Supplement 1. Daily, monthly, 3-month, and seasonal plots at all NOAA ESRL sites between 2006 and 2017.

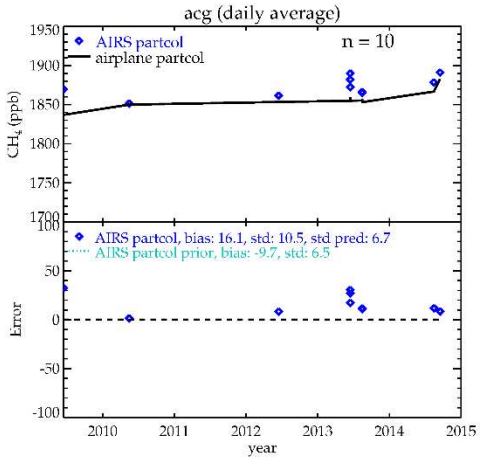
These supplementary plots show daily, monthly, 3-month, and seasonal plots for the 7 aircraft sites used for timeseries comparisons to AIRS. The vertical quantities plotted are: the partial column XCH4 VMR within the pressure levels measured by the aircraft and the aircraft with the AIRS averaging kernel applied (Eq. 6b). Note that most sites take data once or twice a month. Note that other than 2006, our AIRS dataset has gaps (e.g. 2008) causing gaps in these timeseries. Monthly averages have a cutoff of at least 2 observation and 3-month averages have a cutoff of at least 3 observations to test the effect of averaging. The "std pred" is the daily standard deviation divided by the square root of the average number of observations averaged. The seasonal plots convert matched pairs of AIRS + aircraft to 2012 by adding 5.4 ppb per year multiplied by (year minus 2012), then averaging all values in a month. This is done to see if there is a persistent seasonal issue. The mean bias at each site is separately subtracted from the seasonal cycle as indicated on the plot.

The sites are listed here.

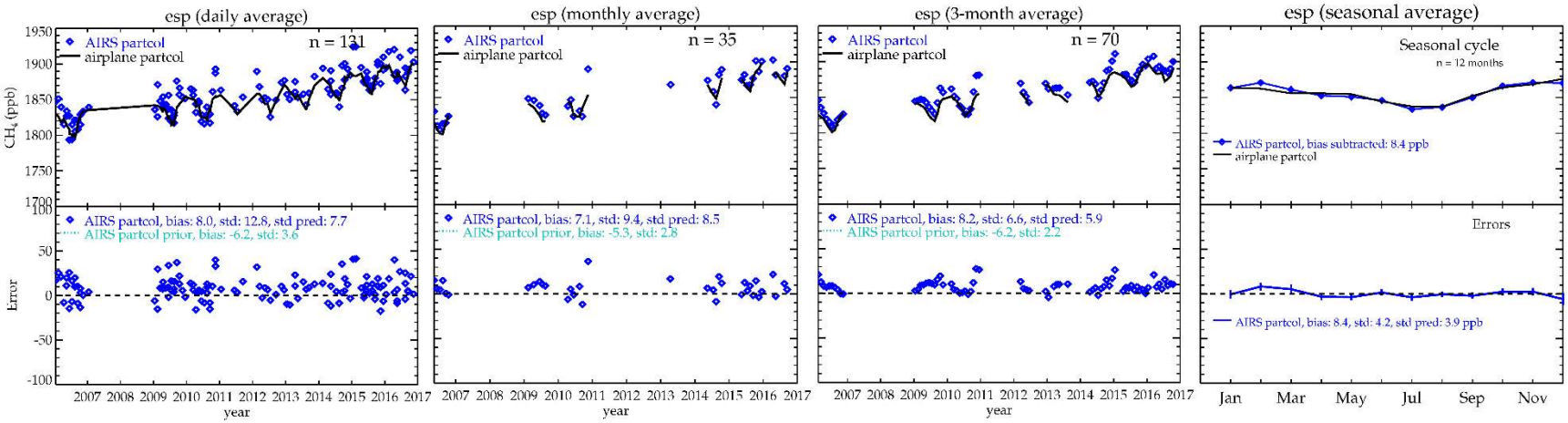
ACG	68N	152W
ESP	49N	126W
NHA	43N	71W
THD	41N	124W
CMA	39N	74W
TGC	28N	97W
RTA	21S	160W

ACG, Alaska Coast Guard, United States (68N, 152W)

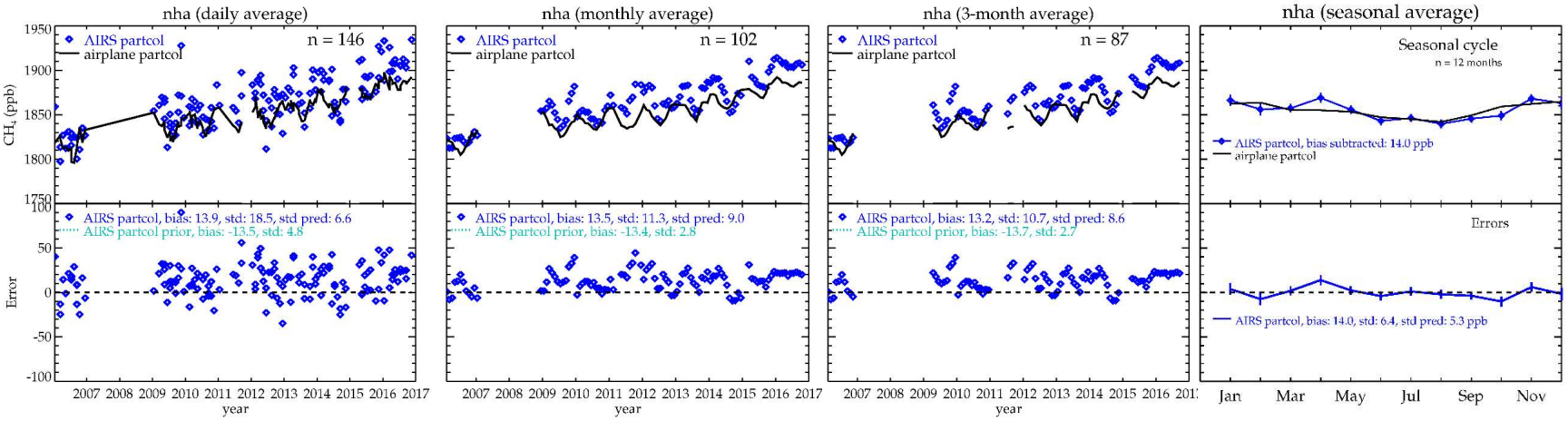
Since 1-month averages have a cutoff of 2, and 3-month averages have a cutoff of 3, there are very few values.



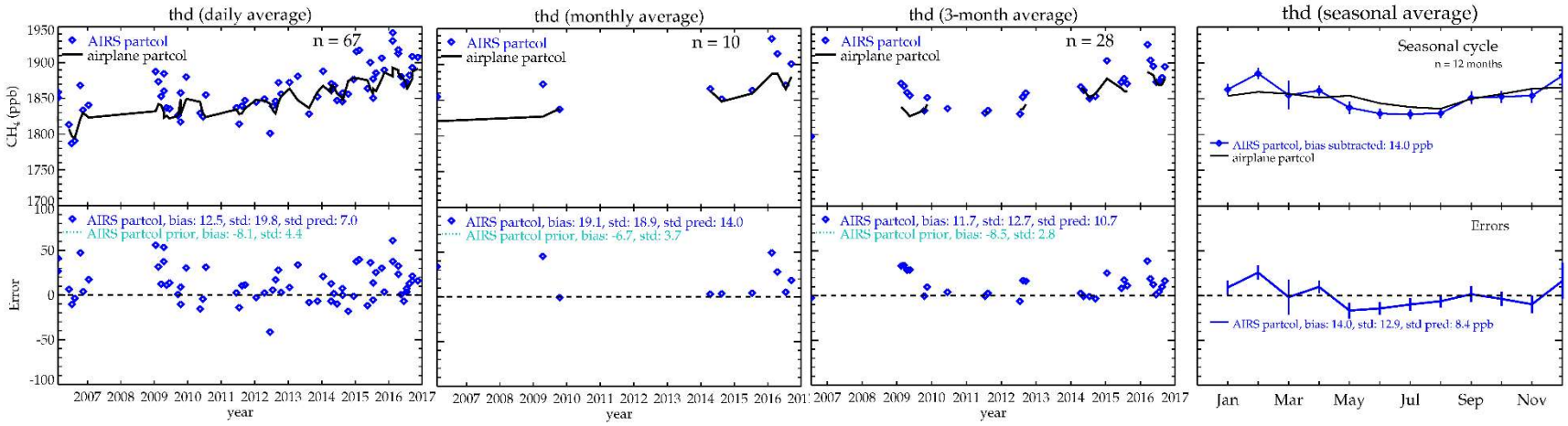
ESP, Estevan Point, British Columbia (49N, 126W)



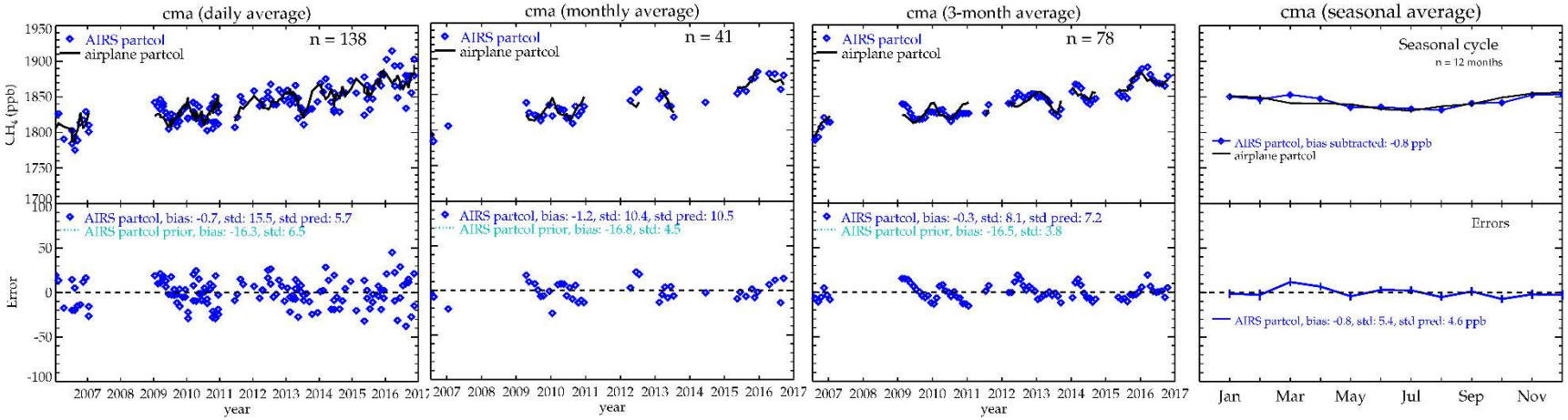
NHA, Offshore Portsmouth, New Hampshire (Isles of Shoals) (43N, 71W)



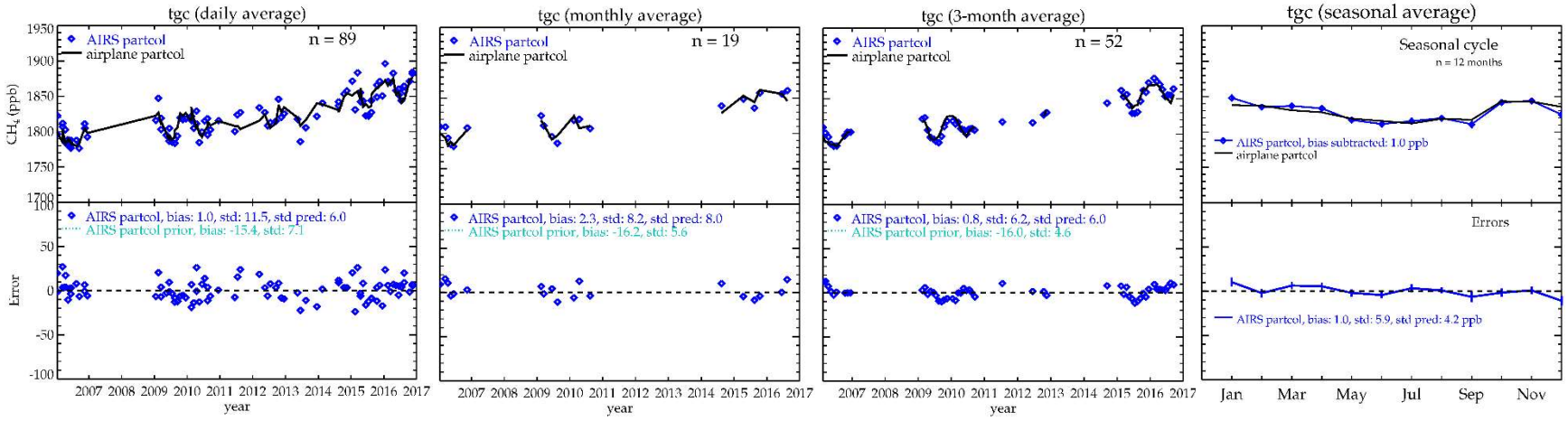
THD, Trinidad Head, California (41N, 124W)



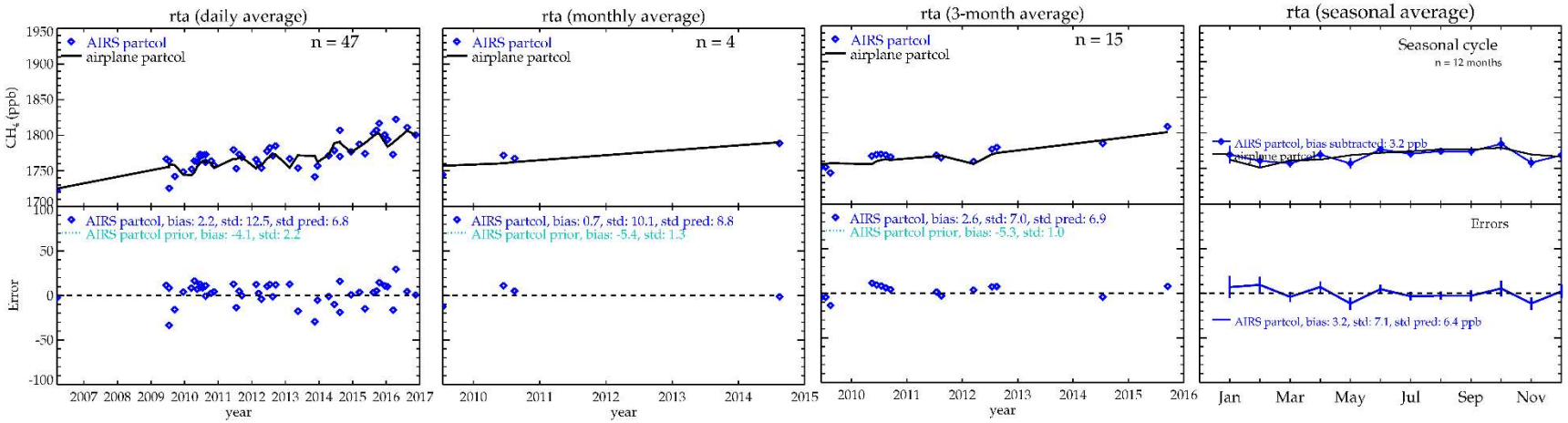
CMA, Offshore Cape May, New Jersey (39N, 74W)

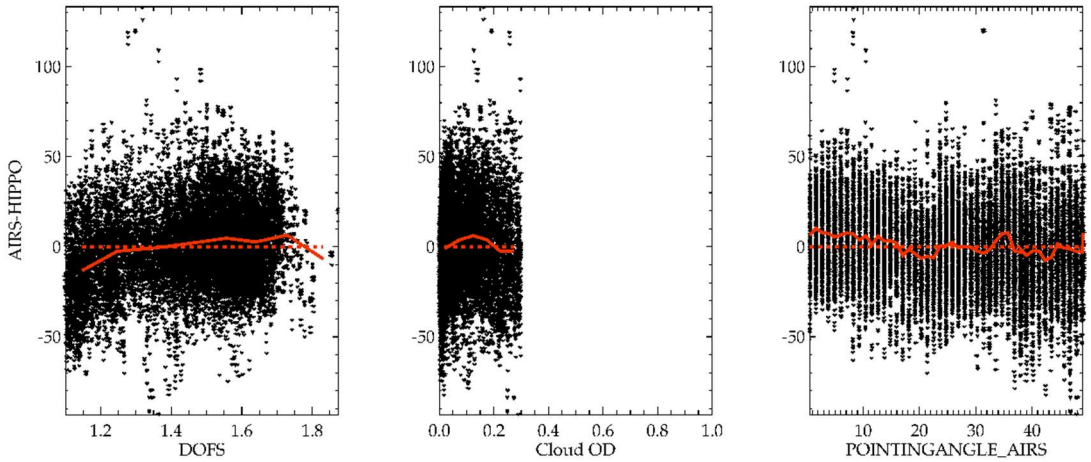


TGC Offshore Corpus Christi, Texas (28N, 97W)



RTA, Rarotonga (21S, 160W)



Supplement 2. Bias versus degrees of freedom, cloud optical depth, and pointing angle.

This supplementary plot shows the AIRS the partial column XCH4 VMR above 750 hPa and the aircraft with the AIRS averaging kernel applied (Eq. 6b) for all HIPPO campaigns. The y-axis shows the difference of AIRS and the aircraft, and the x-axis are: AIRS degrees of freedom, AIRS cloud optical depth, and AIRS pointing angle.