

These files present pressure-weighted partial-column means for the variables CO2.X, CH4.X, H2O.X, O2_AO2, and APO_AO2, where “.X” indicates recommended variables in cases where multiple instruments measured the same species. The ORCAS instrumentation is described at <https://www.eol.ucar.edu/content/orcas-aircraft-instruments> and instrument specific readme files are available at the ORCAS data access page http://data.eol.ucar.edu/master_list/?project=ORCAS. CO2.X is a copy of CO2_NOAA for all flights where CO2_NOAA is available, CO2_QCLS on TF01, and CO2_AO2 on FF01 and FF02. CH4.X is a copy of CH4_NOAA for all flights where CH4_NOAA is available, and CH4_QCLS for the first half of TF01. H2O.X is a copy of VMR_VXL for all flights.

There were 215 unique profile maneuvers during ORCAS, but 12 of these did not descend below 5000 m and 54 of these did not climb above 2000 m. These files only include data for the remaining 149 profiles, all of which span from below 500 m to above at least 4000 m. Of these, the median profile bottom is 157 m (983 hPa) and the median profile top is 10096 m (250 hPa).

The partial-column means are calculated for individual profiles from the surface to a specified capping pressure level (180 hPa or 350 hPa), and weights are given for the pressure-weighted data coverage over this interval. Data from the 10-sec merge file are first averaged into 10 hPa wide pressure bins for each profile, then the average of these bins for each profile is the partial-column mean. Weights are calculated for each variable as the fraction of 10 hPa pressure bins with non-missing data between the surface and the capping pressure level, where surface pressure is estimated from the maximum pressure observed at the bottom of each profile extrapolated to the surface using a pressure lapse rate of 12 hPa / 100 m. We suggest the user filter columns for species with weights below a certain cutoff and in the plots below have used 0.6 (60%).

We additionally provide a file of the full profile data as individual pressure binned means for all profiles and pressure levels, as well as a file listing start and end times and altitudes for each profile.

1. File format

The partial-column mean and partial-column weight products are flat ascii tables, space delimited, with variable names in the first row. The full profile file has variable names in both the first column and first row, with each profile for each species in a separate row. Missing values are given as “NA”.

Profile and flight numbers: The merge products include an “n.prof” variable sequentially numbering all 215 vertical profile maneuvers in the campaign. Flight numbers (variable “flt”) of -3, -2, -1, and 0 correspond to TF01, TF02, FF01, and FF02; flight numbers 1-19 correspond to RF01-RF19, and flight number 20 corresponds to FF03.

Date and time variables: DOY (day of year), and UTC (UTC seconds since midnight on the day of takeoff).

2. Profile products

- a. **ORCAS_profile_pw_180hPa_col_mean.tbl:** pressure-weighted partial-column means from the surface to 180 hPa. Columns are:

```
n.prof flt DOY UTC GGLAT GGLON GGALT CO2.X CH4.X H2O.X  
O2_AO2 APO_AO2 p.min p.max p.top
```

where columns from GGLAT to APO_AO2 represent the partial-column means, p.min is the minimum observed pressure of the capped profile (set to be ≥ 180 hPa), p.max is the maximum observed pressure of the profile, and p.top is the minimum observed pressure of the uncapped profile.

- b. **ORCAS_profile_pw_180hPa_col_wt.tbl:** partial-column weights corresponding to the means in (a). Columns are:

```
n.prof GGALT CO2.X CH4.X H2O.X O2_AO2 APO_AO2
```

Because GGALT exists at all times in the 10-sec merge file, this column represents the pressure-weighted fraction of the partial-column sampled by the GV.

- c. **ORCAS_profile_pw_350hPa_col_mean.tbl:** pressure-weighted partial-column means from the surface to 350 hPa. Columns are as in (a), with p.min set to be ≥ 350 hPa.

- d. **ORCAS_profile_pw_350hPa_col_wt.tbl:** partial-column weights corresponding to the means in (c).

- e. **ORCAS_profile_10hPa_intervals.tbl:** the full set of pressure binned profile data for each species, with columns:

```
Param n.prof flt DOY GGLAT GGLON p.min p.max 145.....1015
```

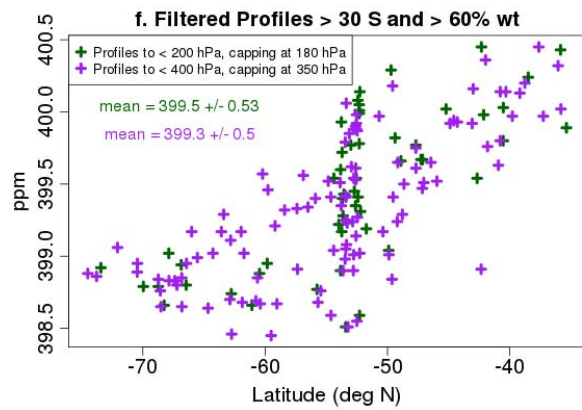
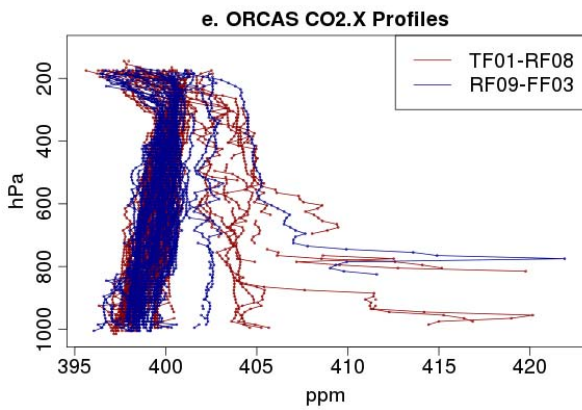
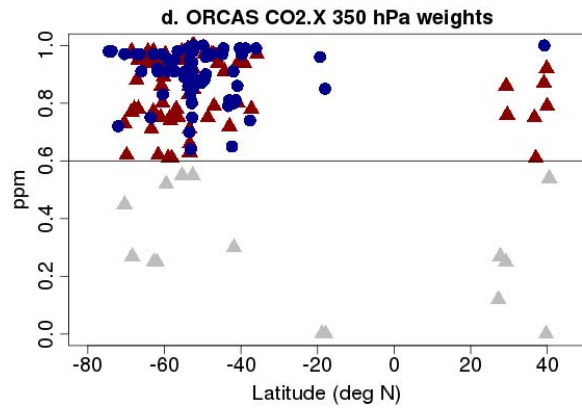
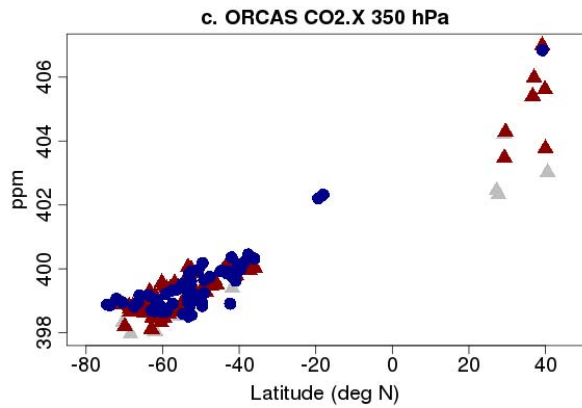
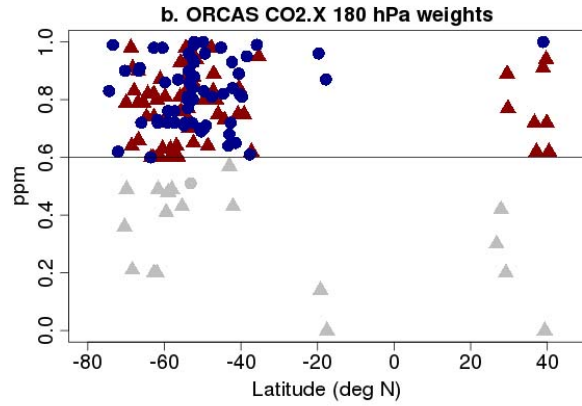
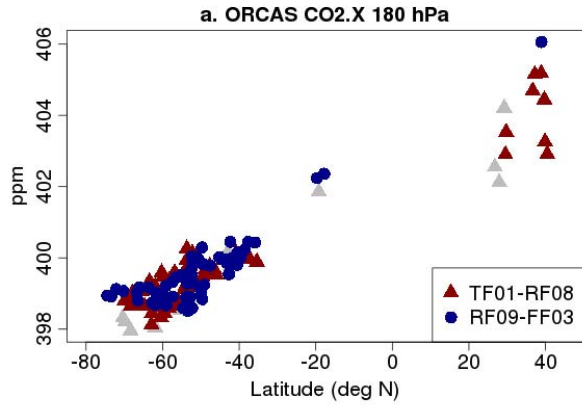
Where each row is a profile for the species listed in the Param column, columns 2-8 describe the profile where p.max is the minimum observed pressure of the uncapped profile, and columns 9-96 list means for 10 hPa wide pressure bins centered on 145 hPa through 1015 hPa.

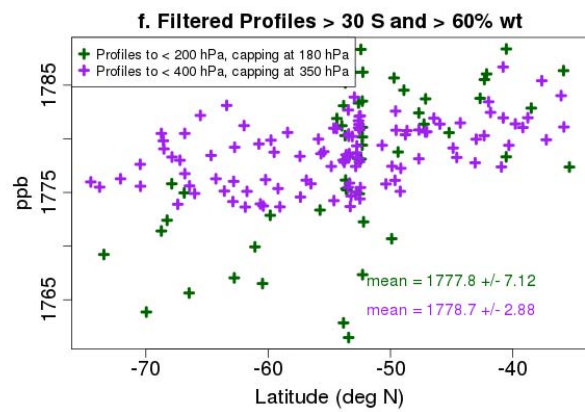
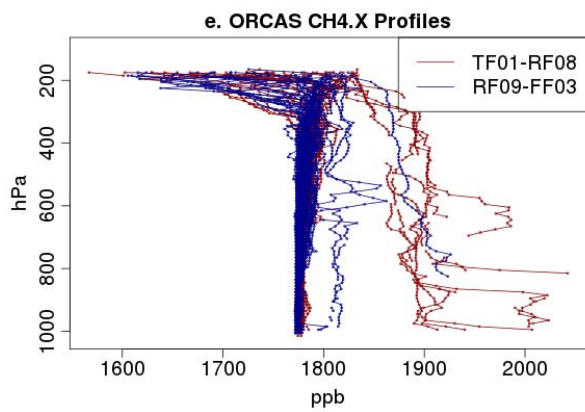
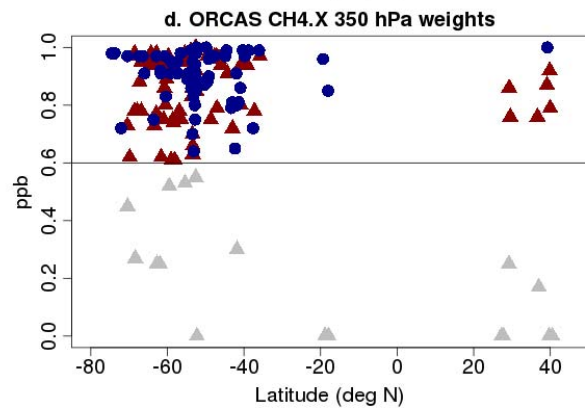
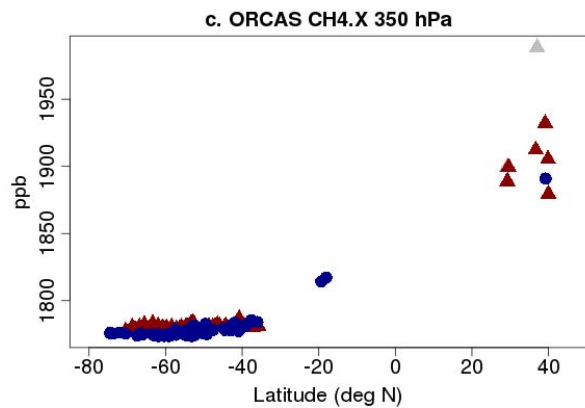
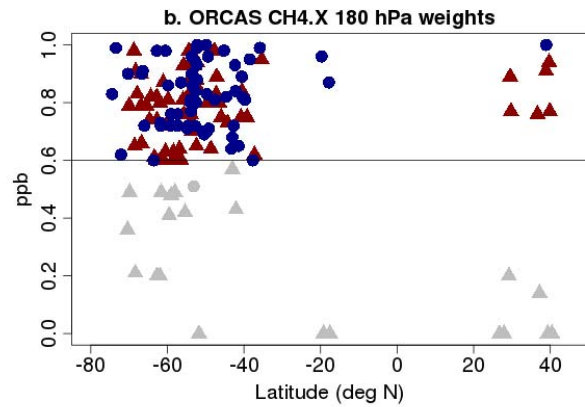
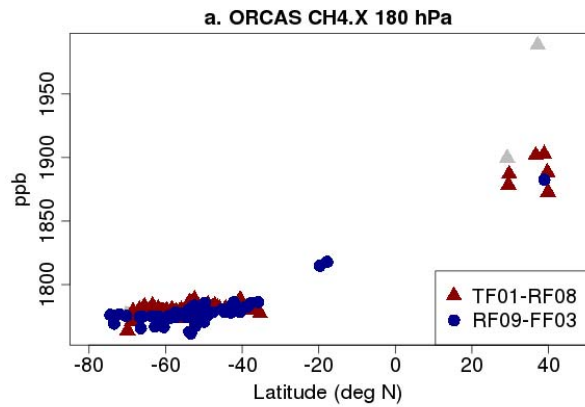
- f. **n.prof.orcas.txt:** details on all 215 ORCAS profiles, with columns:

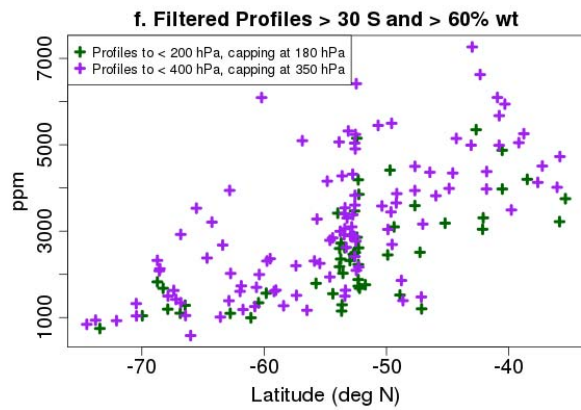
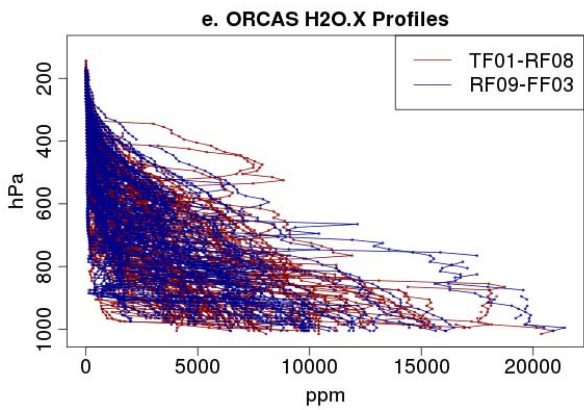
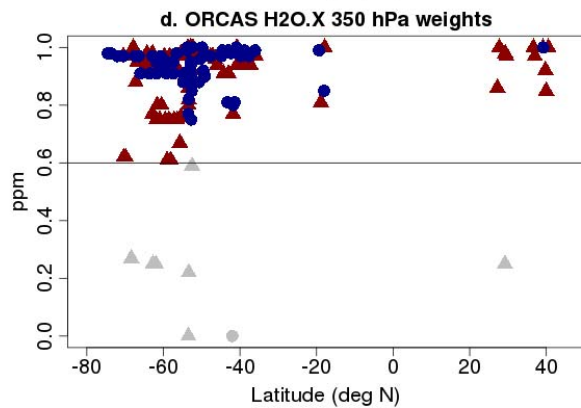
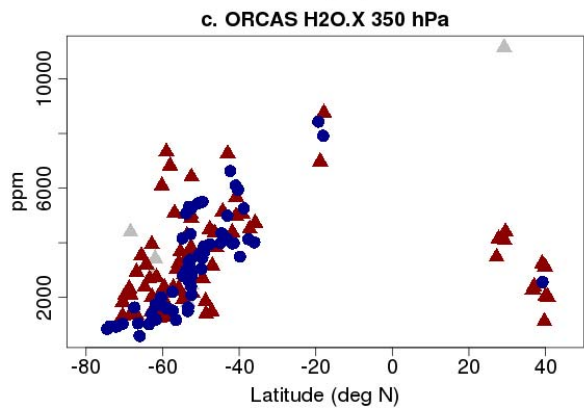
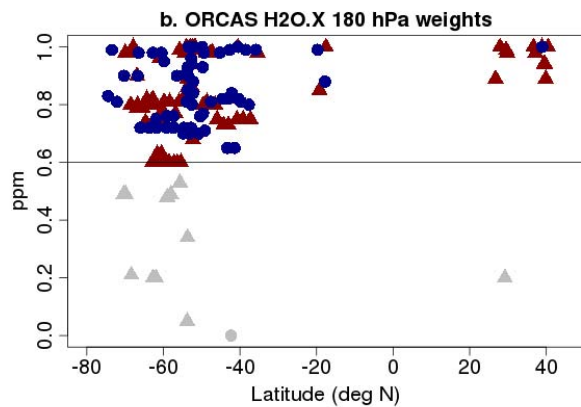
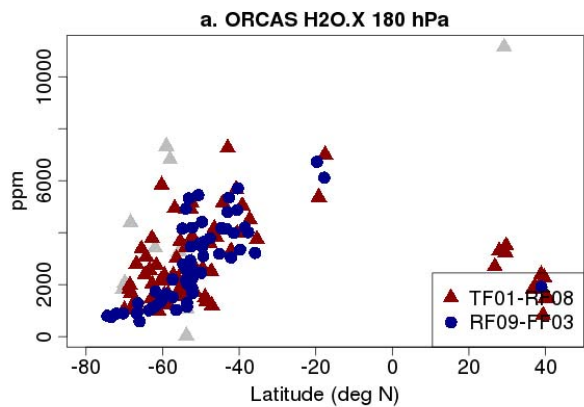
```
n.prof flt UTC.start UTC.end GGALT.start GGALT.end
```

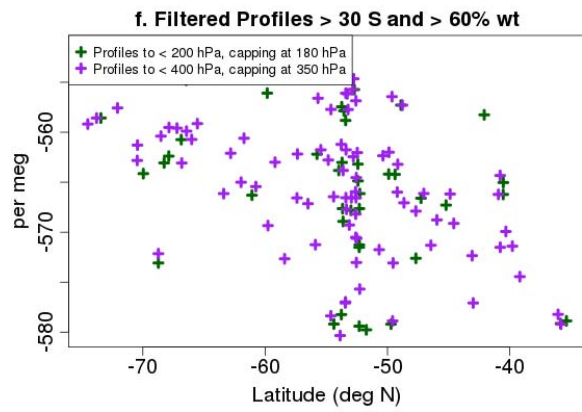
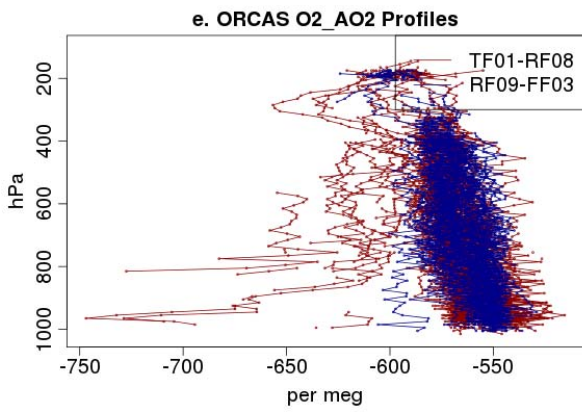
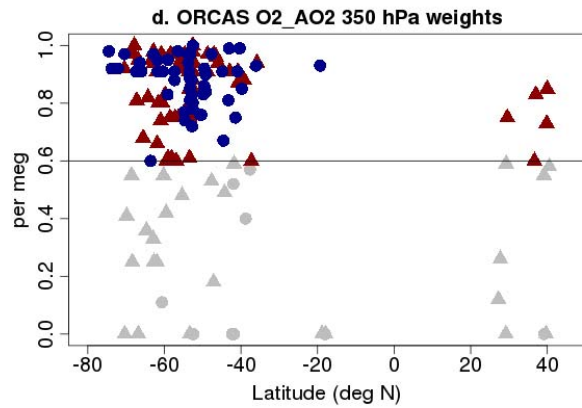
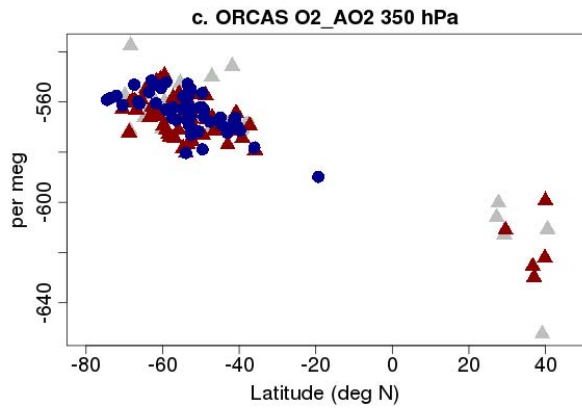
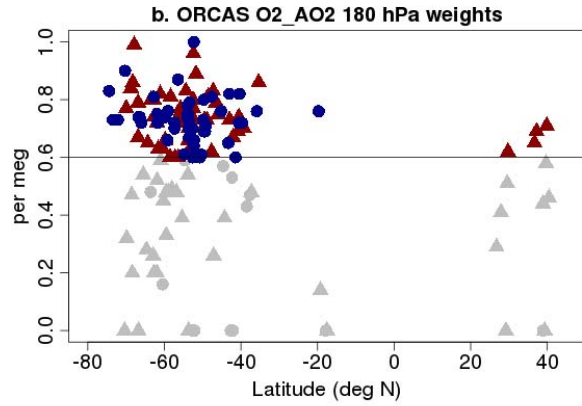
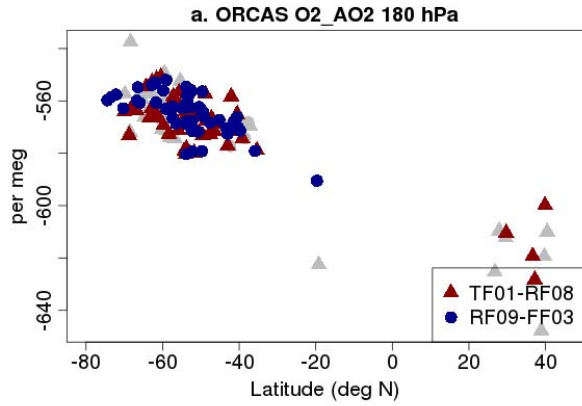
3. Figures

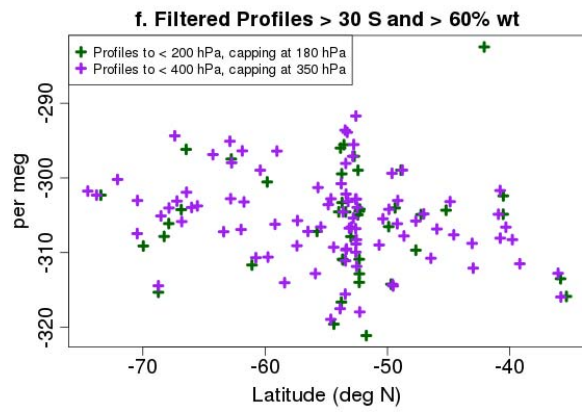
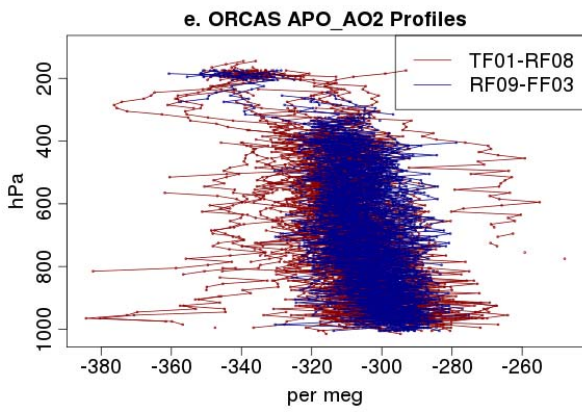
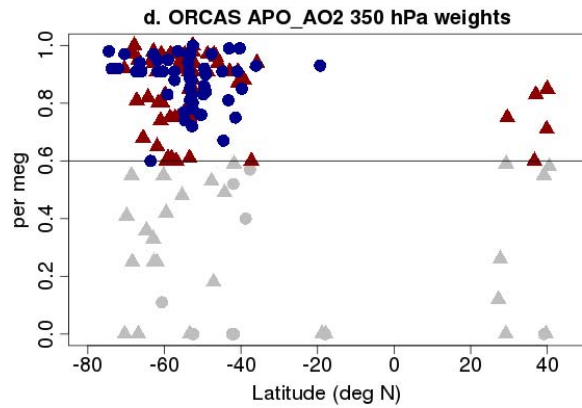
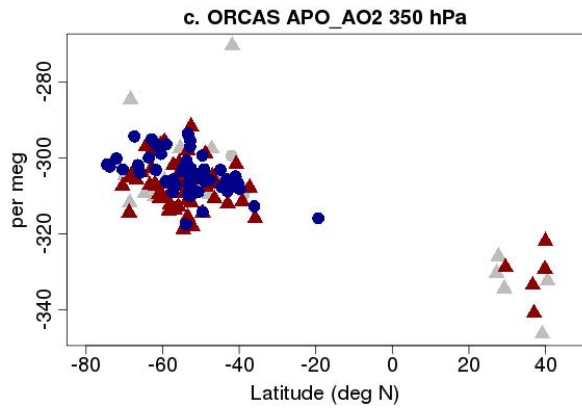
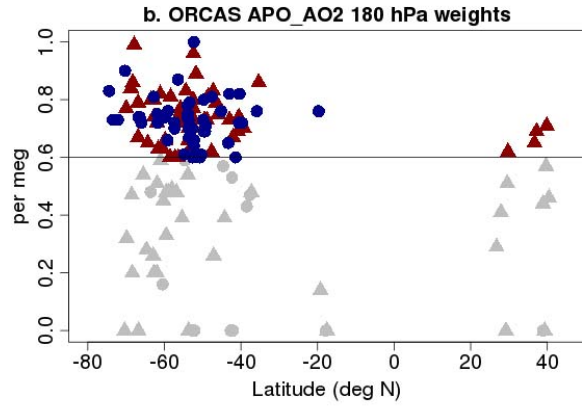
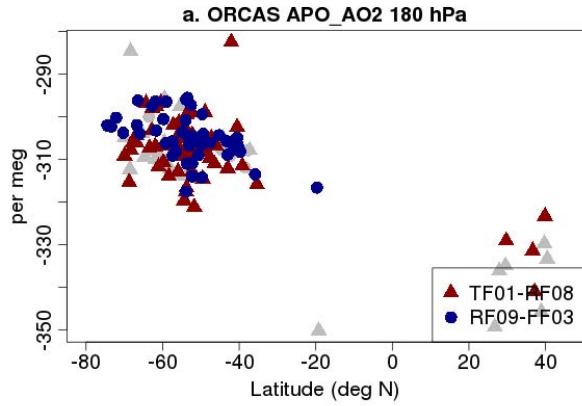
Each of the next 5 pages presents a set of figures for each species in the profile data products: (a and c) means and (b and d) weights for the 180 hPa (a and b) and 350 hPa (c and d) capped profiles with profiles with weights < 0.6 shown in gray, (e) all profiles for entire campaign, and (f) means for profiles > 30 S, $> 60\%$ weight, and reaching 200 hPa or above for 180 hPa capped profiles and 400 hPa or above for 350 hPa capped profiles. In a-e, profiles are separated by color according to the first and second half of the ORCAS campaign.



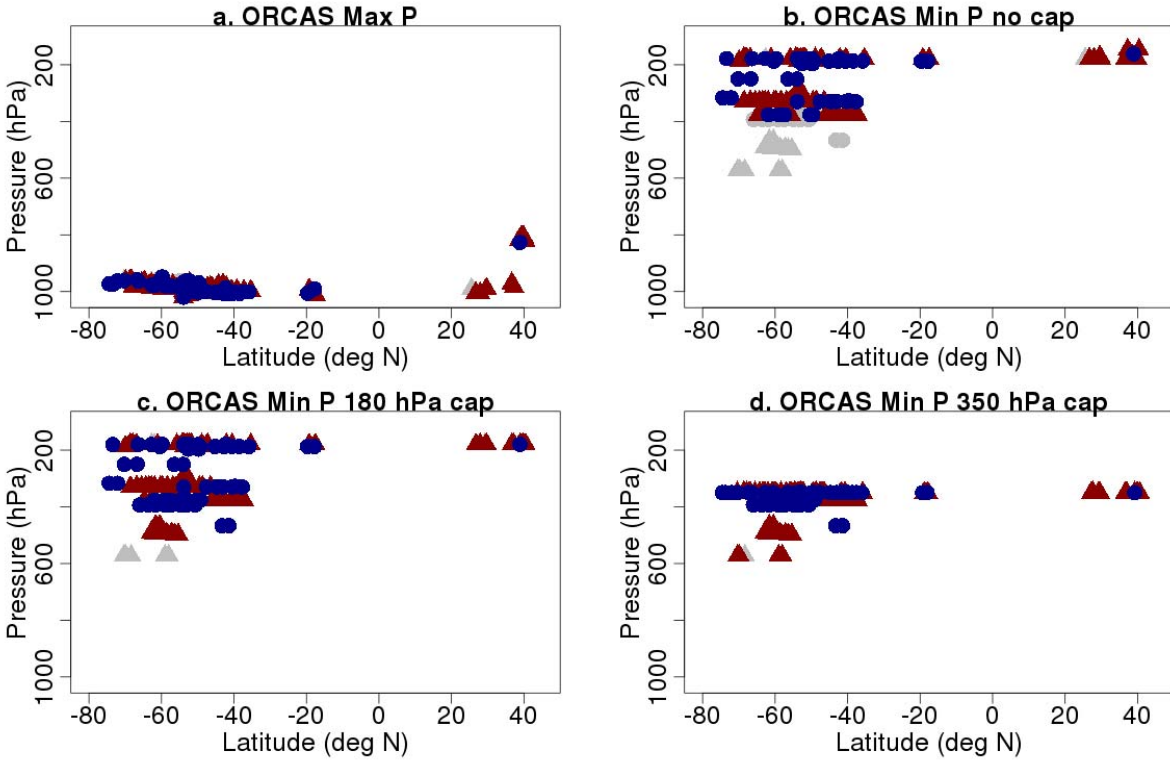






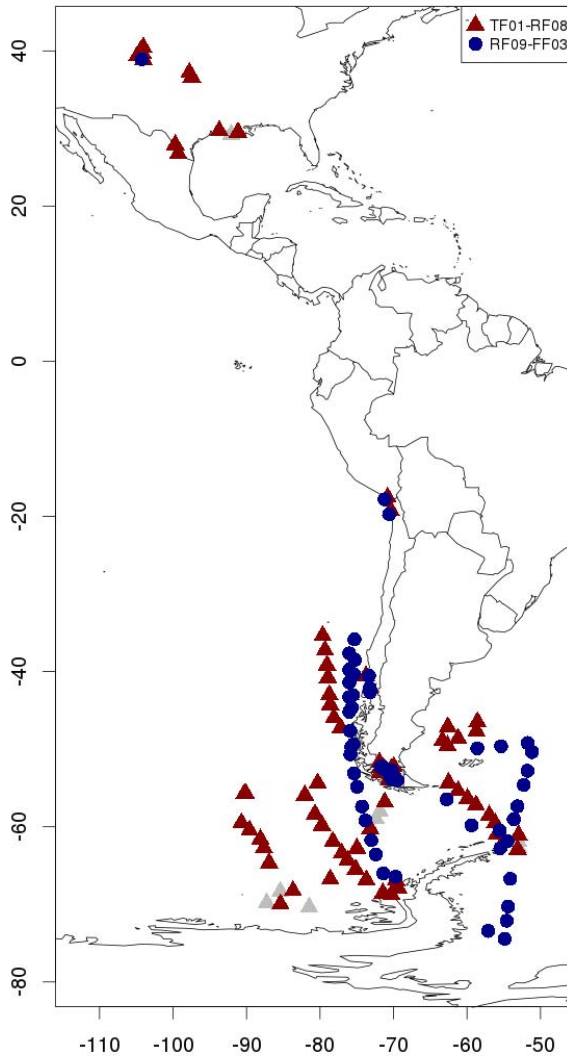


This page plots (a) the maximum observed pressure for all profiles, and the minimum observed pressure for (b) all profiles, (c) all profiles capped at 180 hPa, and (d) all profiles capped at 350 hPa, with profiles with GGALT weights < 0.6 shown in gray and profiles are separated by color according to the first and second half of the ORCAS campaign.

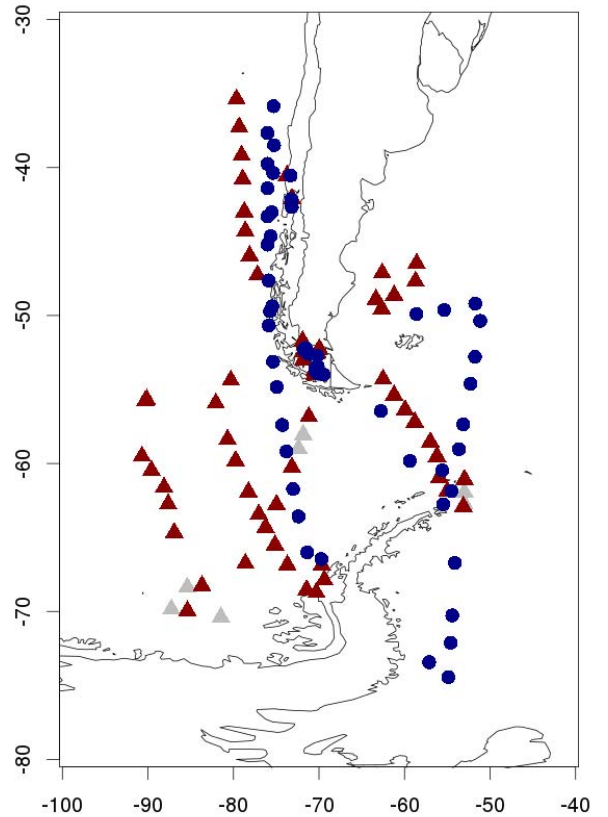


This page shows (a) global and (b) regional maps of the profile locations for the profiles capped at 180 hPa, with profiles with GGALT weights < 0.6 shown in gray and profiles are separated by color according to the first and second half of the ORCAS campaign.

a. 180 hPa capped profiles

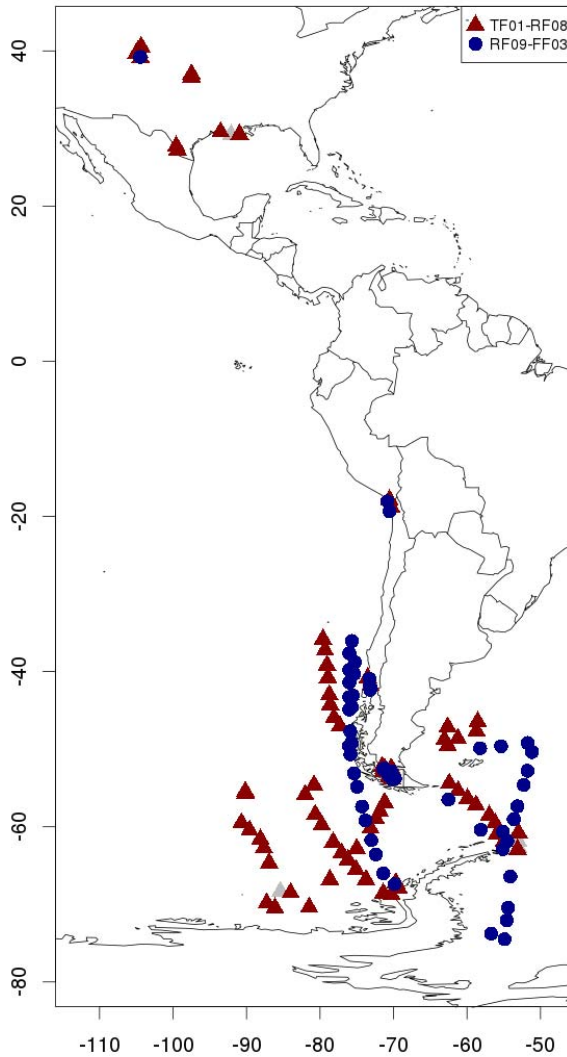


b. 180 hPa capped profiles



This page shows (a) global and (b) regional maps of the profile locations for the profiles capped at 180 hPa, with profiles with GGALT weights < 0.6 shown in gray and profiles are separated by color according to the first and second half of the ORCAS campaign.

a. 350 hPa capped profiles



b. 350 hPa capped profiles

