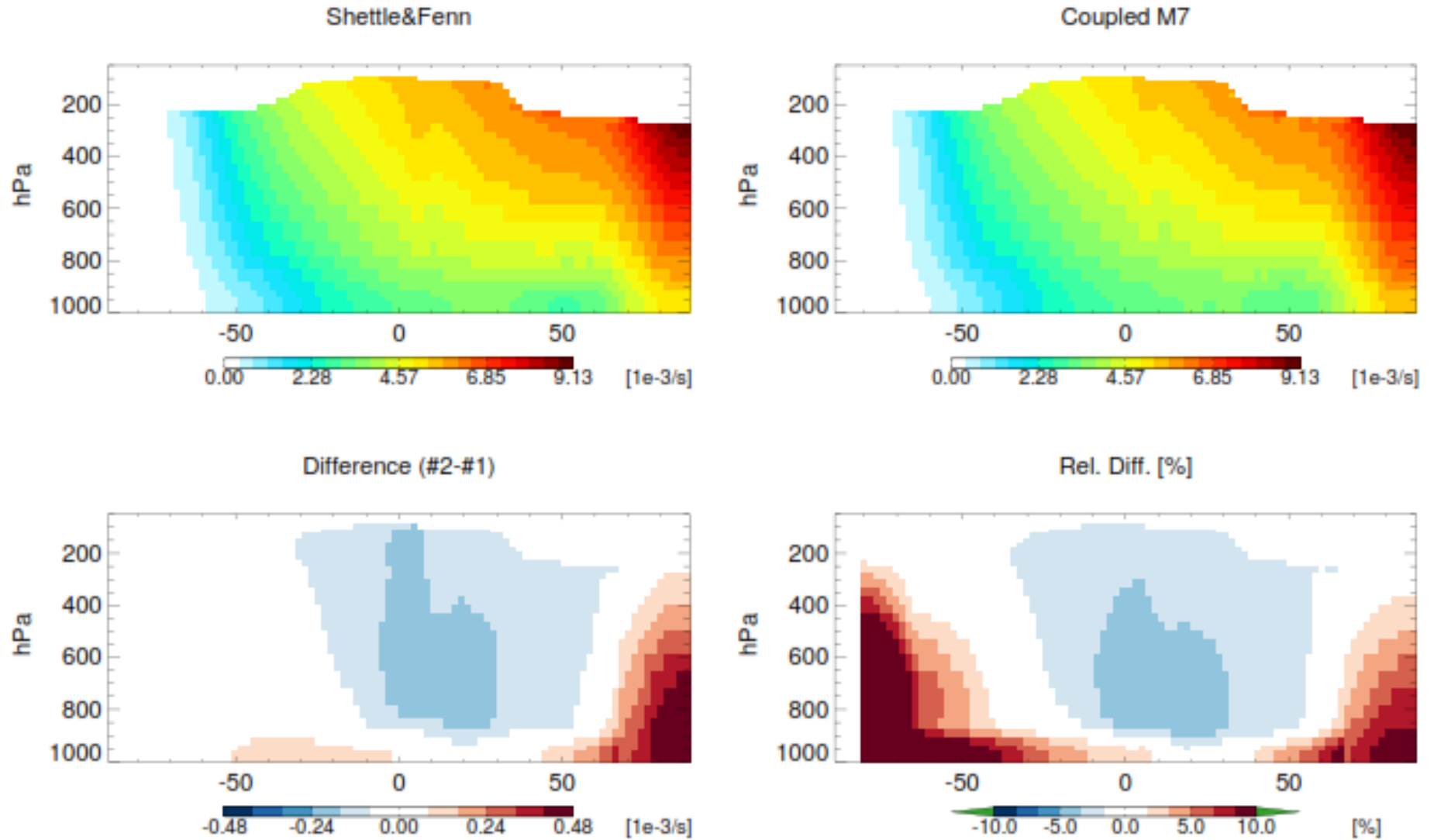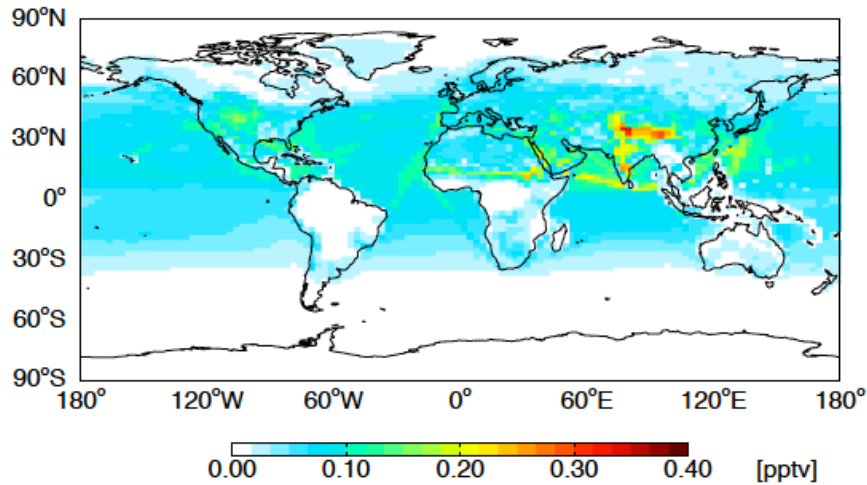JNO2_AV ZONAL MEAN (spring)

M7 vs Shettle&Fenn OH

Surface OH (spring)
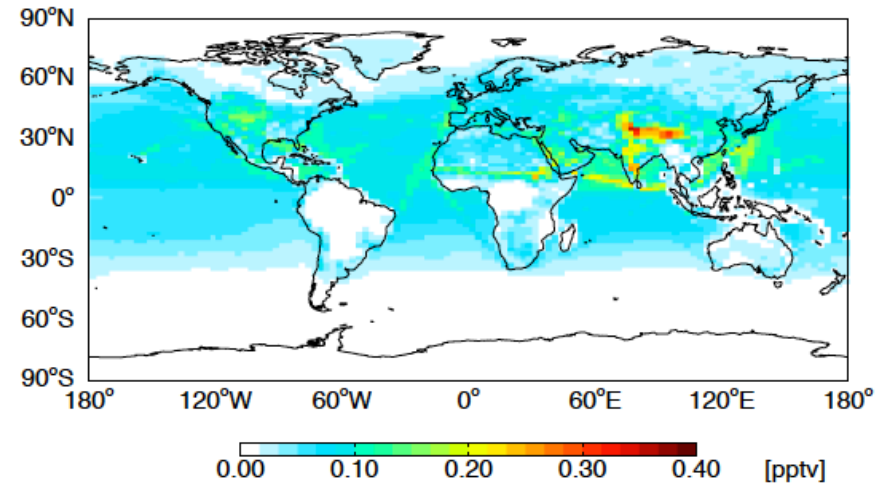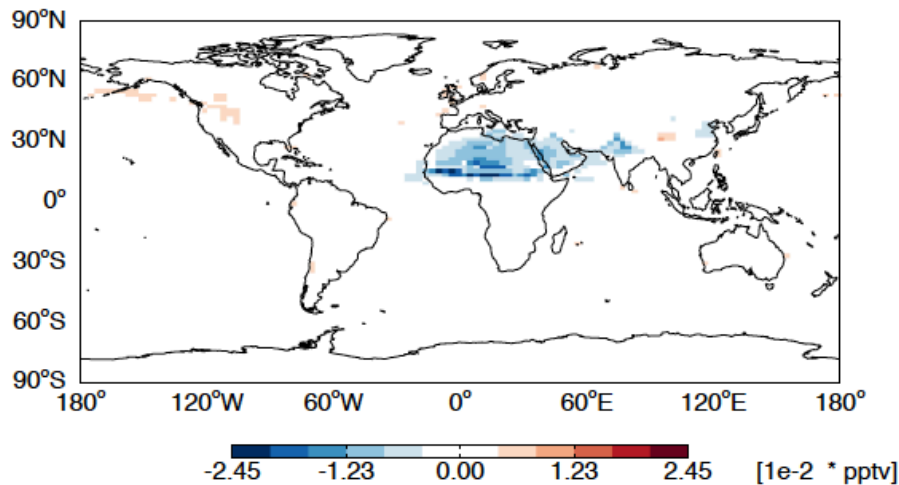
M7 vs Shettle&Fenn OH

OH @ 700 hPa (spring)
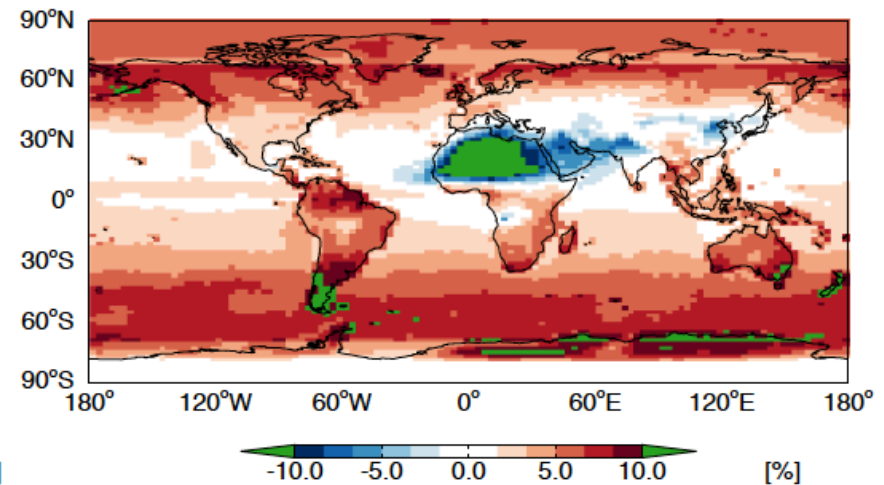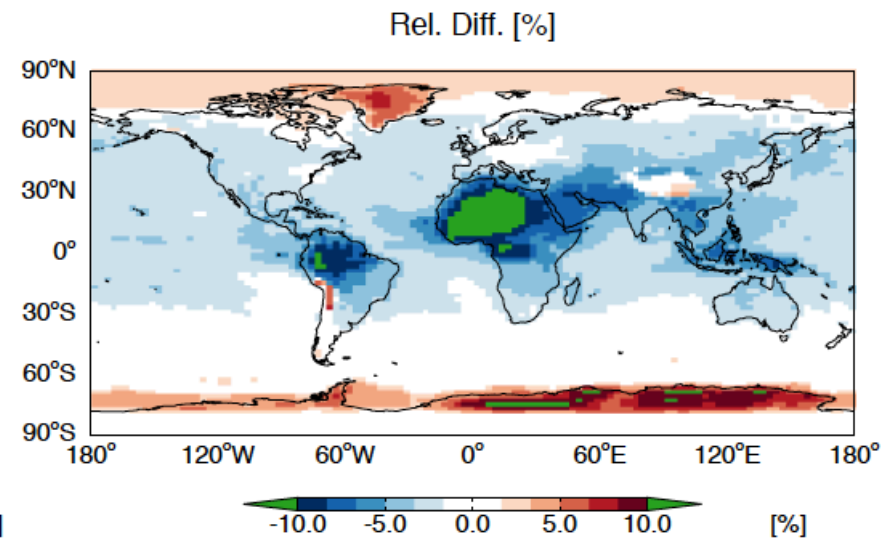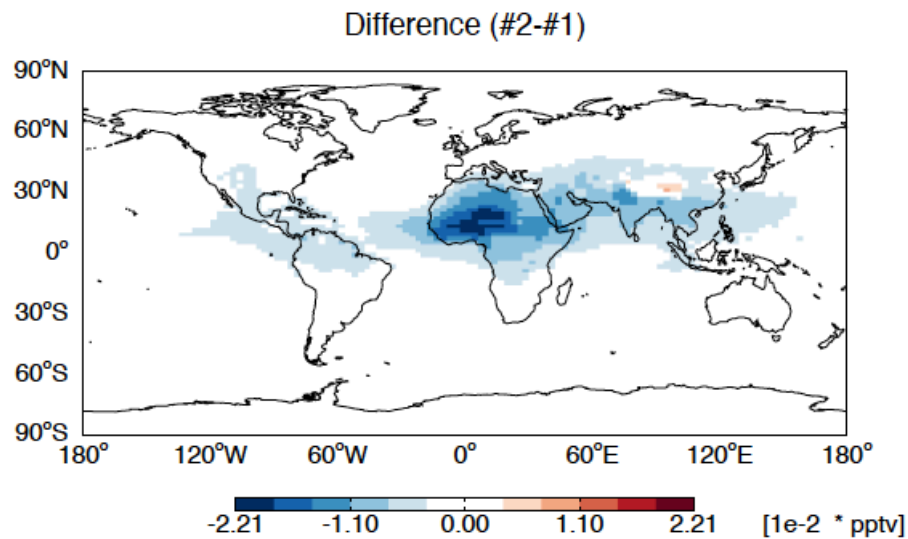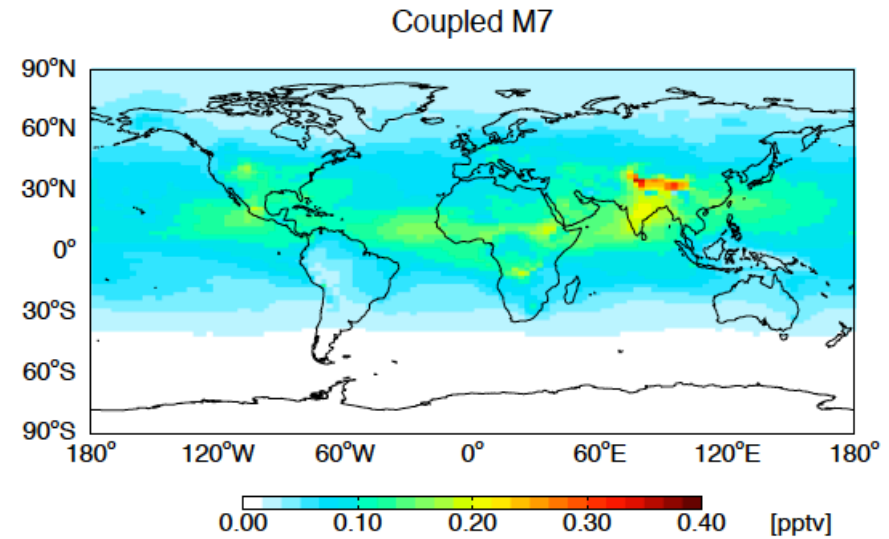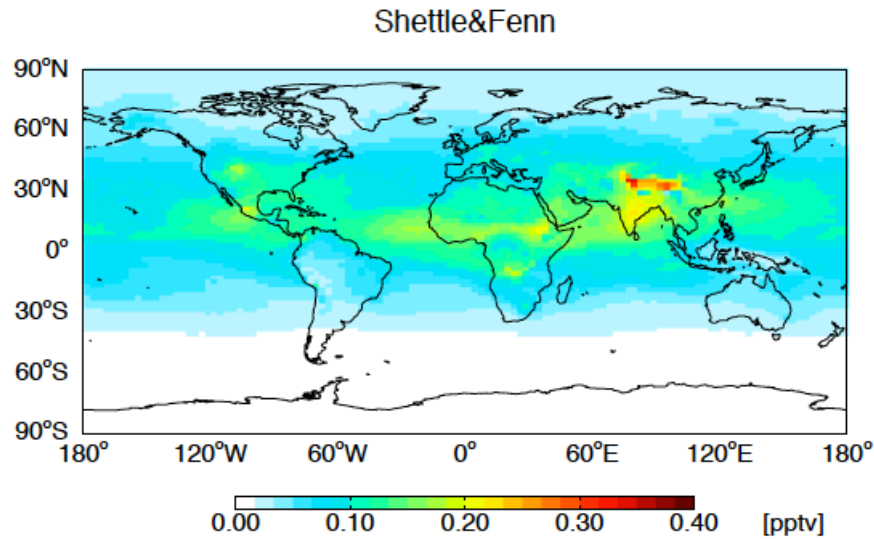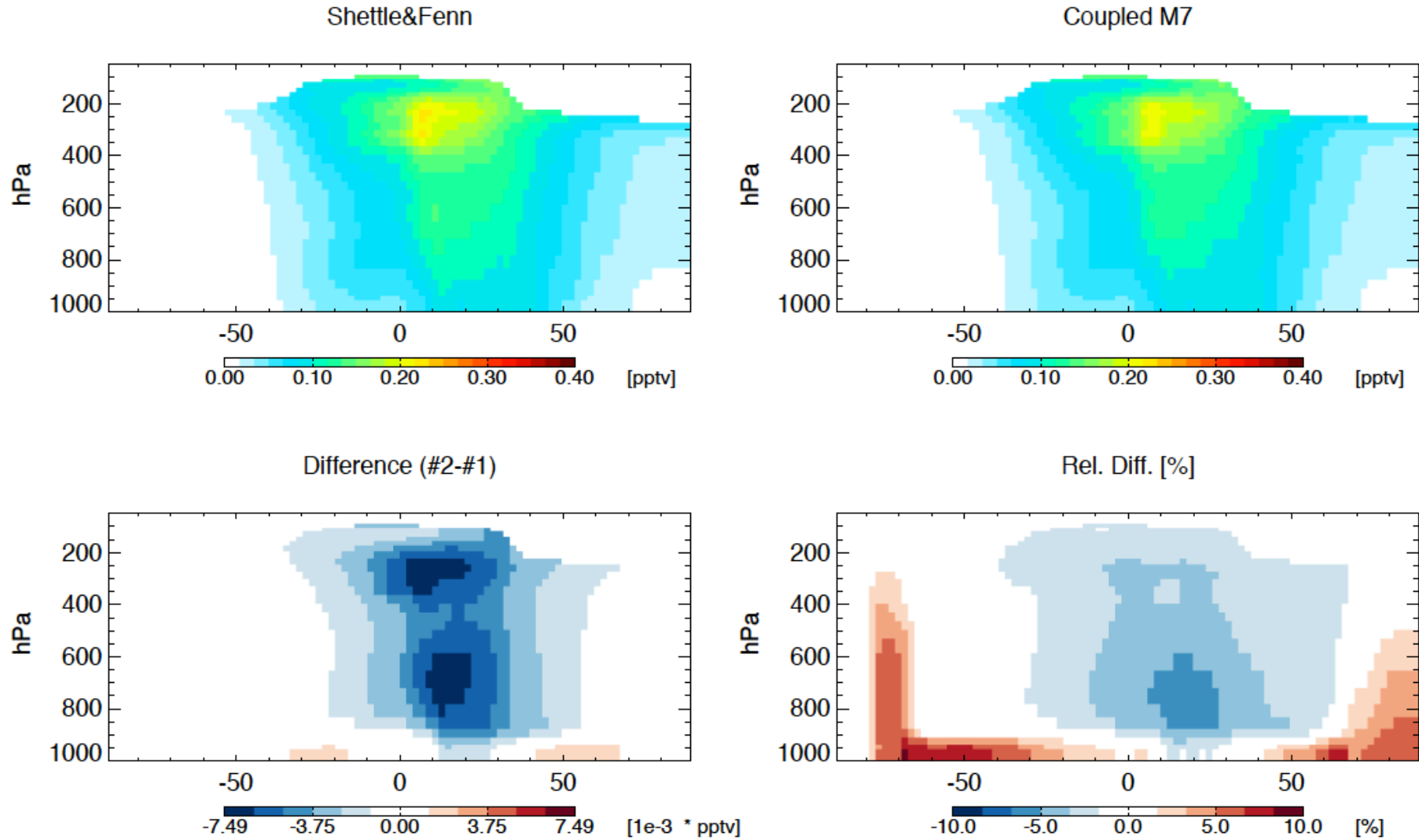
# M7 vs Shettle&Fenn OH

OH ZONAL MEAN (spring)

Conclusions

▸ Coupling of M7 with photolysis is ready for use

▸ Not yet optimized in terms of computing time

(on Huygens 8proc: without M7 - 5h; with M7 – 7h, with coupling – 11h)

▸ The Shettle&Fenn climatology gives high aerosols at ~900 hPa

▸ The effects of aerosols on OH can be up to 5%

▸ Small impact on ozone, Nox and CO (<2%)
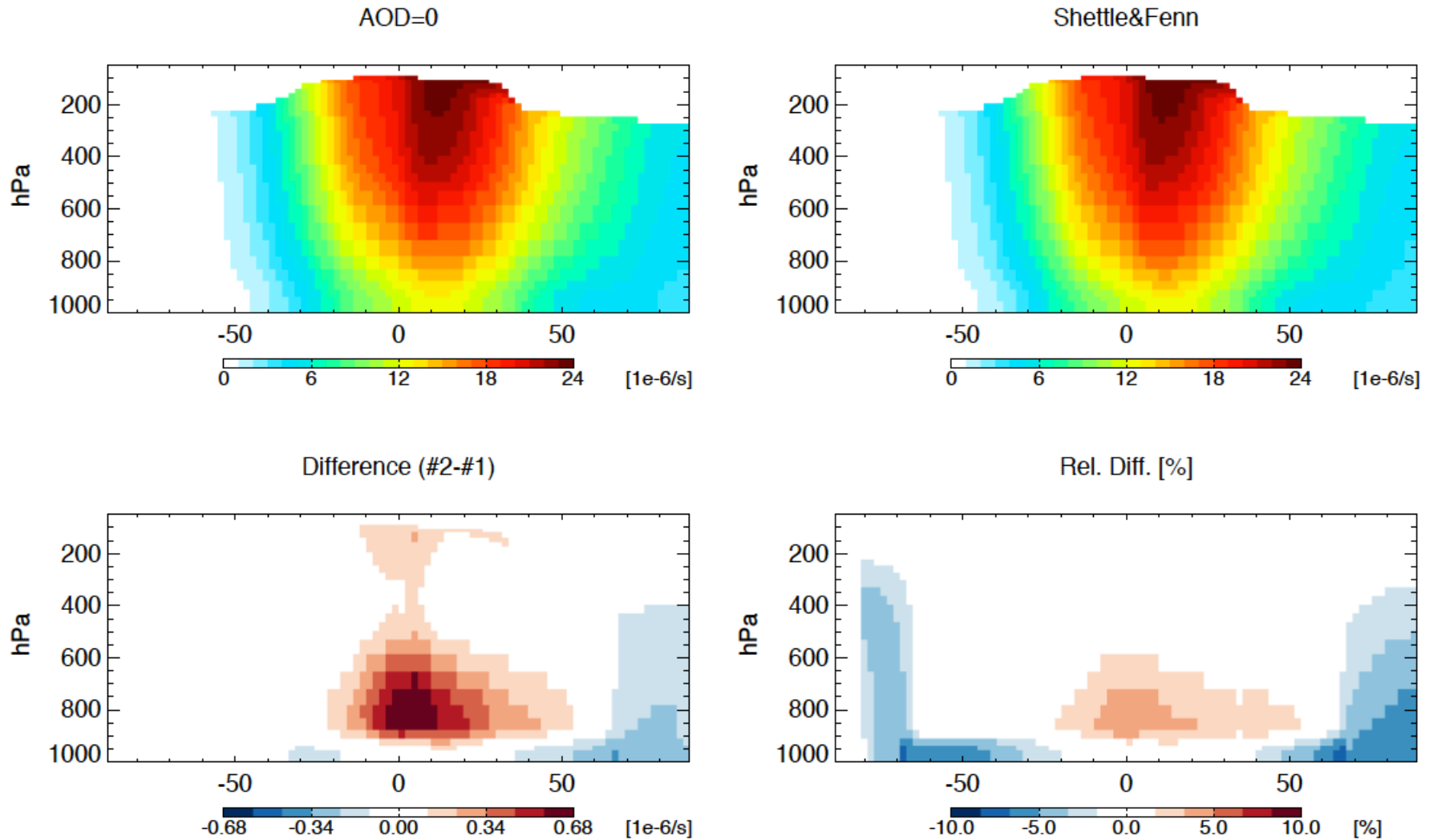
Effect of Shettle&Fenn aerosols on JO3

Surface JO3_AV (spring)
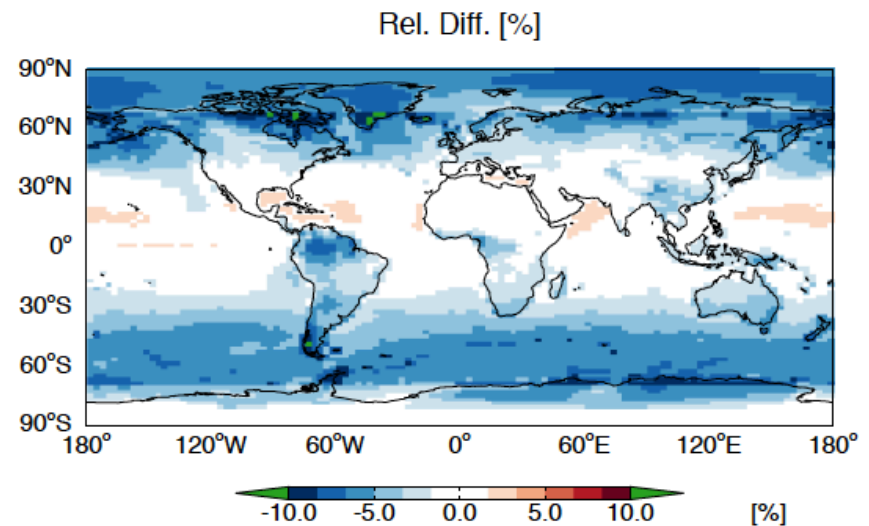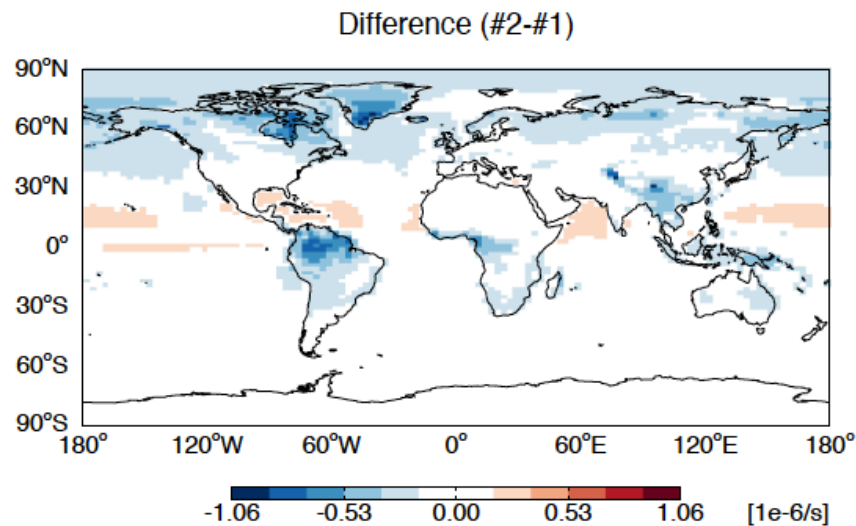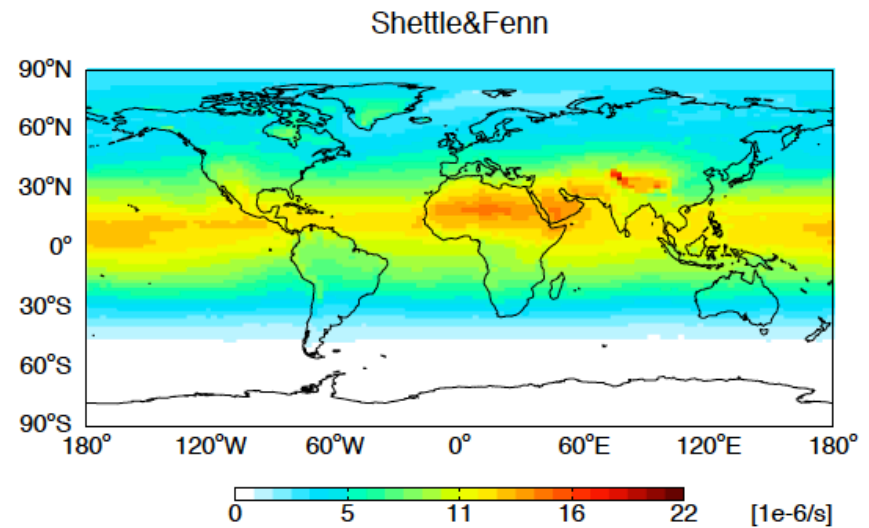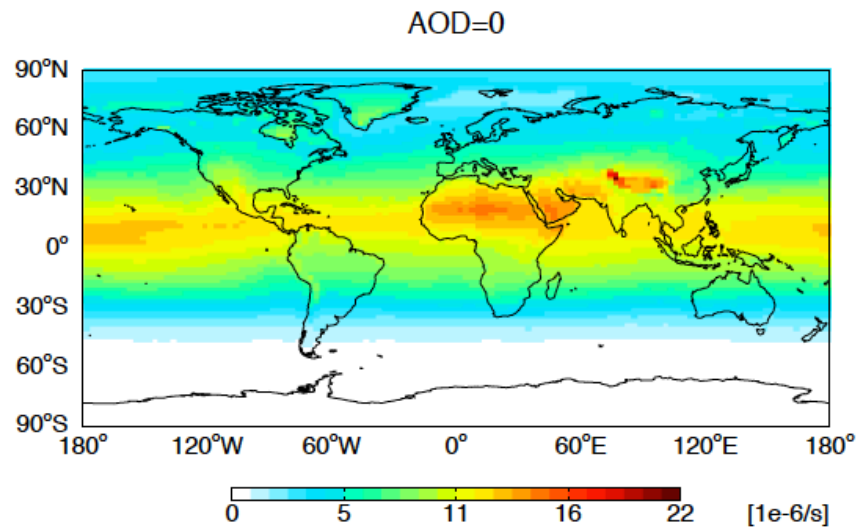
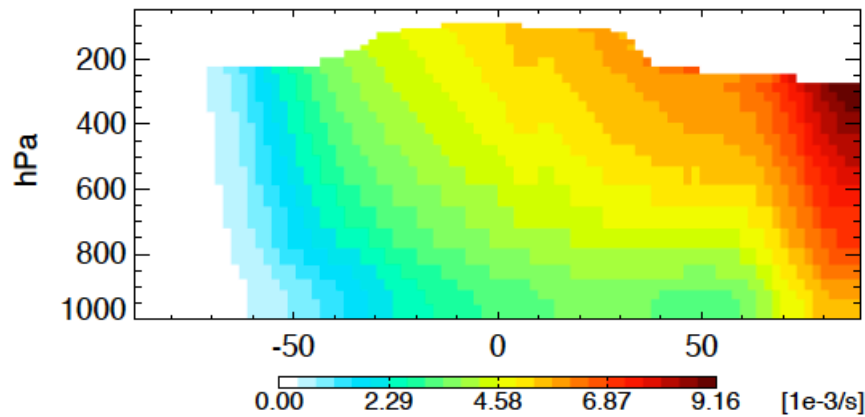# Effect of Shettle&Fenn aerosols on JO3
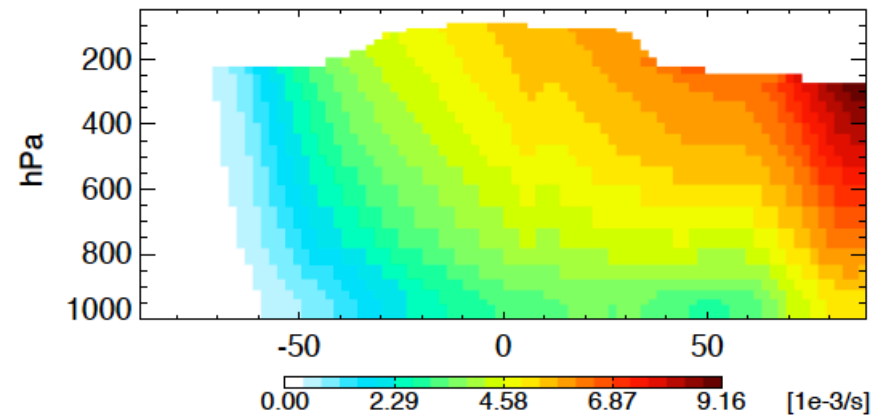

JO3_AV ZONAL MEAN (spring)

Effect of Shettle&Fenn aerosols on JNO2
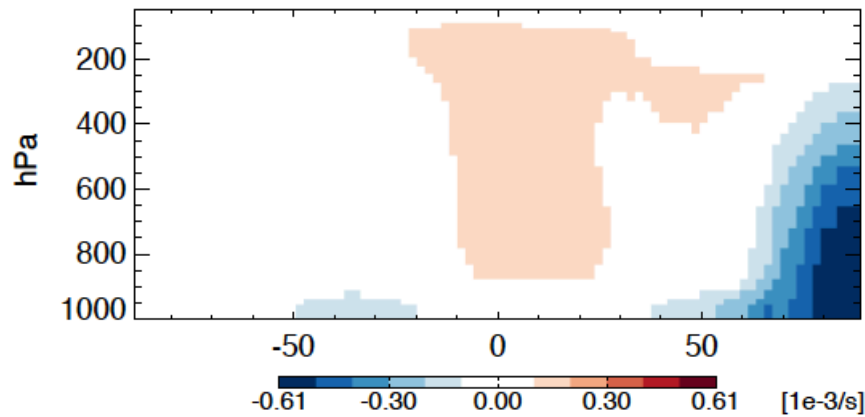

JNO2_AV ZONAL MEAN (spring)

Effect of Shettle&Fenn aerosols on OH

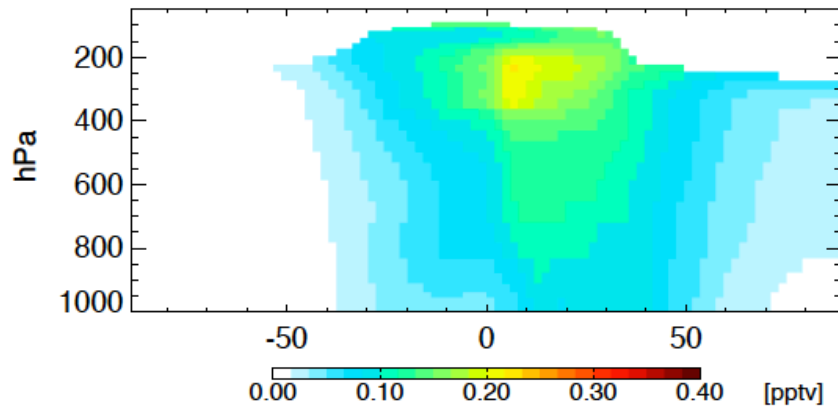OH ZONAL MEAN (spring)

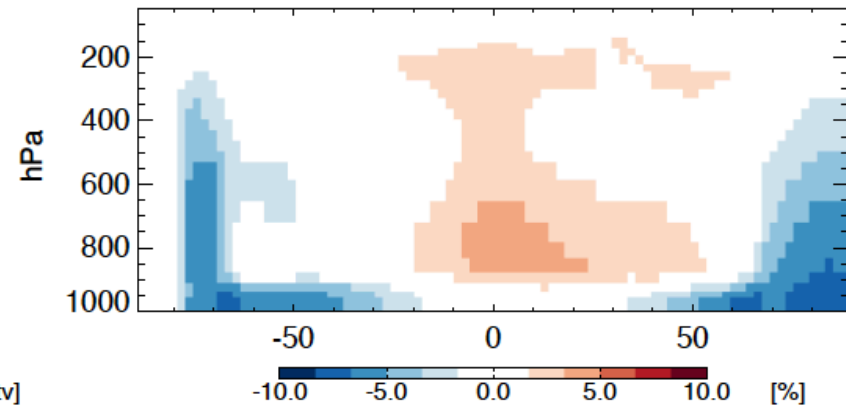# Effect of M7 aerosols on OH

OH ZONAL MEAN (spring)