Chemistry Diagnostics

Release version: amwg_diag_20140207
Add chemistry diagnostics and capability to read timeseries files

- Chemistry and aerosol budgets
- Zonal average comparison of different chemicals between two models
- Comparison to ozonesonde present day climatology (Tilmes et al., 2012)
- Comparison of column ozone to OMI present day climatology, October 2004-Dec 2010, zonal and monthly averages (Ziemke et al., 2011)
- Comparison of column CO with MOPITT Version 6 multispectral 'V6J' Level 3 product present day climatology (Deeter et al., in preparation)
- Comparison to aircraft observations of various chemical species, (updated climatology from Emmons et al. 2000, Tilmes et al., in preparation)
- IMPROVE surface aerosol observations
  NB: At this stage, the chemistry diagnostics don't work in swift mode. This will be implemented in the next release.

This is the link to news of the AMWG website:
http://www.cgd.ucar.edu/amp/amwg/diagnostics/news.html

Preliminary Version! Please send input to tilmes@ucar.edu

NESL

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DIAG SET1 Chemistry: ANN MEANS GLOBAL for O3 < 150ppb

TEST CASE: SD-CAM5-Chem (yrs 2002-2006)

CONTROL CASE: SD-CAM4-Chem (yrs 2002-2006)

Variable              SD-CAM5-Chem      SD-CAM4-Chem      SD-CAM5-Chem-SD-CAM4-Chem
missing
CH4_BURDEN (Tg)            4051.779          4058.730          -6.951
CH4_EMIS (Tg/yr)              0.000             0.000           0.000
CH4_TDEP (Tg/yr)              0.000             0.000           0.000
CH4_CHEM_LOSS (Tg/yr)       503.639           468.649          34.990
CH4_LIFETIME (yr)             8.045             8.660          -0.615
CO_BURDEN (Tg)              273.065           288.577         -15.512
CO_EMIS (Tg/yr)            1116.893          1116.893           0.000
CO_TDEP (Tg/yr)             133.237           133.366          -0.129
CO_CHEM_LOSS (Tg/yr)       1945.959          1883.570          62.389
CO_LIFETIME (yr)              0.131             0.143          -0.012
O3_BURDEN (Tg)              304.172           298.739           5.433
O3_EMIS (Tg/yr)               0.000             0.000           0.000
O3_TDEP (Tg/yr)             646.650           660.591         -13.941
O3_CHEM_LOSS (Tg/yr)          0.000             0.000           0.000
O3_LIFETIME (yr)              0.470             0.452           0.018
O3_CHEM Prod (Tg/yr)          0.000             0.000           0.000
O3_NET_CHEM_CHANGE (Tg/yr) 265.666           259.218           6.448
O3_STE (Tg/yr)              380.984           401.373         -20.389
O3 Strat BURDEN (Tg/yr)    2743.141          2726.511          16.629
ISOP_EMIS TgN/yr)           537.404           537.404           0.000
Monoterpene_EMIS TgN/yr)     81.795            81.795           0.000
Methanol_EMIS TgN/yr)       236.893           236.893           0.000
Aceton_EMIS TgN/yr)          26.956            26.956           0.000
LNO_PROD (TgN/yr)             4.381             4.248           0.000
Total optical depth           0.105             0.095          -0.133
DUST optical depth            0.029             0.028          -0.010
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DIAG SET1 Aerosol: ANN MEANS GLOBAL < 200hPa

TEST CASE: SD-CAM5-Chem (yrs 2002-2006)

CONTROL CASE: SD-CAM4-Chem (yrs 2002-2006)

Variable              SD-CAM5-Chem        SD-CAM4-Chem      SD-CAM5-Chem-SD-CAM4-Chem
missing
POM_BURDEN (TgC)             0.658               0.583             0.075
POM_EMIS (TgC/yr)           50.328              34.661            15.667
POM_DRYDEP (TgC/yr)          8.628               7.427             1.201
POM_WETDEP (TgC/yr)        -41.498             -27.457           -14.041
POM_CHMP (TgC/yr)            0.000               0.000             0.000
POM_LIFETIME (days)          4.790               6.097            -1.307
SOA_BURDEN (TgC)             1.198               0.850             0.348
SOA_EMIS (TgC/yr)            0.000               0.000             0.000
SOA_DRYDEP (TgC/yr)         15.145               2.302            12.843
SOA_WETDEP (TgC/yr)        -88.186             -18.202           -69.985
SOA_CHMP (TgC/yr)          103.477              20.467            83.009
SOA_LIFETIME (days)          1.198               0.850             0.348
BC_BURDEN (TgC)              0.091               0.118            -0.028
BC_EMIS (TgC/yr)             7.769               7.769             0.000
BC_DRYDEP (TgC/yr)           1.524               0.000             1.524
BC_WETDEP (TgC/yr)          -6.226              -6.270             0.044
BC_CHMP (TgC/yr)             0.000               0.000             0.000
BC_LIFETIME (days)           4.273               0.000             4.273
DUST_BURDEN (TgC)           38.876              34.879             3.997
DUST_EMIS (TgC/yr)        5615.960            2859.839          2756.121
DUST_DRYDEP (TgC/yr)      3815.801               0.000          3815.801
DUST_WETDEP (TgC/yr)     -1800.053               0.000         -1800.053
DUST_CHMP (TgC/yr)           0.000               0.000             0.000
DUST_LIFETIME (days)         2.527               0.000             2.527
SALT_BURDEN (TgC)            9.160               7.205             1.956
SALT_EMIS (TgC/yr)        4587.192            4817.189          -229.997
SALT_DRYDEP (TgC/yr)      2255.737               0.000          2255.737
SALT_WETDEP (TgC/yr)     -2328.603               0.000         -2328.603
SALT_CHMP (TgC/yr)           0.000               0.000             0.000
SALT_LIFETIME (days)         0.729               0.000             0.729
SO4_BURDEN (TgS)             0.413               0.520            -0.107
SO4_EMIS (TgS/yr)            1.664               0.000             1.664
SO4_DRYDEP (TgS/yr)          5.630               6.088            -0.457
SO4_WETDEP (TgS/yr)        -31.944             -44.385            12.441
SO4_CHMP (TgS/yr)           11.368               8.122             3.246
SO4_AQ_PROD (TgS/yr)        24.097              42.435           -18.338
SO4_TOTAL_PROD (TgS/yr)     35.547              50.557           -15.010
SO4_LIFETIME (days)          4.011               3.238             0.773
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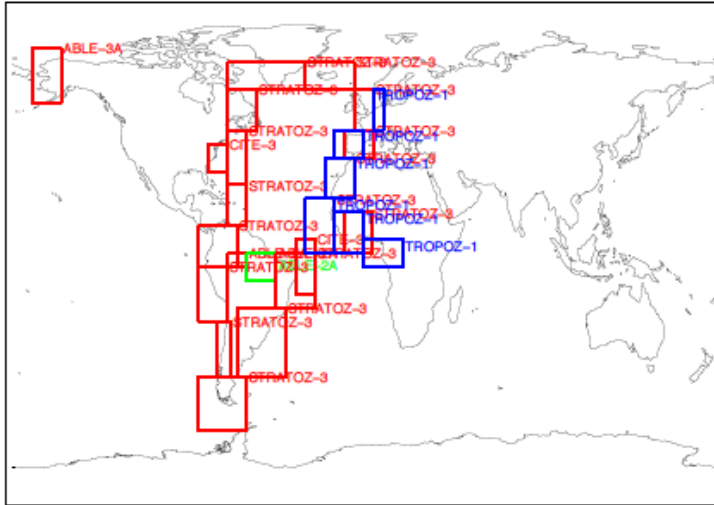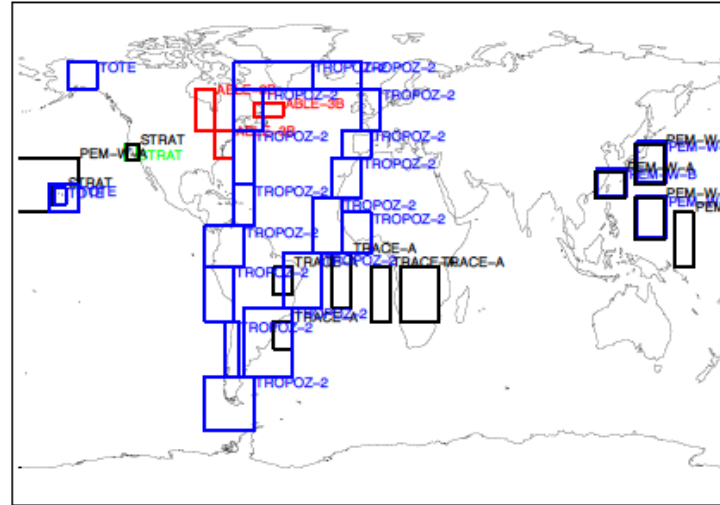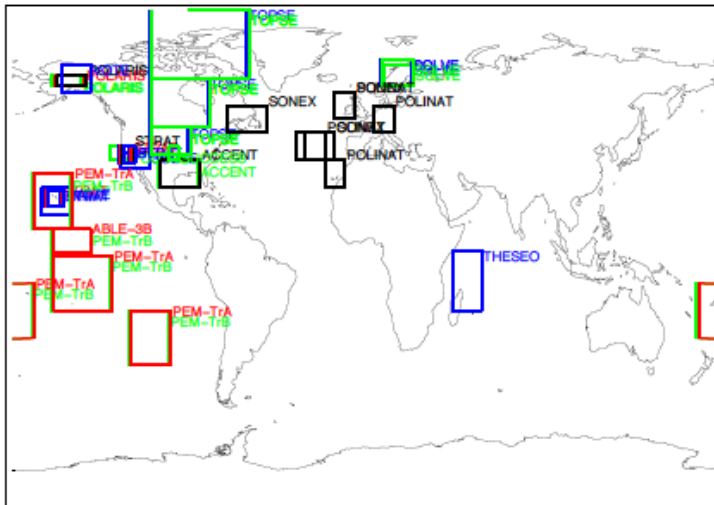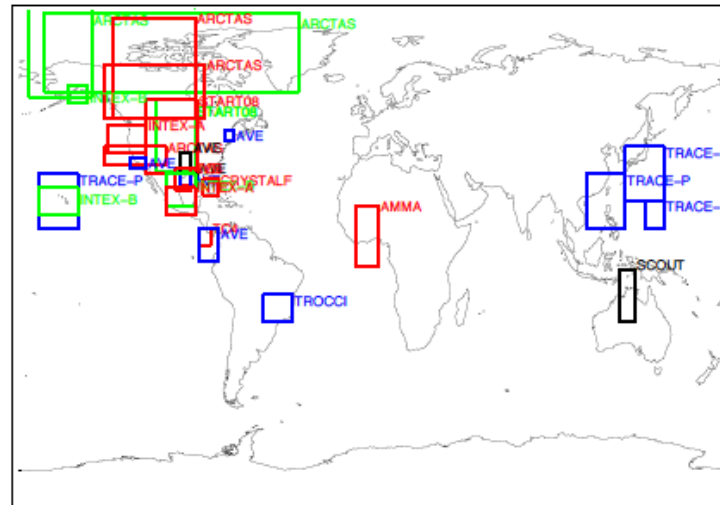
Ozonesonde Climatology 1995-2011

Tilmes et al. 2012, Atmos. Chem. Phys.
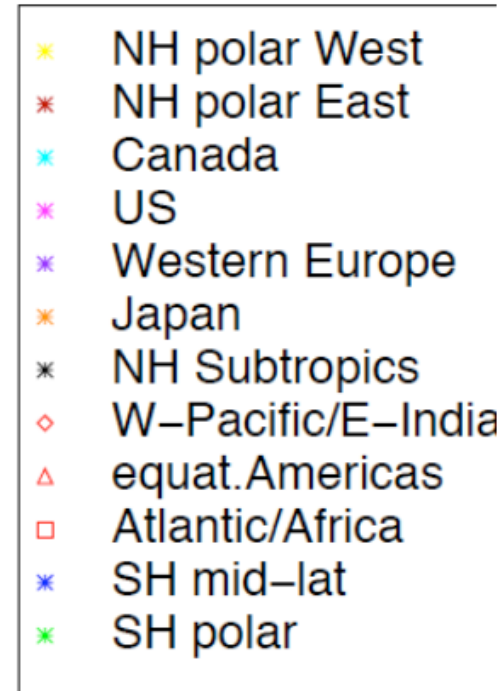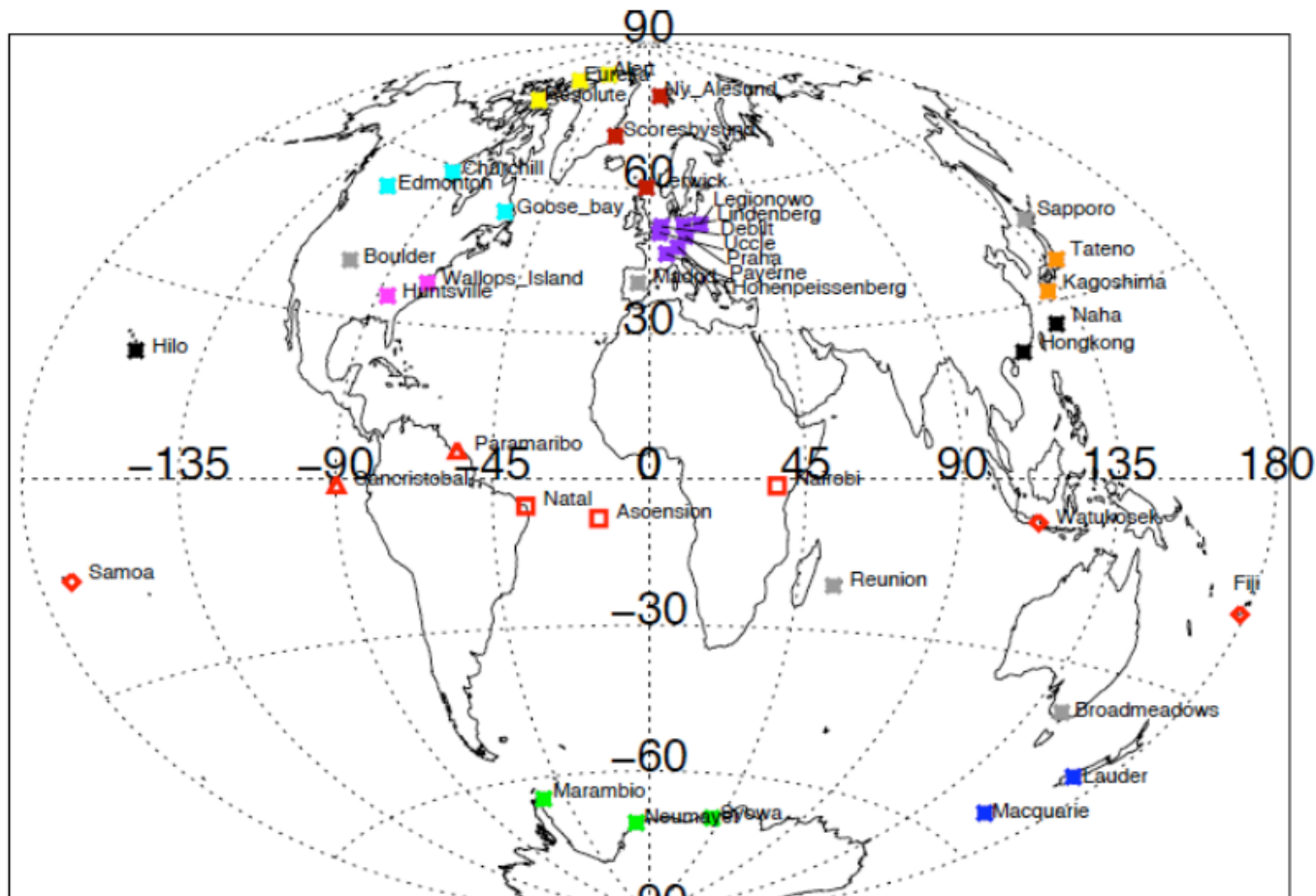
Aircraft Climatology

Chemistry Diagnostics

Instructions for running with Chemistry:
Follow Script instruction to define control and test run
setenv DIAG_HOME /glade/p/cesm/amwg/amwg_diagnostics_dev

Chemistry Specific:
    set strip_off_vars = 1   # (0=ON,1=OFF)   #set to OFF for running with
    Chemistry or not all chemistry variables will be used
Select Chemistry Set:
    set wset_1 = 0   # (0=ON,1=OFF) vertical zonal mean contour plots (log scale)
    set cset_1 = 0   # (0=ON,1=OFF) tables of global budgets
    set cset_2 = 0   # (0=ON,1=OFF) vertical zonal mean contour plots (log scale)
    set cset_3 = 0   # (0=ON,1=OFF) Ozonesonde comparisions
    set cset_4 = 0   # (0=ON,1=OFF) Column Ozone/CO Comparisons
    set cset_5 = 0   # (0=ON,1=OFF) NOAA Aircraft comparisons
    set cset_6 = 0   # (0=ON,1=OFF) Emmons Aircraft climatology
    set cset_7 = 0   # (0=ON,1=OFF) surface comparisons (ozone, co, improve)
Best tested for comparison of two models and observations!
Problems:
    some sets do have problems if Ozone and Z3 is not included in the output
    set sig_lvl = 0.05   #does not work for chemistry comparisons currently