**README document for datasets**

The following are the files used for the manuscript "Contribution of biomass burning to black carbon deposition on Andean glaciers: Consequences for radiative forcing." The types of data include modeling estimates, observations from glacial samples, observations from AERONET sites, and model codes. Units for variables in the spreadsheets are included in the documents.

Please contact the senior author of this paper, Loretta J. Mickley (mickley@fas.harvard.edu), if you plan to use these data.

Important: All papers making use of these data should reference Bonilla et al. (2023):

Bonilla, E.X., L. J. Mickley, E. G. Beaudon, L. G. Thompson, W. E. Rodriguez, R. Cruz Encarnación, C. A. Whicker, M. G. Flanner, C. G. Schmitt, and P. Ginot (2023), Contribution of biomass burning to black carbon deposition on Andean glaciers: Consequences for radiative forcing, *Environmental Research Letters*, in press.

**Modeling data**

*BC_GEOS_Chem_data_caw_apr25.xlsx*
Excel sheet containing radiative forcing estimates from SNICAR-Adv3 with GEOS-Chem estimates of black carbon in snow on Andean glaciers.

*BC_GEOS_Chem_data_file_albedo_RF.xlsx*
Excel sheet containing radiative forcing and albedo estimates from SNICAR-Adv3 with GEOS-Chem estimates of black carbon in snow on Andean glaciers.

*DryDep_BCDST_2014mgm2d_noGFED.nc4* to
*DryDep_BCDST_2019mgm2d_noGFED.nc4*
Dry deposition estimates for dust and black carbon from GEOS-Chem from 2014 to 2019 in units of mg $m^{-2}$ $day^{-1}$ without biomass burning emissions from GFED4s.

*DryDep_BCDST_2014mgm2m_noGFED.nc4* to
*DryDep_BCDST_2019mgm2m_noGFED.nc4*
Dry deposition estimates for dust and black carbon from GEOS-Chem from 2014 to 2019 in units of mg $m^{-2}$ $month^{-1}$ without biomass burning emissions from GFED4s.

*DryDep_BCDST_2014mgm2y_noGFED.nc4* to
*DryDep_BCDST_2019mgm2y_noGFED.nc4*
Dry deposition estimates for dust and black carbon from GEOS-Chem from 2014 to 2019 in units of mg $m^{-2}$ $year^{-1}$ without biomass burning emissions from GFED4s.

*DryDep_BCDST_2014mgm2d.nc4* to
*DryDep_BCDST_2019mgm2d.nc4*
Dry deposition estimates for dust and black carbon from GEOS-Chem from 2014 to 2019 in units of mg $m^{-2}$ $day^{-1}$ with biomass burning emissions from GFED4s.

*DryDep_BCDST_2014mgm2m.nc4* to
*DryDep_BCDST_2019mgm2m.nc4*
Dry deposition estimates for dust and black carbon from GEOS-Chem from 2014 to 2019 in units of mg $m^{-2}$ $month^{-1}$ with biomass burning emissions from GFED4s.

*DryDep_BCDST_2014mgm2y.nc4* to
*DryDep_BCDST_2019mgm2y.nc4*
Dry deposition estimates for dust and black carbon from GEOS-Chem from 2014 to 2019 in units of mg $m^{-2}$ $year^{-1}$ with biomass burning emissions from GFED4s.

*GEOSChem.AerosolMass_BC.2014.nc4* to
*GEOSChem.AerosolMass_BC.2019.nc4*
Atmospheric aerosol mass estimates for black carbon from GEOS-Chem for 2014 to 2019 with biomass burning emissions from GFED4s in units of μgC $m^{-3}$.

*GEOSChem.AerosolMass_BC.2014_noGFED.nc4* to
*GEOSChem.AerosolMass_BC.2019_noGFED.nc4*
Atmospheric aerosol mass estimates for black carbon from GEOS-Chem for 2014 to 2019 without biomass burning emissions from GFED4s in units of μgC $m^{-3}$.

*GEOSChem.Aerosols_Col.2014.nc4* to
*GEOSChem.Aerosols_Col.2019.nc4*
Aerosol optical depth estimates from GEOS-Chem for each column for 2014 to 2019 with biomass burning emissions from GFED4s (unitless).

*GEOSChem.StateMet.2014_prec_height.nc4* to
*GEOSChem.StateMet.2019_prec_height.nc4*
Meteorological data from MERRA-2 used in GEOS-Chem. The files contain precipitation (in mm $d^{-1}$) and/or elevation (in meters) data for 2014 to 2019.

*WetLossConv_BCDST_2014mgm2d.nc4* to
*WetLossConv_BCDST_2019mgm2d.nc4*
Dust and black carbon wet deposition from wet scavenging in convective updrafts in units of mg $m^{-2}$ $day^{-1}$ with biomass burning emissions from GFED4s from 2014 to 2019.

*WetLossConv_BCDST_2014mgm2d_noGFED.nc4* to
*WetLossConv_BCDST_2019mgm2d_noGFED.nc4*
Dust and black carbon wet deposition from wet scavenging in convective updrafts in units of mg $m^{-2}$ $day^{-1}$ without biomass burning emissions from GFED4s from 2014 to 2019.

*WetLossConv_BCDST_2014mgm2m.nc4* to
*WetLossConv_BCDST_2019mgm2m.nc4*
Dust and black carbon wet deposition from wet scavenging in convective updrafts in units of mg $m^{-2}$ $month^{-1}$ with biomass burning emissions from GFED4s from 2014 to 2019.

*WetLossConv_BCDST_2014mgm2m_noGFED.nc4* to
*WetLossConv_BCDST_2019mgm2m_noGFED.nc4*
Dust and black carbon wet deposition from wet scavenging in convective updrafts in units of mg $m^{-2}$ $month^{-1}$ without biomass burning emissions from GFED4s from 2014 to 2019.

*WetLossConv_BCDST_2014mgm2y.nc4* to
*WetLossConv_BCDST_2019mgm2y.nc4*
Dust and black carbon wet deposition from wet scavenging in convective updrafts in units of mg $m^{-2}$ $year^{-1}$ with biomass burning emissions from GFED4s from 2014 to 2019.

*WetLossConv_BCDST_2014mgm2y_noGFED.nc4* to
*WetLossConv_BCDST_2019mgm2y_noGFED.nc4*
Dust and black carbon wet deposition from wet scavenging in convective updrafts in units of mg $m^{-2}$ $year^{-1}$ without biomass burning emissions from GFED4s from 2014 to 2019.

*WetLossLS_BCDST_2014mgm2d.nc4* to
*WetLossLS_BCDST_2019mgm2d.nc4*
Dust and black carbon from rainout and washout in large-scale wet deposition in units of mg $m^{-2}$ $day^{-1}$ with biomass burning emissions from GFED4s from 2014 to 2019.

*WetLossLS_BCDST_2014mgm2d_noGFED.nc4* to
*WetLossLS_BCDST_2019mgm2d_noGFED.nc4*
Dust and black carbon from rainout and washout in large-scale wet deposition in units of mg $m^{-2}$ $day^{-1}$ without biomass burning emissions from GFED4s from 2014 to 2019.

*WetLossLS_BCDST_2014mgm2m.nc4* to
*WetLossLS_BCDST_2019mgm2m.nc4*
Dust and black carbon from rainout and washout in large-scale wet deposition in units of mg $m^{-2}$ $month^{-1}$ with biomass burning inventory GFED4s from 2014 to 2019.

*WetLossLS_BCDST_2014mgm2m_noGFED.nc4* to
*WetLossLS_BCDST_2019mgm2m_noGFED.nc4*
Dust and black carbon from rainout and washout in large-scale wet deposition in units of mg $m^{-2}$ $month^{-1}$ without biomass burning inventory GFED4s from 2014 to 2019.

*WetLossLS_BCDST_2014mgm2y.nc4* to
*WetLossLS_BCDST_2019mgm2y.nc4*
Dust and black carbon from rainout and washout in large-scale wet deposition in units of mg $m^{-2}$ $year^{-1}$ with biomass burning emissions from GFED4s from 2014 to 2019.

*WetLossLS_BCDST_2014mgm2y_noGFED.nc4* to
*WetLossLS_BCDST_2019mgm2y_noGFED.nc4*
Dust and black carbon from rainout and washout in large-scale wet deposition in units of mg $m^{-2}$ $year^{-1}$ without biomass burning emissions from GFED4s from 2014 to 2019.

**Observations**

*AERONET_South America.csv*
Aerosol optical depths v2, level 3 data from AERONET for South America (unitless)

*amazon_fires_2000_2019.csv*
Fires locations from INPE online data for 2000 to 2019 as detected by MODIS.

*ARTESONRAJU 2016-2020.xlsx*
Climate data for Artesonraju glacial site in Peru including temperature (°C), precipitation(mm), wind speed (km $hr^{-1}$), max wind speed (km $hr^{-1}$), and location.

*ARUNTANI 2015-2020.xlsx*
Climate data for Aruntani glacial site in Peru including temperature (°C), average humidity (%), precipitation(mm), wind speed (m $s^{-1}$), wind direction (°), and location.

*BC_snow_peru.xlsx*
Black carbon observations from Andean glaciers in Peru. These include monthly observations from Yanapaccha and Shallap as well as ice core observations from Huascaran and snow pit observations from Quelccaya.

*daily_AERONET_means.csv*
Daily averages of aerosol optical depth in South American AERONET sites.

*glacier_inventory_region_extract.csv*
Locations of glaciers from the World Glacier Inventory.

*Illimani99_harvard.xlsx*
Black carbon concentrations from the Illimani ice core.

*monthly_AERONET_means.csv*
Monthly averages of aerosol optical depth in South American AERONET sites.

*weekly_AERONET_means.csv*
Weekly averages of aerosol optical depth in South American AERONET sites.

**Model codes**

*AndesBCenv.yml*
Python environment used in both jupyter notebook codes for this project.

*BC_andes_2014_2019.ipynb*
Main code for black carbon deposition on Andean glaciers. The file format is a jupyter notebook.

*BC_Andes_AOD.ipynb*
Code used to compare AOD from observations of AERONET locations in South America versus estimates from GOES-Chem. The file format is a jupyter notebook.