Supporting Information for Occurrence, abundance, and formation of atmospheric tarballs from a wide range of wildfires in the western US

Kouji Adachi[1], Jack E. Dibb[2], Joseph M. Katich[3,4#], Joshua P. Schwarz[3], Hongyu Guo[4,5], Pedro Campuzano-Jost[4,5], Jose L. Jimenez[4,5], Jeff Peischl[3], Christopher D. Holmes[6], James Crawford[7]

[1]Department of Atmosphere, Ocean, and Earth System Modelling Research, Meteorological Research Institute, Tsukuba, Japan
[2]Institute for the Study of Earth, Oceans, and Space, University of New Hampshire, Durham, NH, USA
[3]Chemical Sciences Laboratory, National Oceanic and Atmospheric Administration, Boulder, CO, USA
[4]Cooperative Institute for Research in Environmental Sciences, University of Colorado Boulder, Boulder, CO, USA
[5]Department of Chemistry, University of Colorado Boulder, Boulder, CO, USA
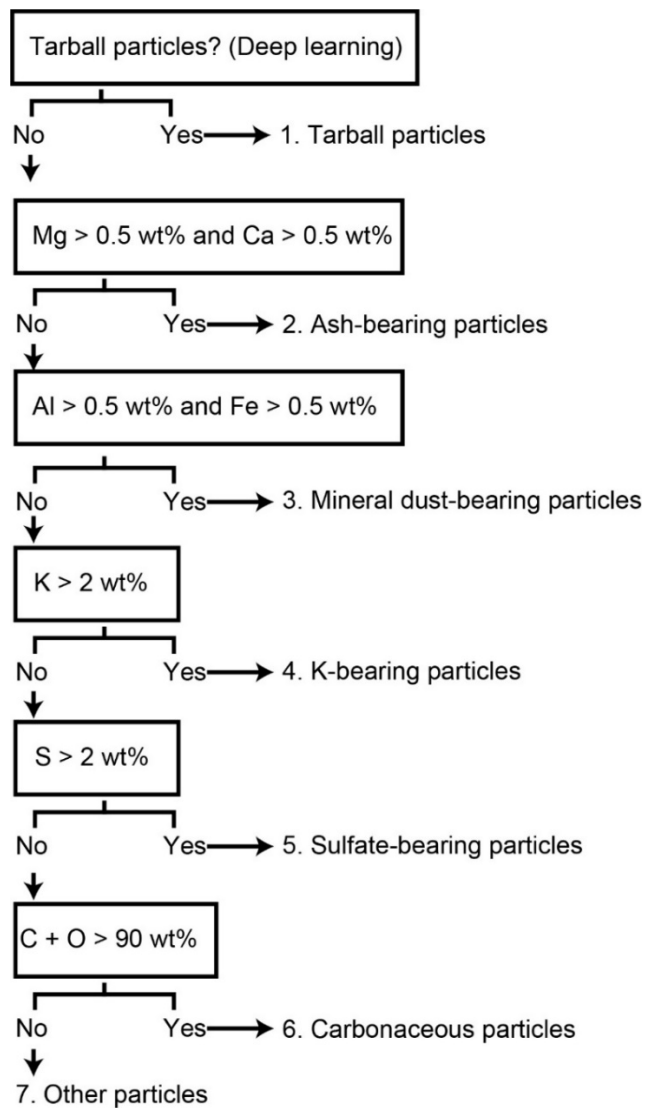[6]Earth, Ocean, and Atmospheric Science, Florida State University, Tallahassee, FL, USA
[7]NASA Langley Research Center, Hampton, VA, USA
[#]now at Ball Aerospace, Boulder, CO, USA

Correspondence to: Kouji Adachi (adachik@mri-jma.go.jp)

Supporting figures 1-3.

Tarball particles? (Deep learning)

No → Yes → 1. Tarball particles

Mg > 0.5 wt% and Ca > 0.5 wt%

No → Yes → 2. Ash-bearing particles

Al > 0.5 wt% and Fe > 0.5 wt%

No → Yes → 3. Mineral dust-bearing particles

K > 2 wt%

No → Yes → 4. K-bearing particles

S > 2 wt%

No → Yes → 5. Sulfate-bearing particles

C + O > 90 wt%

No → Yes → 6. Carbonaceous particles

7. Other particles

Figure S1. The flow chart for classifying individual particles into seven categories based on an image analysis technique (Deep learning) and STEM-EDS measurements.
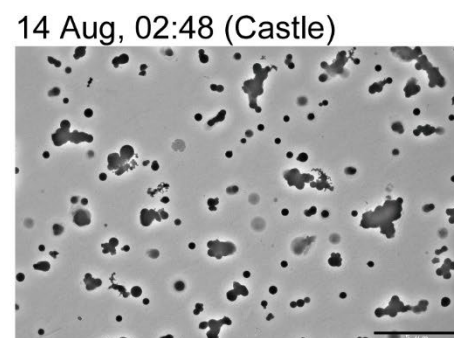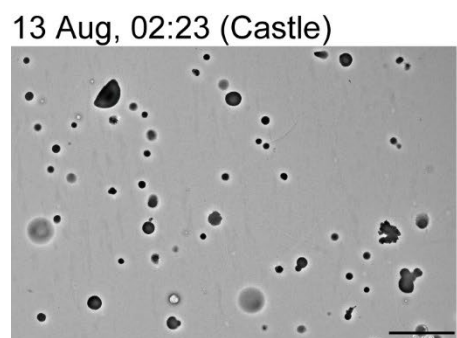
26 July, 01:04 (Shady)

07 Aug, 00:20 (Horsefly)

5µm

08 Aug, 00:43 (Williams Flats)

09 Aug, 00:13 (Williams Flats)

13 Aug, 02:23 (Castle)

14 Aug, 02:48 (Castle)
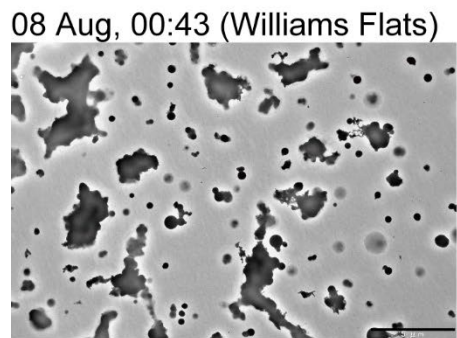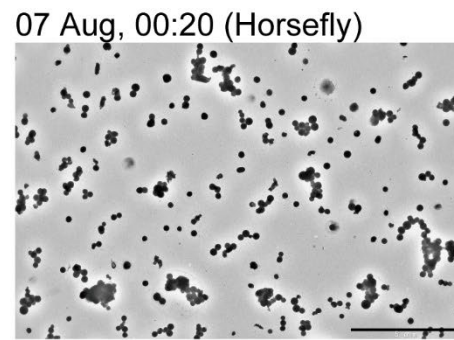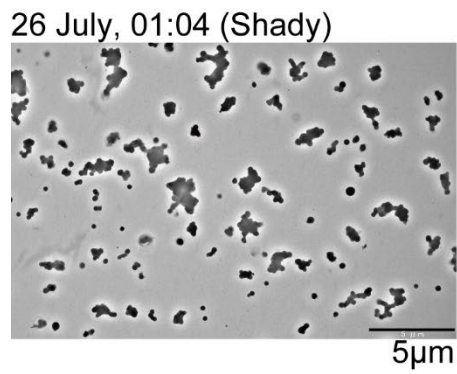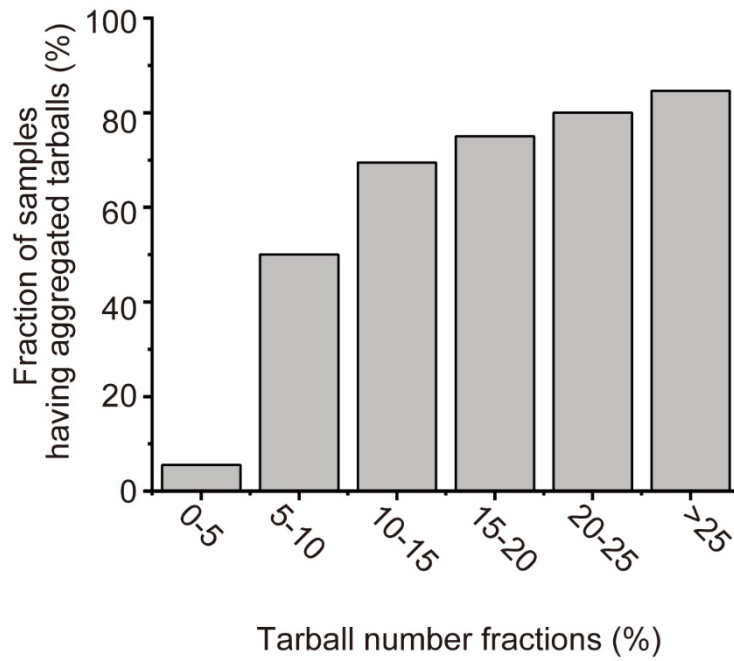
16 Aug, 04:15 (Sheridan)

17 Aug, 04:13 (Sheridan)

25
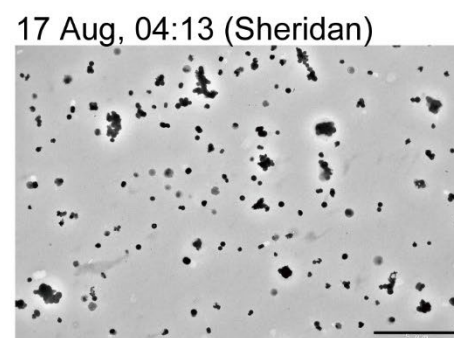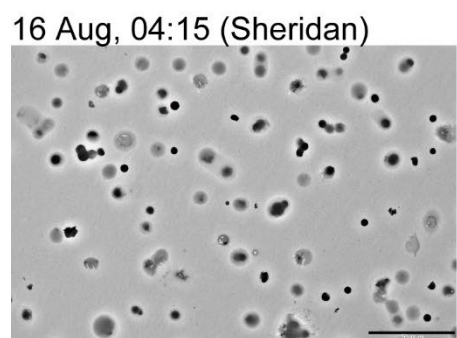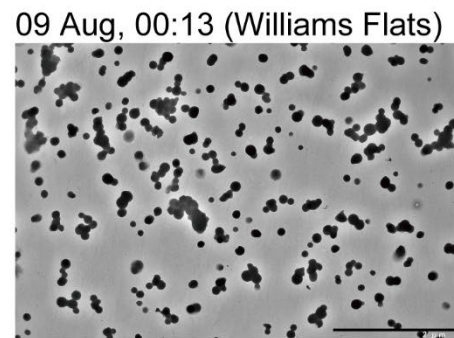
Figure S2. Representative TEM images of samples containing TBs from each wildfire. Scale bars indicate 5 µm. The header of each TEM image shows the sampling date and time (UTC) and the name of the wildfire.

30   **Figure S3. Fractions of samples having aggregated TBs for samples with various TB number fractions. The number of samples containing TBs was 179, while those containing aggregated TBs were 84. n = 54, 50, 36, 16, 10, and 13 for the number of samples with TB fractions of 0%–5%, 5%–10%, 10%–15%, 15%–20%, 20%–25%, and >25%, respectively.**