HIPPO Whole Air Sampling (WAS) Methodology and Validation

A proposal for a paper

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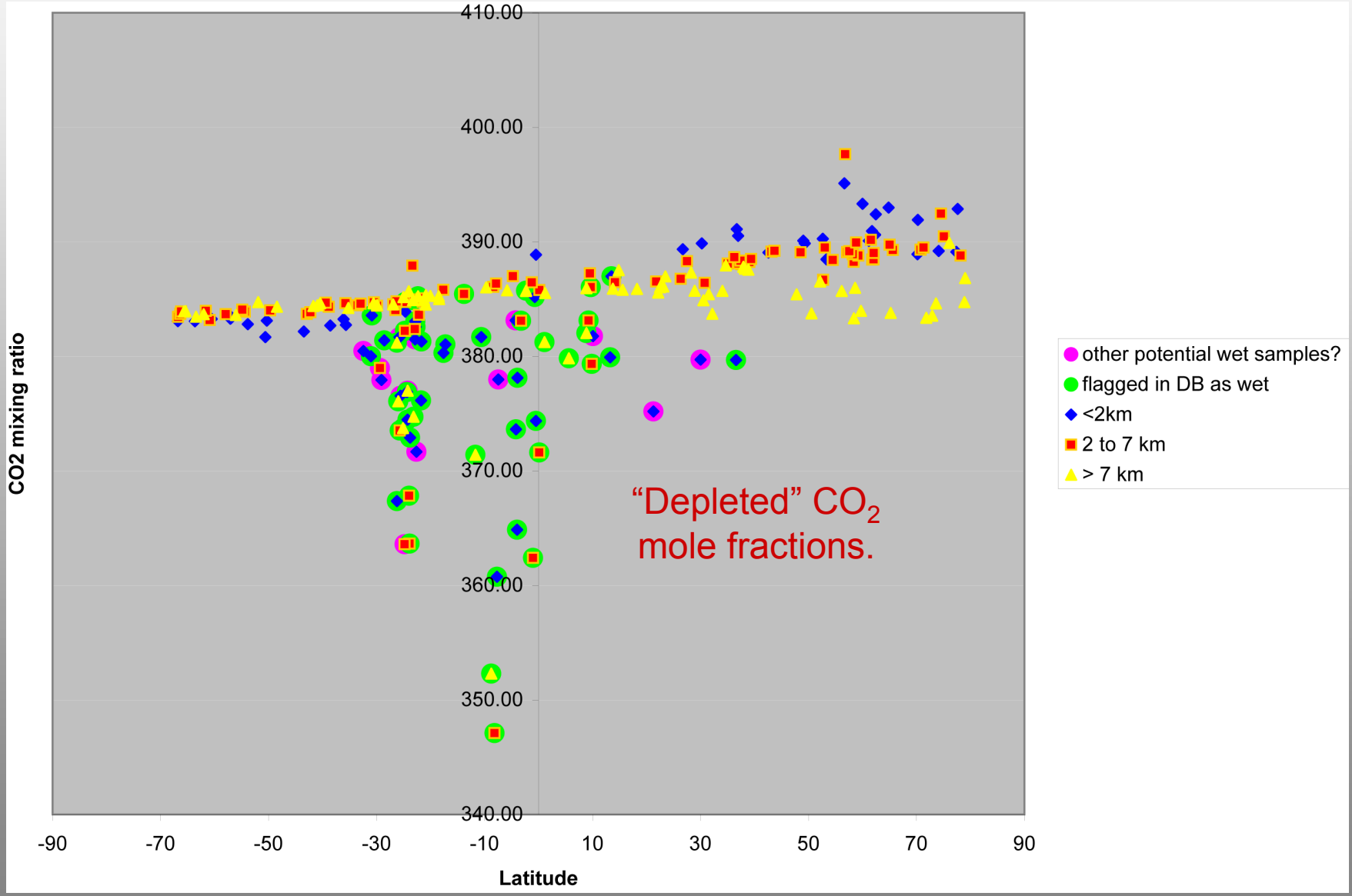
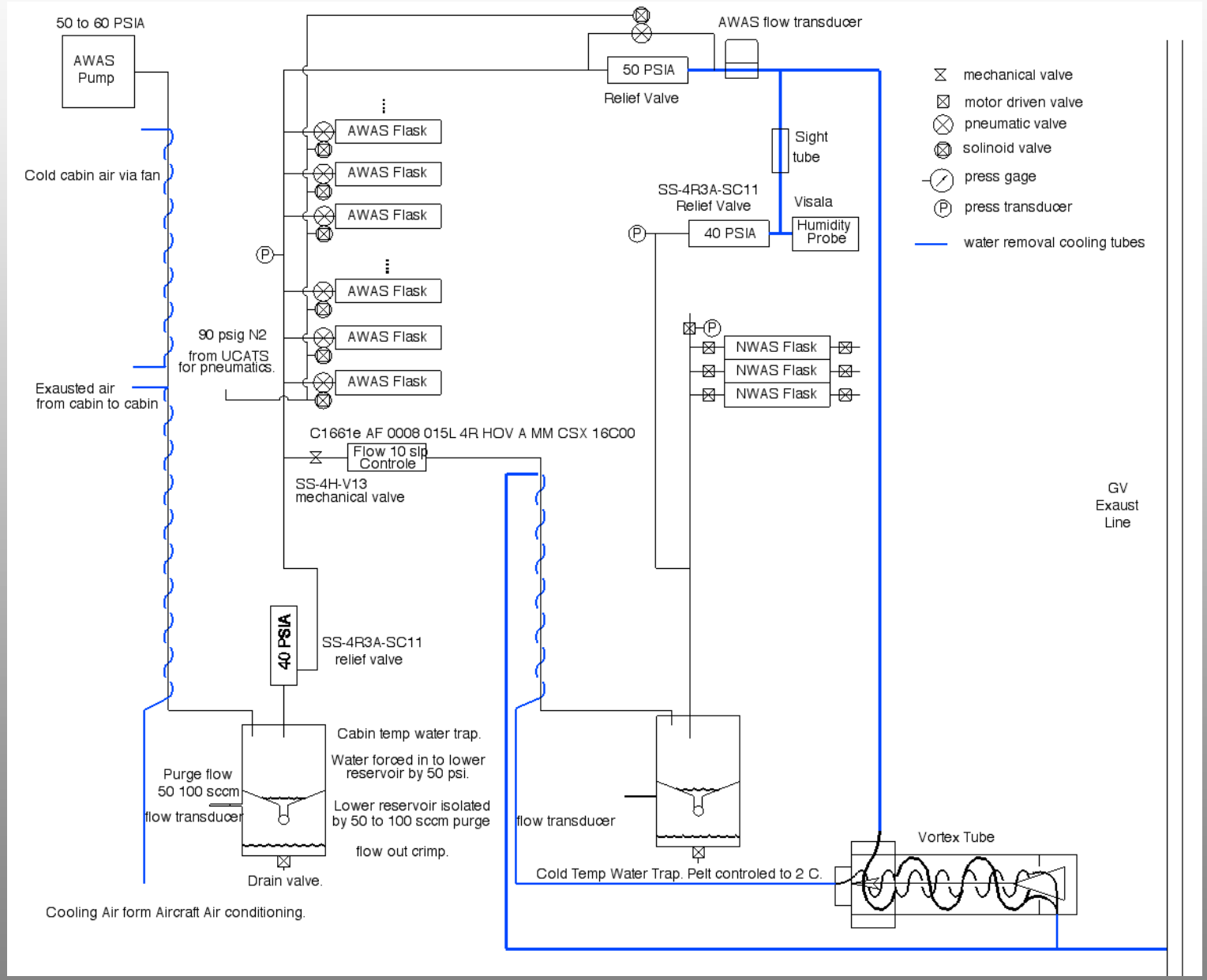
Motivation:

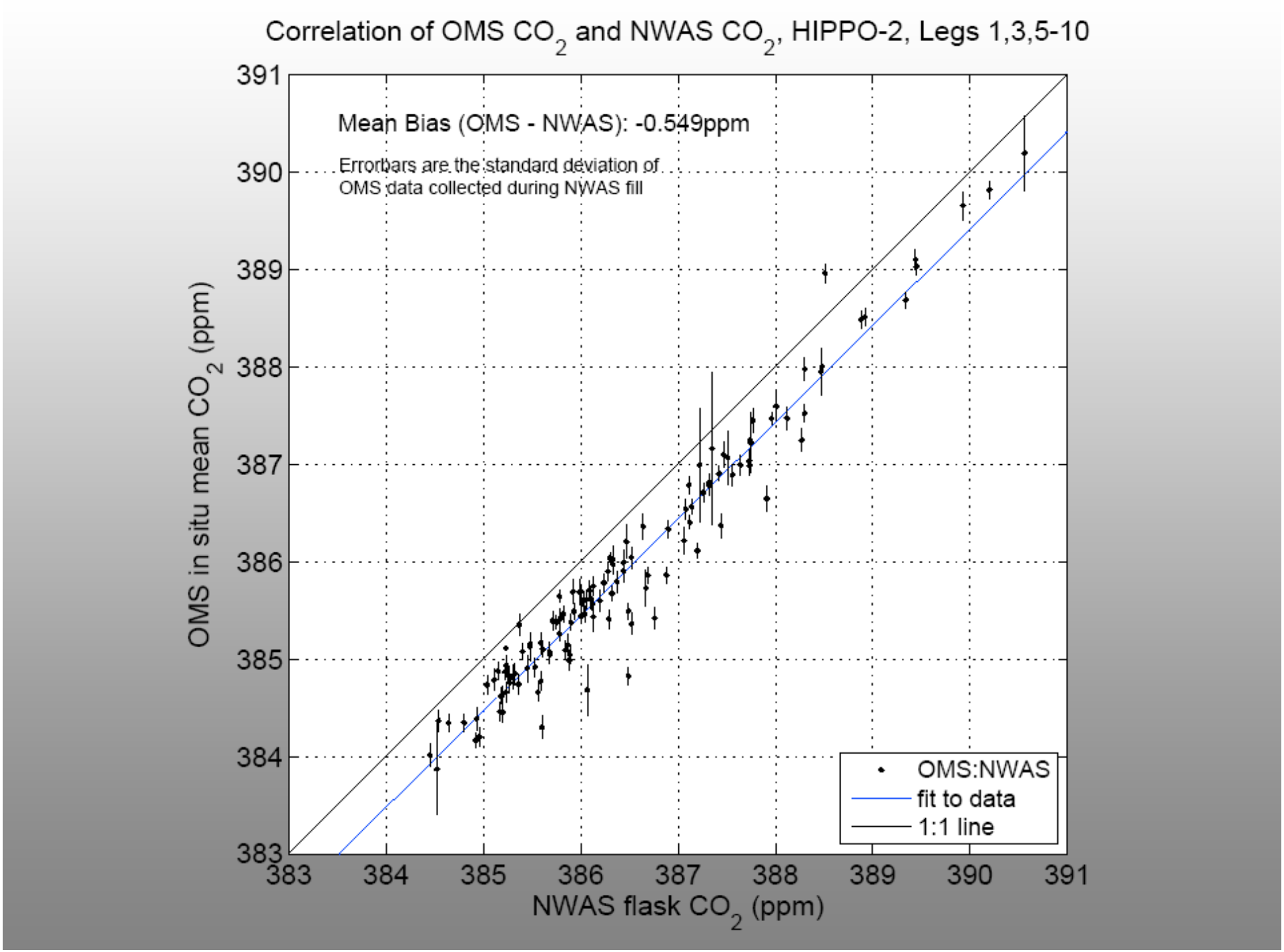
- A novel flask sampling methodology was developed specifically for the demands of HIPPO, but is also applicable to other aircraft platforms.
  - High-altitude sampling.
  - Wide range of initial sample moistures reduced to ≤2ºC dewpoint.
  - Rapid fill (order 15-30 sec).
  - Minimal sampling artifacts for ~50 compounds and isotopes.
- Validation
  - Intercomparison of WAS and in situ CO2.
  - Intercomparison of WAS ^{18}O-CO_2 and ^{13}C-CO_2 with CCGG small aircraft and previously published latitudinal gradients.
- Documentation of this methodology serves as a reference for subsequent “science” papers that use these flask data.

HIPPO-1 Flask Sampling Problem – Excessive Liquid Water!



The Solution to Liquid Water Problems – A New Flask Rack (HIPPO-2 & -3)




Correlation of OMS CO2 and NWAS CO2, HIPPO-2, Legs 1,3,5-10
Mean Bias (OMS - NWAS): -0.549ppm
Errorbars are the standard deviation of
OMS data collected during NWAS fill
OMS in situ mean CO2 (ppm)
NWAS flask CO2 (ppm)
391
390
389
388
387
386
385
384
383
383
384
385
386
387
388
389
390
391
OMS:NWAS
fit to data
1:1 line

Previously published ^{18}O-CO_2 latitudinal gradients

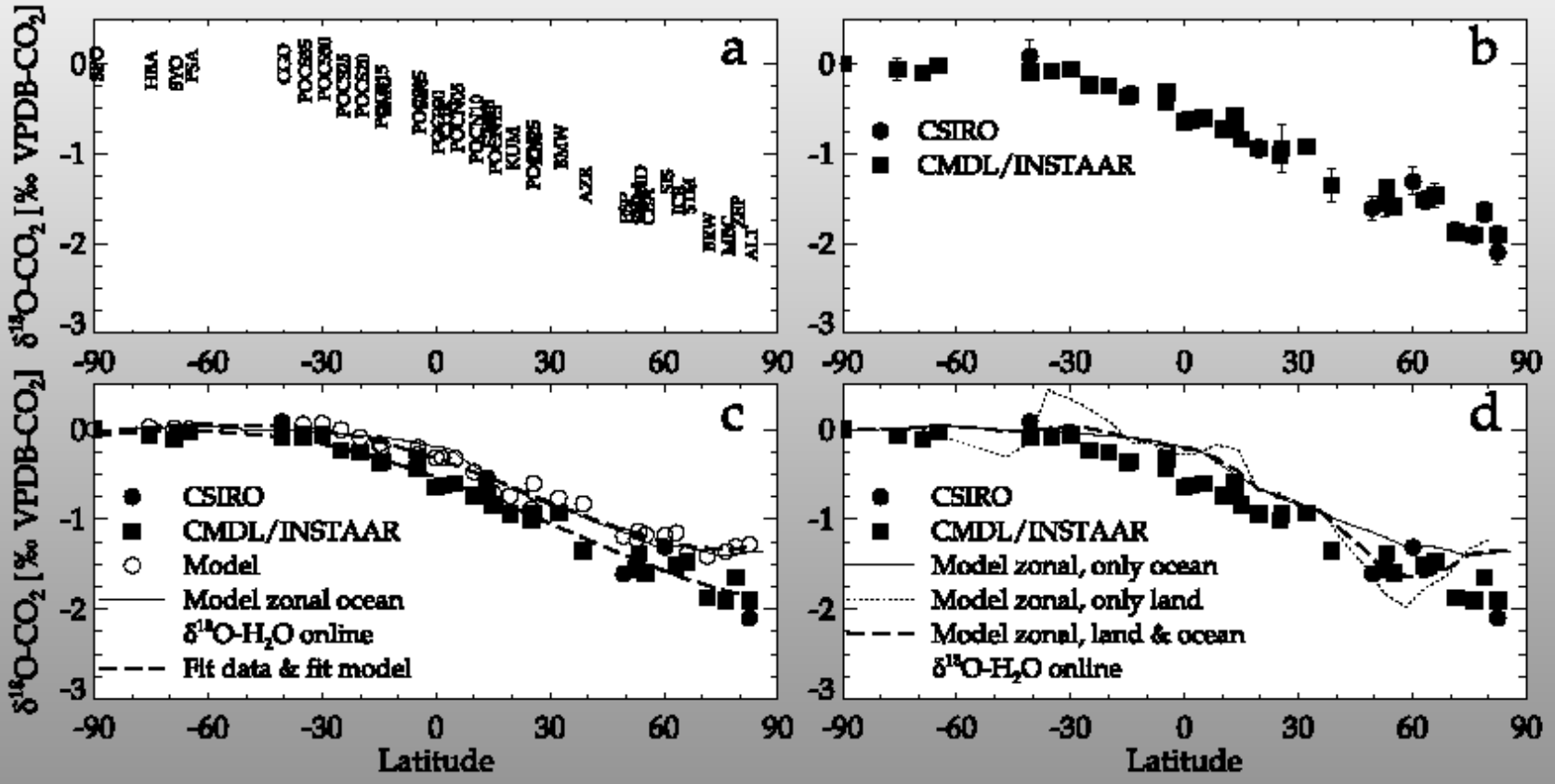
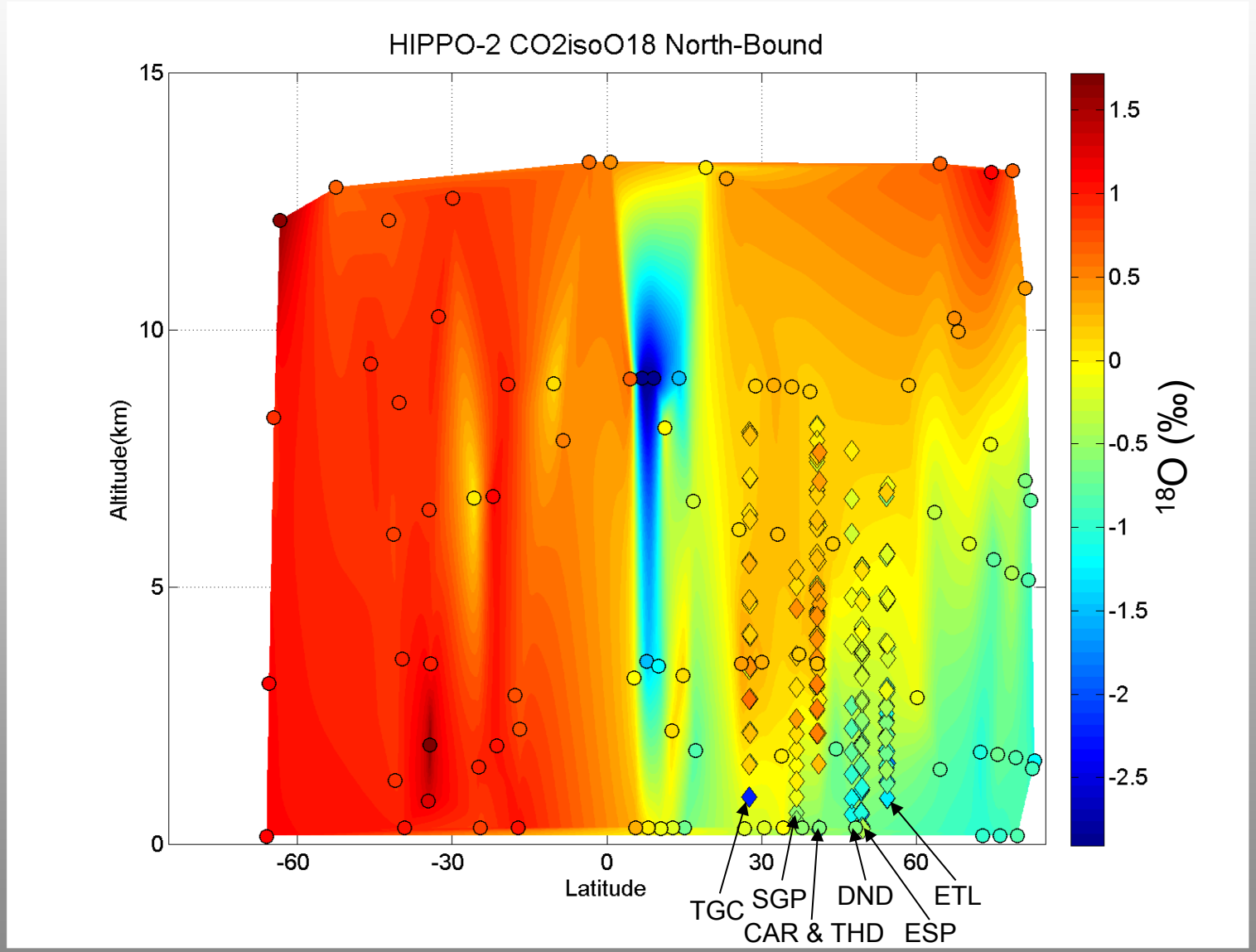
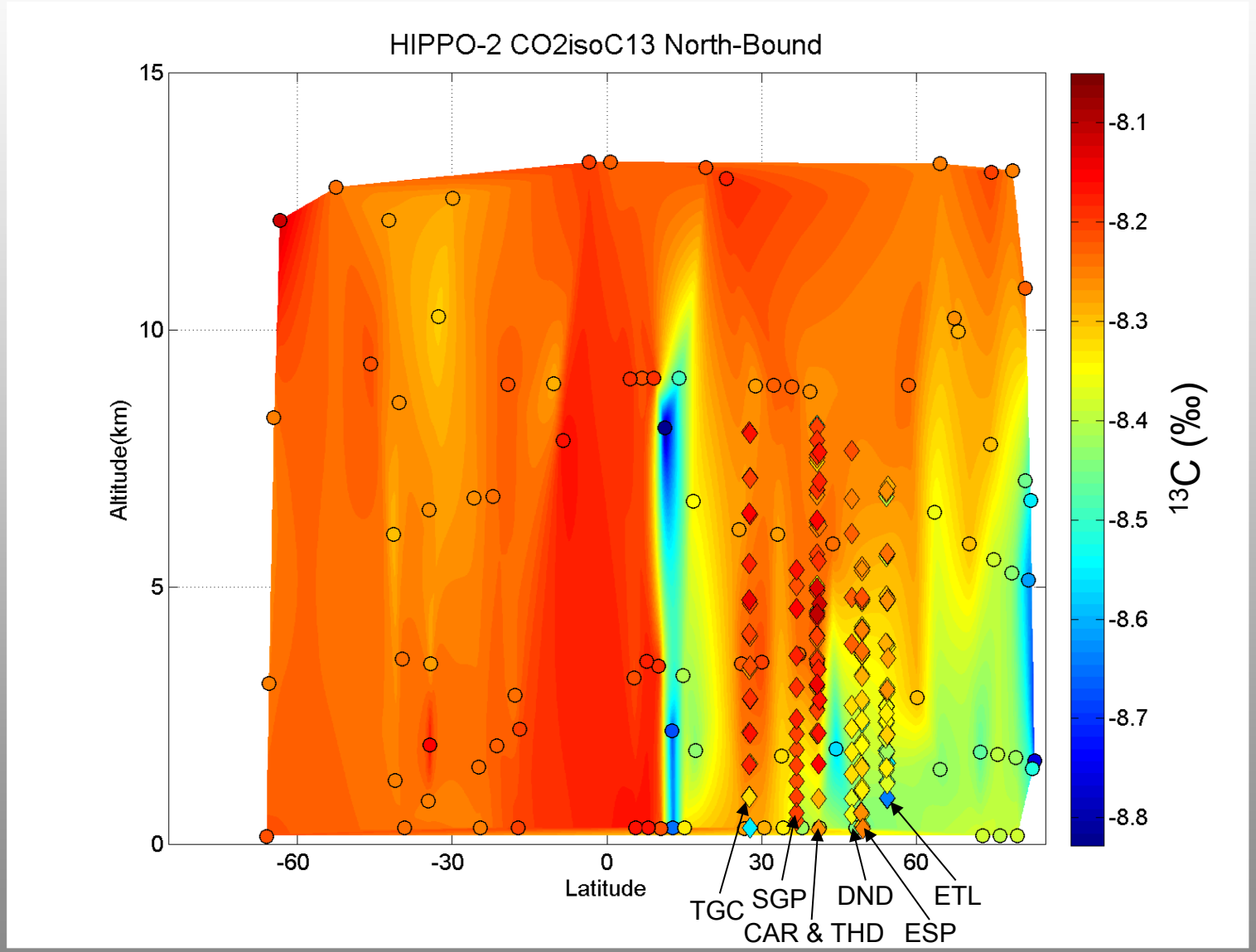


Figure 4. Meridional gradient of $d^{18}O$-CO_2 relative to South Pole. For simplicity, Figure 4a shows each MBL station's abbreviation centered over its mean value relative to South Pole; . . .


HIPPO-2 CO2isoO18 North-Bound
Altitude(km)
15
10
5
0
-60
-30
0
30
60
Latitude
1.5
1
0.5
0
-0.5
-1
-1.5
-2
-2.5
δ18O (‰)
TGC
SGP
CAR & THD
DND
ESP
ETL


HIPPO-2 CO2isoC13 North-Bound
Altitude(km)
15
10
5
0
-60
-30
0
30
60
Latitude
-8.1
-8.2
-8.3
-8.4
-8.5
-8.6
-8.7
-8.8
13C (‰)
TGC
SGP
CAR & THD
DND
ESP
ETL