Dust and Carbon deposition to surface models Project

Project for passing dust and carbon deposition to surface models

Latest versions of the surface models need dust and carbon deposition rates. CLM now has SNICAR which needs these fields, and there is current work ongoing to get it into CICE. The ocean model as well wants dust deposition for the BGC model.

Mission statement:

Pass dust and carbon deposition rates to all of the CCSM components as needed for CCSM4.

Personnel:

Project Coordinator: Mariana Vertenstein

Development Lead: Erik Kluzek

Scientific Lead: Mark Flanner

Resources:

- Francis Vitt (BGC and chemistry expert on trop_mozart in CAM)
- David Bailey - sea-ice
- Mark Flanner (SNICAR expert - work on getting these fields into CAM)
- Mat Rothstein (CAM software development)
- Brian Eaton (CAM advice, approve changes going into CAM)
- Erik Kluzek (CLM and datm software development)
- Mariana Vertenstein (cpl7)
- David Lawrence (CLM project)
- Brian Kauffman (datm7 expert to vett changes going into datm7)

Plan:

- Mariana and Erik get these fields into xatm, datm7 and cam as missing values.
- Wait for work with modal aerosols in cam as should pass different information to cpl.
- Cpl should take modal information and bin appropriately for models needing it.
- Erik puts this into datm7
- Mat puts this into CAM for prescribed mode.
- Mat and Mark put this into CAM for prognostic mode
- Dave Bailey uses the fields passed from cpl7 in CICE
- Ocean model wants these fields for future work.
- Erik removes the code in CLM for reading these datasets and always used the fields passed by the coupler.

Work completed:

- Mariana and Erik get these fields into drv and cpl7 as missing values. ccsm4_0_alpha36 and clm3_6_13 (DONE!)
- Dave Bailey starts using these fields in CICE reading in the clm datasets in CICE. (DONE!)

Requirements:

- All CCSM atm components will pass the modal information for the fields: dust for dry and wet deposition, Black and Organic Carbon for hydrophilic and hydrophobic.
- Driver and cpl will take the modal information and compute the bulk info into: 4 bins for dust, and 1 for each of the carbon species.
- Driver and cpl7 will need to recognize these fields and route them appropriately.
- Surface models take this as input - NOT output (although CLM has an option to send DUST as output as well - but this is a separate issue).
- CAM needs to have both a prognostic mode for predicting these fields as well as a prescribed mode for reading it from a file.
- CAM in prescribed mode needs to remap the datafiles (existing infrastructure should be used to do this).
- CAM in prognostic mode should do this regardless of the chemistry or aerosol package used.
- In the short term CLM and CICE should use the same input files of bulk aerosols provided by Mark Flanner.
- Files for aerosol deposition used by CAM should be the same files used by datm.
- datm7 will remap the datafiles to the atm grid using existing infrastructure.
- CLM will need to use the fields passed from the coupler rather than the datasets it read itself.
- Surface models should check that the field values are not spval and only then use them.
- Surface models should get the same answers when the fields are passed - but they are set to missing value.
- NO CPP tokens or run-time variables will be used to turn these on or off - they are always ON for all Compsets.
- CAM prescribed mode and datm7 mode should give similar results (probably not b4b as interpolation different). Possibly this should be b4b or roundoff different when no interpolation is done.
- Native resolution for the data will be on the fv1.9x2.5 grid.
- CLM should get answers that are roundoff the same with running with reading faerdep itself versus getting the fields from the coupler via datm7 for the fv1.9x2.5 grid.

Software questions:

- How will it need to be done in trop_mozart? What about other chemistry package options? We need this in all chemistry options for CAM.

- Is the way Mark implemented this into cam3_5_07 different than the latest CAM? YES!

Scientific questions:

- How will this work for the modal aerosol package going into CAM?
  We'll need to pass different information including information on the size distributions, so can be re-binned in the cpl.

Existing Software and data resources:

Bug reports:

http://bugs.cgd.ucar.edu/show_bug.cgi?id=738
http://bugs.cgd.ucar.edu/show_bug.cgi?id=737

CAM3.5.07 code that passes data needed for SNICAR:

On bluefire, files modified are under:
/blhome/mflanner/snicar_cam3_5_07

CLM code to read datasets:

https://svn-ccsm-models.cgd.ucar.edu/clm2/branch_tags/clm36sci_tags/clm36sci17_clm3_6_11/models/lnd/clm/src/main/aerdepMod.F90

CLM datasets currently in use:

1.9x2.5 is the native resolution. This is from 1990 prognostic aerosols from cam3.1.
The code used to interpolate these datasets is at:
https://svn-ccsm-models.cgd.ucar.edu/clm2/branch_tags/clm36sci_tags/clm36sci17_clm3_6_11/models/lnd/clm/tools/ncl_scripts/aerdepregrid.ncl
<pre>

- lnd/clm2/snicardata/aerosoldep_monthly_1990s_mean_0.47x0.63_c080410.nc
- lnd/clm2/snicardata/aerosoldep_monthly_1990s_mean_1.9x2.5_c080401.nc
- lnd/clm2/snicardata/aerosoldep_monthly_1990s_mean_2.65x3.33_c080709.nc
- lnd/clm2/snicardata/aerosoldep_monthly_1990s_mean_4x5_c080410.nc
- lnd/clm2/snicardata/aerosoldep_monthly_1990s_mean_10x15_c080410.nc
- lnd/clm2/snicardata/aerosoldep_monthly_1990s_mean_360x720_c080415.nc
- lnd/clm2/snicardata/aerosoldep_monthly_1990s_mean_64x128_c080410.nc
- lnd/clm2/snicardata/aerosoldep_monthly_1990s_mean_48x96_c080410.nc
- lnd/clm2/snicardata/aerosoldep_monthly_1990s_mean_5x5_amazon_c080410.nc
- lnd/clm2/snicardata/aerosoldep_monthly_1990s_mean_1x1_vancouverCAN_c080410.nc
- lnd/clm2/snicardata/aerosoldep_monthly_1990s_mean_1x1_mexicocityMEX_c080410.nc
- lnd/clm2/snicardata/aerosoldep_monthly_1990s_mean_1x1_camdenNJ_c080410.nc
- lnd/clm2/snicardata/aerosoldep_monthly_1990s_mean_1x1_brazil_c080410.nc
- lnd/clm2/snicardata/aerosoldep_monthly_1990s_mean_1x1_asphaltjungleNJ_c080410.nc
- lnd/clm2/snicardata/aerosoldep_monthly_1990s_mean_1x1_tropicAtl_c080410.nc

Creating 1870 proxy datasets

We talked about using old CAM cases - but don't trust doing that (PJR). As a result PJR suggests taking the 1990 data, and scaling it accordingly. Leave the dust the same, and scale black carbon back by 30% for 1870.

Transient datasets?

Also do NOT have transient dataset from 1870 to present - and we are not sure if this would work in clm.

Fieldnames in Trop-mozart

I believe the fieldnames are: dust1, dust2, dust3, dust4, bcar1, bcar2, ocar1, ocar2
To output wet deposition you add a prefix of WD_ and dry deposition DF_. I'm not sure if this is all to the surface? There's also surface specific deposition with SFWET postfix.