

Mission Science Report
FIREX-AQ DC8
20190806
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Main Targets:
Williams Flats Fire, WA
Horsefly Fire, MT

The flight plan was motivated by serendipitous satellite passes over Washington state: a ~ 19:10 UTC MISR overpass approximately centered on the Williams Flats fire, followed by a ~21:15 CALIPSO overpass that was expected to provide a lidar retrieval crossing ~16 km downwind of the fire. The Williams Flats fire had burned through the weekend (first sampled on the flight of 20190803), and was producing smoke on the morning of the flight. Models indicated that early smoke would spread to the South, and after the fire heated up and the plume rose up, the smoke would be carried to the East. Additional assets sampling the smoke both remotely and in situ were associated with the ER-2, which arrived in WA shortly before the DC8, as well as a mobile DRAGON sunphotometer/lidar and the MACH2 aerosol mobile lab from LARGE. Spokane experienced degraded air quality during this period, likely due, in part, to wildfire smoke influences.

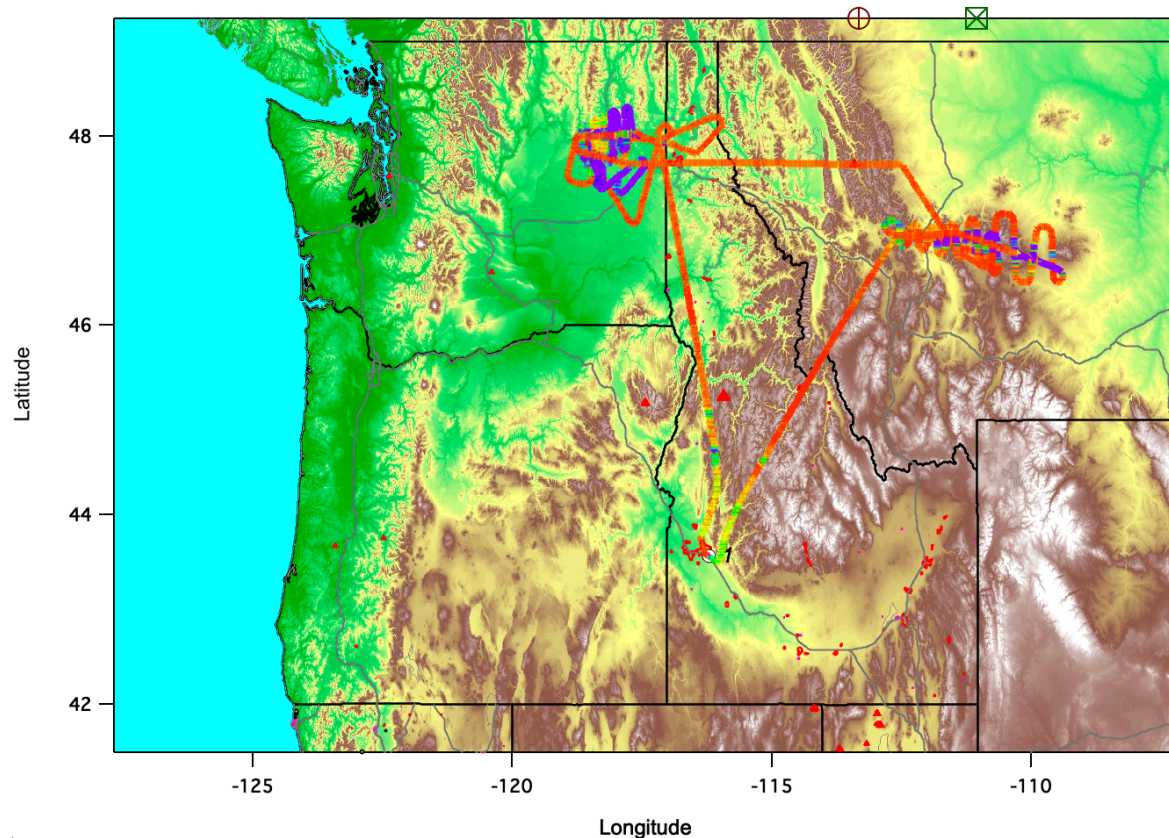
DC8 takeoff was timed to allow sampling in WA to begin shortly before arrival of MISR. During transit we did a leg over the Cascade Reservoir at 17kft for MASTER. Then transited for an initial downwind to upwind remote sensing (RS) leg of the Williams Flats plume. Models were showing some potential for Siberian smoke in the area (although more to the North), so we may have sampled some during the high level legs in this area, or during descent. During this overpass, and from satellite imagery, it was obvious that there were two main hotspots in the fire, a northern one slightly to the West of the southern, smaller hot spot. This separation led to sampling of only the northern plume on the first transect of the smoke during the in situ segment.

Before starting the descent into smoke, the DC8 conducted a remote-sensing survey of the plain to the South and East of the fire to measure low-lying smoke relevant to air quality and the satellite retrievals. The low lying smoke appeared to be most concentrated in the North-East of the triangular area mapped out in this way. The DC8 performed a low-approach at the Spokane airport at a period of impaired air quality and sampled smoke relevant to health impacts and to potential urban/wildfire chemistry. The DC8 then remained at low altitude while attempting to sample in the plain.

This was followed by a climb to redo the remote sensing run over the smoke and then the normal "lawn-mowing" of the plume. Due to altitude restrictions, the first downwind transect was too high to sample the smoke from the Southern/Eastern hotspot; hence the enhancements on this leg were only from the northern/western hotspot. Later transects on this fire reflect both contributions to the smoke. We continued sampling smoke in situ with overpasses of the MACH2/DRAGON. A transect was repeated (approx Longitude: -118.08, 67630 - 77600 s UTC) for test purposes: some aerosol

instruments changed dilutions between the first and second pass at this position in the smoke. After a few more transects, the plane turned upwind in the middle of the plume and ascended to perform another RS run over the plume and fire.

Then we transited to study fires in Montana, on this leg we sampled aged pollution which may or not have been from fires. We flew for a RS overpass of the Snow Creek fire in Montana, a RS overpass over the Horsefly fire in MT, and then in situ sampling of Horsefly began. The Horsefly plume was very complex, with different layers and a lot of structure. There were layers above us during the 25kft RS leg, as well as cirrus above us. Due to more air traffic restrictions, our first three transects down wind of the fire were too high to get us in smoke. "Lawn-mowing" proceeded down wind over more than 200 km. One transect was cut short due to ATC control. Running low on fuel, we did a final RS run over the plume and fire, and returned to Boise.



Map of flight path, colored by black carbon concentration.