PMIP4 CESM dust data

Contact

Information and data provided by Samuel Albani

Data files

- each variable for each climate period is in a separate file. In the `conc` (dust concentration) case, which contains the three-dimensional dust concentration in the atmosphere, ancillary variables are also included in the same file, i.e. those necessary to fully describe the vertical coordinate (lev, ilev, hyai, hybi, hyam, hybm, PS)
- file names = `PMIP4_DUST_Albani_<field>_<expt>.nc`
  - `field` = see Variables section below
  - `expt` = `PI` (pre-Industrial), `MH` (mid-Holocene) or `LGM` (Last Glacial Maximum)
    - The gaussian weights file does not depend on the experiment: `PMIP4_DUST_Albani_gw.nc`

Dimensions

- nb_time = 12
  - 12 time steps in each file, corresponding to the climatological monthly averages (with the exception of `erod`, the soil erodibility variable), indicated as days since 2020-01-01 00:00:00. They are assumed to all have equal weight
  - time = [14, 44, 74, ... 284, 314, 344]
- nb_lat, nb_lon = 192, 288 (0.95 x 1.25 degrees)
  - latitude_values = [-90, -89.05759, -88.11518, ... 88.11518, 89.05759, 90]
  - longitude_values = [0, 1.25, 2.5, ... 356.25, 357.5, 358.75]
- size_bin = 4 (dust particle size classes)
  - dust size bin edges = 0.1, 1.0, 2.5, 5.0, 10.0 µm (diameters)
  - size values = [1, 2, 3, 4]
    - 1 = 0.1-1.0 µm, 2 = 1.0-2.5 µm, 3 = 2.5-5.0 µm, 4 = 5.0-10.0 µm (diameters)
- nb_levels = 26 hybrid sigma-pressure levels
  - only for the `conc` variable
  - check the `PMIP4_DUST_Albani_conc_<expt>.nc` files for details about the hybrid coordinates

Variables

2D dust fields

- **erod**: Soil erodibility
  - soil_erodibility

    - dimensions: [latitude, longitude]
    - units: binary (0 or 1)
      0 = non-erodible grid cell
      1 = erodible grid cell
- **emis**: Dust emission flux (size-resolved)
    - tendency_of_atmosphere_mass_content_of_dust_dry_aerosol_particles_due_to_emission
    - dimensions: [time, size, latitude, longitude]
    - units: kg m-2 s-1
- **load**: Dust load (size-resolved)
    - atmosphere_mass_content_of_dust_dry_aerosol_particles
    - dimensions: [time, size, latitude, longitude]
    - units: kg m-2
- **aot**: Dust Aerosol Optical Thickness (size-resolved) at 550 nm
    - atmosphere_optical_thickness_due_to_dust_dry_aerosol_particles
    - dimensions: [time, size, latitude, longitude]
    - units: 1 (*unitless*)
- **ddep**: Dust dry deposition flux (size-resolved)
    - tendency_of_atmosphere_mass_content_of_dust_dry_aerosol_particles_due_to_dry_deposition
    - dimensions: [time, size, latitude, longitude]
    - units: kg m-2 s-1
- **wdep**: Dust wet deposition flux (size-resolved)
    - tendency_of_atmosphere_mass_content_of_dust_dry_aerosol_particles_due_to_wet_deposition
    - dimensions: [time, size, latitude, longitude]
    - units: kg m-2 s-1
- **rfts**: Dust Direct Radiative Forcing (TOA, SW)
    - toa_net_downward_shortwave_radiative_forcing_due_to_dust_dry_aerosol_particles
    - dimensions: [time, latitude, longitude]
    - units: W m-2
- **rftl**: Dust Direct Radiative Forcing (TOA, LW)
    - toa_net_downward_longwave_radiative_forcing_due_to_dust_dry_aerosol_particles
    - dimensions: [time, latitude, longitude]
    - units: W m-2
- **rfss**: Dust Direct Radiative Forcing (surface, SW)
    - surface_net_downward_shortwave_radiative_forcing_due_to_dust_dry_aerosol_particles
    - dimensions: [time, latitude, longitude]
    - units: W m-2
- **rfsl**: Dust Direct Radiative Forcing (surface, LW)
    - surface_net_downward_longwave_radiative_forcing_due_to_dust_dry_aerosol_particles
    - dimensions: [time, latitude, longitude]
    - units: W m-2

3D dust field

- **conc**: Dust concentration (size resolved)
    - mass_concentration_of_dust_dry_aerosol_particles_in_air
    - dimensions: [time, size, lev, latitude, longitude]
    - units: kg m-3

The `PMIP4_DUST_Albani_conc_<exp>.nc` files also store the ancillary variables necessary to fully describe the vertical coordinate

- **ilev**: hybrid level at interfaces (1000*(A+B))
  - atmosphere_hybrid_sigma_pressure_coordinate
  - dimensions: [ilev]
  - units: 1
  - p(n,k,j,i) = a(k)*p0 + b(k)*ps(n,j,i)
  - a: hyai b: hybi p0: P0 ps: PS
- **PS**: Surface pressure
  - surface_air_pressure
  - dimensions: [time, latitude, longitude]
  - units: Pa
- **hyam**
  - hybrid A coefficient at layer midpoints
- **hybm**
  - hybrid B coefficient at layer midpoints
- **hyai**
  - hybrid A coefficient at layer interfaces
- **hybi**
  - hybrid B coefficient at layer interfaces

References

Please cite **at least one** of the following papers

- Albani, S., Mahowald, N. M., Perry, A. T., Scanza, R. A., Zender, C. S., Heavens, N. G., Maggi, V., Kok, J. F., and Otto-Bliesner, B. L.: **Improved dust representation in the Community Atmosphere Model**, J. Adv. Model. Earth Syst., 6, 541–570, doi:10.1002/2013MS000279, 2014.
  - Note: this paper describes the LGM simulation

- Albani, S., Mahowald, N. M., Winckler, G., Anderson, R. F., Bradtmiller, L. I., Delmonte, B., François, R., Goman, M., Heavens, N. G., Hesse, P. P., Hovan, S. A., Kang, S., Kohfeld, K. E., Lu, H., Maggi, V., Mason, J. A., Mayewski, P. A., McGee, D., Miao, X., Otto-Bliesner, B. L., Perry, A. T., Pourmand, A., Roberts, H. M., Rosenbloom, N., Stevens, T., and Sun, J.: **Twelve thousand years of dust: the Holocene global dust cycle constrained by natural archives**, Clim. Past, 11, 869-903, doi:10.5194/cp-11-869-2015, 2015.
  - Note: this paper describes the mid-Holocene simulation

- Albani, S., Mahowald, N. M., Murphy, L. N., Raiswell, R., Moore, J. K., Anderson, R. F., McGee, D., Bradtmiller, L., Delmonte, B., Hesse, P. P., and Mayewski, P. A.: **Paleodust variability since the Last Glacial Maximum and implications for iron inputs to the ocean**, Geophys. Res. Lett., 43, doi:10.1002/2016GL067911, 2016.
  - Note: this paper describes the pre-Industrial simulation and compares it to the mid-Holocene and LGM simulations in previous papers

Download

You will find below a table with all the available data files, and their *md5sum* checksum (if you want to check that you download was OK, you can just type `md5sum file.nc` and compare the result to what is displayed in the table).

If you want to download a file, click on the PMIP4 CESM dust data download link and then on the file you need.

md5sum output	Data file
8859ab3b77ce01008785b05fec5cc459	PMIP4_DUST_Albani_aot_LGM.nc
a99c8627d21cdc67ab989437b0808e00	PMIP4_DUST_Albani_aot_MH.nc
118d105d29a7da31e5a443fba87c4e96	PMIP4_DUST_Albani_aot_PI.nc
5fa086e300324080614db8175b223220	PMIP4_DUST_Albani_conc_LGM.nc
e7c929737c681bde8cde11198578af9e	PMIP4_DUST_Albani_conc_MH.nc
bf0baa1a003a2d85d306d62e2b5f20f9	PMIP4_DUST_Albani_conc_PI.nc
3727a77888c8809a0f87c8e51e37668b	PMIP4_DUST_Albani_ddep_LGM.nc
568f5f2ecc516a618b27aebbf6ac8475	PMIP4_DUST_Albani_ddep_MH.nc
01db9ba162a3ec1f8bd0d0bc2abcc63a	PMIP4_DUST_Albani_ddep_PI.nc
d29ad13c7508a0389ef0740c83069d1a	PMIP4_DUST_Albani_emis_LGM.nc
7ecaf8a616bd31ccb600c8162ad8f815	PMIP4_DUST_Albani_emis_MH.nc
5eff212c3cfc96bacc119eedfe0ee91e	PMIP4_DUST_Albani_emis_PI.nc
e14a6ffba0b74a9211ad67e9642b5987	PMIP4_DUST_Albani_erod_LGM.nc
5d6f767abbca1e560a5fc326e828aee1	PMIP4_DUST_Albani_erod_MH.nc
24e8470134020cecdc552afd2dddf425	PMIP4_DUST_Albani_erod_PI.nc
1cf6720ad615ad97b50842298fd02f51	PMIP4_DUST_Albani_gw.nc
6c7f9d1a84c36540b42ea6bb1eeadf59	PMIP4_DUST_Albani_load_LGM.nc
76079e93089a87e3fd128b9895db3297	PMIP4_DUST_Albani_load_MH.nc
2e121549b158cf9dad1761ea681ca835	PMIP4_DUST_Albani_load_PI.nc
e47e21fa07df86629e1de6b38459eae0	PMIP4_DUST_Albani_rfsl_LGM.nc
46a397182b1c0324173a0bd84b8bf9b9	PMIP4_DUST_Albani_rfsl_MH.nc
f9bb094451dd31a8b6d92ba320944307	PMIP4_DUST_Albani_rfsl_PI.nc
1359e872a421df6970da5e3e50f453cd	PMIP4_DUST_Albani_rfss_LGM.nc
cfb9261506308e84d90d1041a8cafb19	PMIP4_DUST_Albani_rfss_MH.nc
6b3e529f314775270fd87007c45d4e1b	PMIP4_DUST_Albani_rfss_PI.nc
a43755b757169c516d2aad9cdffa1456	PMIP4_DUST_Albani_rftl_LGM.nc
fb7474a2c61668f9f2b5d88199fdf03b	PMIP4_DUST_Albani_rftl_MH.nc
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f83c22185608042a92107609f59ef658	PMIP4_DUST_Albani_wdep_MH.nc
1dc20b285c666765cf9ea61e53a20549	PMIP4_DUST_Albani_wdep_PI.nc