

Title: Supporting scanning transmission electron microscopy (STEM) data for manuscript titled "Observations of Ice Nucleating Particles in the Free Troposphere from Western U.S. Wildfires"

Abstract: Images, elemental maps, and energy dispersive x-ray spectra, sizing data and categorizations made on the basis of these data are assembled in this archive, which is associated with the above-noted publication. Data describe atmospheric particles collected within or around wildfire plumes from the NSF/NCAR C-130 aircraft during Western Wildfire Experiment for Cloud Chemistry, Aerosol Absorption, and Nitrogen (WE-CAN), under support of the National Science Foundation Atmospheric and Geospace Sciences award number 1650786. Based from Boise, ID, maps of the WE-CAN research flights will be published in the submitted publication reference listed at the end of this file. Particle collections were made onto 3-mm diameter transmission electron microscope supports (200 mesh) made of Cu or Ni, and coated with C-formvar films. Collections, as fully described in the publication, represent total particles in a size class from 0.13 to 0.55 microns (using an impactor system) from two different wildfire plume (so-called Sugarloaf fire, research flight 15) during two different plume penetrations (RF15A and RF15C), and ice nucleating particles (INPs) collected/integrated over a number of plume passes. The INPs were collected as activated ice crystals within the Colorado State University (CSU) continuous flow diffusion chamber (CFDC), simulating freezing under supercooled clouds conditions (cf., publication for details). Drs. Cynthia Twohy (NWRA) and Darin Toohey (University of Colorado) oversaw ambient particle collections. Dr. Paul DeMott, Dr. Ezra Levin, and Mr. Kevin Barry oversaw INP collections. Ambient plume particles and INPs processed in the CFDC were both collected from a solid diffuser inlet system on the NSF/NCAR C-130, and represent wildfire particles at ages of 1-2.5 hours aging. INPs were limited in size entering the CFDC at 2.5 microns, although the majority of these were in the same size range as the total particles. STEM data were collected at the Colorado State University Analytical Resources Core – Imaging and Surface Science facility. Dr. Roy Geiss (CSU Chemistry) conducted STEM analyses.

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*Additional data presented in the same paper are available for this study at:
https://data.eol.ucar.edu/master_lists/generated/we-can/

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Those interested in using these data are encouraged to contact Dr. Paul DeMott (Paul.Demott@colostate.edu) for more information.

Recommended data citation: Barry, K. R., Hill, T. C. J., Levin, E. J. T., Twohy, C. H., Moore, K. A., Weller, Z. D., Toohey, D. W., Reeves, M., Campos, T., Geiss, R., Fischer, E. V., Kreidenweis, S. M., & DeMott, P. J. (2020). Supporting scanning transmission electron microscopy (STEM) data for manuscript titled "Observations of Ice Nucleating Particles in the Free Troposphere from Western U.S. Wildfires." Colorado State University. Libraries. <http://dx.doi.org/10.25675/10217/211646>

Format of data files: Three spreadsheets (*.xls) are included, each including all data associated with single TEM grid collections and analyses; one for ice nucleating particles and two for different atmospheric aerosol samples. PDFs are included of each entire spreadsheet. Text information in these spreadsheets are included as *.csv files, and these include processing dates, particle size analyses, categorizations and references to the names of all image files. Image files of all particles on a site by site basis, elemental maps, and x-ray spectra are provided as JPEG *.jpg files. Metadata files are provided in *.txt format for sets of particle images, elemental map images, and spectral images.

Location where data were collected: Samples were collected onboard the NSF/NCAR C-130 aircraft during Western Wildfire Experiment for Cloud Chemistry, Aerosol Absorption, and Nitrogen (WE-CAN). Based from Boise, ID, maps of the research flights will be published in the submitted publication listed at the end of this file. STEM data were collected at the Colorado State University Analytical Resources Core – Imaging and Surface Science facility. Some raw image file data are retained in non-permanent archives there.

Time period during which data were collected: Physical samples (TEM grids) were collected on August 26, 2018, referred to as research flight 15 (RF15). STEM analyses were conducted on various dates between March 2019 and April 2020. The archive includes 363 total files, organized as different image file types and summary archive file listings (.csv), PDF, and native spreadsheet (.xlsx). Type examples are listed below each folder.

WECAN_TEM_RF15A-2_particles_element_strips/:
WECAN_RF15A-2(08262018)_Particle_rnd1_site1_element.jpg ...

WECAN_TEM_RF15A-2_particles_Spectra/:
WECAN_RF15A-2(08262018)_Particle_rnd1_site1_spectra.jpg ...

WECAN_TEM_RF15A-2_particles_Images/:
WECAN_RF15A-2(08262018)_Particle_rnd1_site1_image.jpg ...

WECAN_TEM_RF15A-2_particles_archive.xls
WECAN_TEM_RF15A-2_particles_archive.pdf
WECAN_TEM_RF15A-2_particles_archive.csv

WECAN_TEM_RF15C-2_particles_element_strips/:
WECAN_RF15C-2(08262018)_Particle_rnd1_site1_element.jpg ...

WECAN_TEM_RF15C-2_particles_Spectra/:
WECAN_RF15C-2(08262018)_Particle_rnd1_site1_spectra.jpg ...

WECAN_TEM_RF15C-2_particles_Images/:
WECAN_RF15C-2(08262018)_Particle_rnd1_site1_image.jpg ...

WECAN_TEM_RF15C-2_particles_archive.xls
WECAN_TEM_RF15C-2_particles_archive.pdf
WECAN_TEM_RF15C-2_particles_archive.csv

WECAN_TEM_RF15INPs_element_strips/:
WECAN_RF15(08262018)_INPs_rnd1_site2_element.jpg ...

WECAN_TEM_RF15INPs_Spectra/:
WECAN_RF15(08262018)_INP_rnd1_site2_spectra.jpg ...

WECAN_TEM_RF15INPs_Images/:
WECAN_RF15 (08262018)_INP_rnd1_site1_image.jpg ...

WECAN_TEM_RF15INPs_archive.xls
WECAN_TEM_RF15INPs_archive.pdf
WECAN_TEM_RF15INPs_archive.csv

Definitions of acronyms, site abbreviations, or other project-specific designations used in the data file names or documentation files:

WECAN: Western Wildfire Experiment for Cloud Chemistry, Aerosol Absorption, and Nitrogen

INPs: Ice nucleating particles

CFDC: Continuous Flow Diffusion Chamber

CSU: Colorado State University

STEM: Scanning Transmission Electron Microscopy

NSF: National Science Foundation

NCAR: National Center for Atmospheric Research

NWRA: NorthWest Research Associates

Variable information: Variable information for each data file is described in the corresponding metadata file.

Uncertainty, precision and accuracy of measurements: These are not definable for the present data. The particle type (4 types) categorization scheme is explained in the manuscript, using the data herein and sometimes additional spectra focused in on specific elements such as N.

Environmental or experimental conditions: STEM grids were collected under conditions listed in the metadata files that go with each folder in the Zipped archive.

Method(s): Data provided were analyzed as described in the publication.

Standards or calibrations that were used: The standards, calibrations and blanks are all described in the publication.

Software: Any image file read/display software can open the image files. A text editor can read all csv files, or the Excel program can open these. Excel must be used with the .xls files, but these files are printed also in PDF format.

Quality assurance and quality control that have been applied: All data have been quality controlled, details are reported in the publication.

Related Files: This dataset is used in the paper: Kevin R. Barry, Thomas C. J. Hill, Ezra J. T. Levin, Cynthia H. Twohy, Kathryn A. Moore, Zachary D. Weller, Darin W. Toohey, Mike Reeves, Teresa Campos, Roy Geiss, Emily V. Fischer, Sonia M. Kreidenweis, and Paul J. DeMott (2020), Observations of Ice Nucleating Particles in the Free Troposphere from Western U.S. Wildfires, *J. Geophys. Res. – Atmos.*, 126, e2020JD033752.
<https://doi.org/10.1029/2020JD033752>