



# A Comparison of Automatic Weather Station Measurements at Dome C, Antarctica

Steven W. Fons<sup>1,2</sup>, Matthew A. Lazzara<sup>1,3</sup>, Linda M. Keller<sup>1,2</sup>

<sup>1</sup>Antarctic Meteorological Research Center, UW-Madison Space Science and Engineering Center

<sup>2</sup>University of Wisconsin-Madison, Department of Atmospheric and Oceanic Sciences

<sup>3</sup>Department of Physical Sciences, School of Arts and Sciences, Madison Area Technical College, Madison, WI (sfons@wisc.edu)



## Abstract

For the past 36 years, the University of Wisconsin-Madison's Antarctic Meteorological Research Center (AMRC) has operated an Automatic Weather Station (AWS) at Dome C, Antarctica. The current UW AWS, Dome C II AWS, is located high on the expansive Antarctic Plateau making it useful for calibration and validation of the Moderate Resolution Imaging Spectrometers (MODIS) on board NASA's Terra and Aqua satellites. This study will compare Dome C II to other AWS at Dome C, to assess the observation techniques and data gathered in the area and to ensure that the surface observations are as precise and dependable as possible for MODIS calibration and validation. Dome C II is compared with four other AWS at Dome C—one Italian and three French towers—in terms of temperature, pressure, wind speed, and wind direction for the year 2014. Apart from the environmental variables, the five AWSs will also be related with reference to data acquisition practices and ease of data availability. By comparing these AWS, this study hopes to determine the value of AMRC's Dome C II AWS as a tool for satellite calibration/validation, as well as an accurate and reliable source for future meteorological and climatological studies at Dome C.

## AWS at Dome C

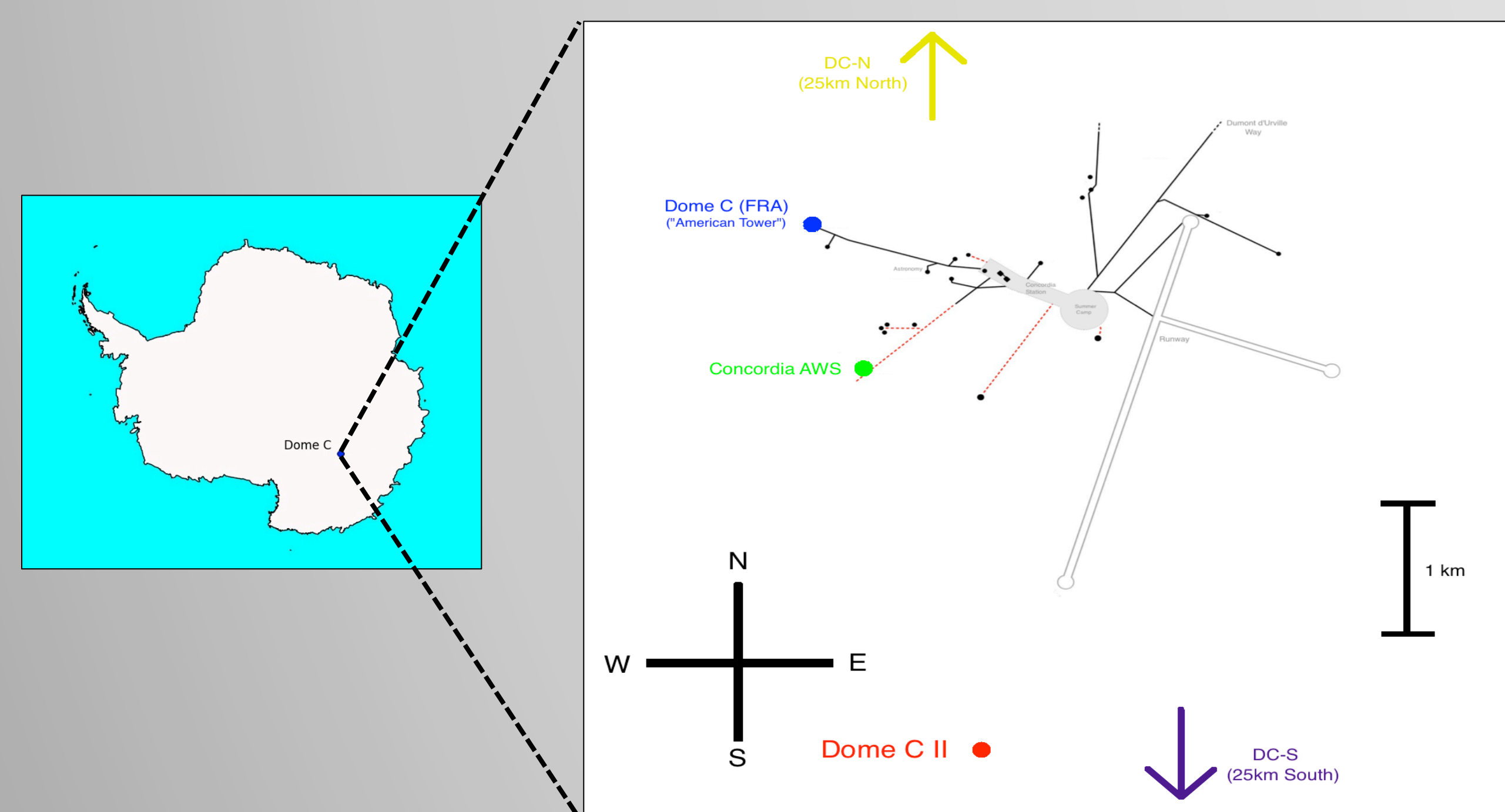


Figure 1: A map of Concordia Station showing the five AWS located in the vicinity of Dome C.

Station	Location (Lat, Lon)	Elevation (m)	AWS Height (m)	Temperature Instrument	Pressure Instrument	Wind Speed Instrument
Dome C II AWS	75.13°S 123.33°E	3240	1.22 Temp: .85	Weed PRT (+/- .5°C)	Paroscientific Model 215 A (+/- .2 hPa)	Belfort 123 (+/- .5 ms <sup>-1</sup> )
Concordia AWS	75.11°S 123.31°E	3233	3	PT100 Vaisala DTS12 (+/- .13°C)	Vaisala DPA12 (+/- .5 hPa)	Vaisala WAA 15A (+/- .4 ms <sup>-1</sup> )
Dome C (FRA)	75.10°S 123.30°E	3235	45 Temp: 3.23 Wind: 3.75	HMP155 (+/- .2°C)	(Unknown)	Young 05106 (+/- .3 ms <sup>-1</sup> )
DC-N	74.88°S 123.39°E	3228	2	HMP155 (+/- .2°C)	-	Young 05103 (+/- .3 ms <sup>-1</sup> )
DC-S	75.32°S 123.39°E	3226	2	HMP155 (+/- .2°C)	-	Young 05103 (+/- .3 ms <sup>-1</sup> )

Table 1: Information and specifications of the 5 AWS located at Dome C (from the year 2014).

## Results

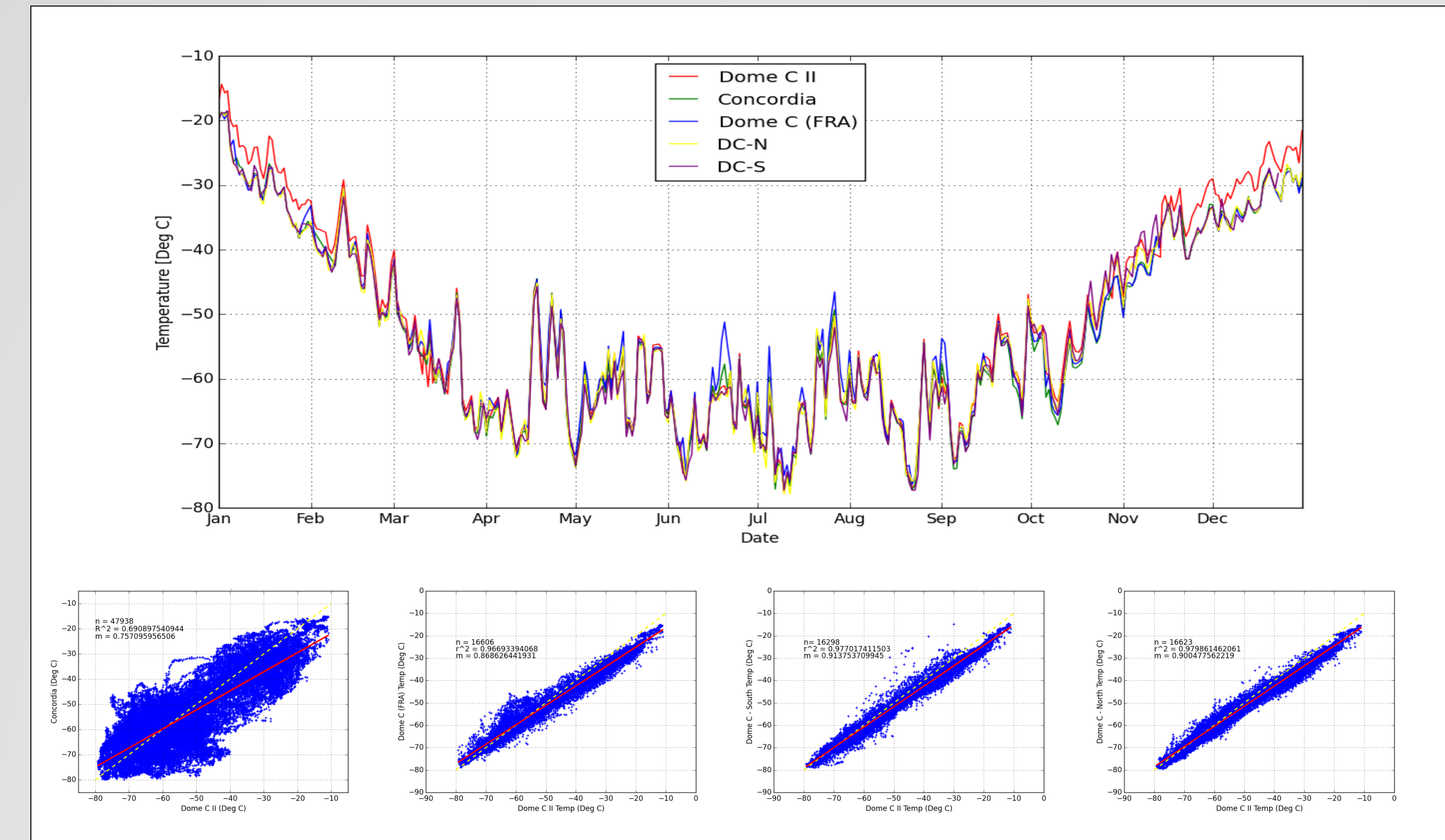


Figure 2: [top] Daily average temperatures from the five AWS at Dome C and [bottom] temporally coincident temperature scatter plots comparing Dome C II to [left to right] Concordia AWS, Dome C (FRA), DC-N, and DC-S.

### Temperature Measurements

- Dome C II consistently records a warmer temperature than the other AWS during the austral summer months (November-February).
- At warmer temperatures Dome C II exhibits a warm bias, while at colder temperatures Dome C II exhibits a cold bias compared to the other AWS
- Dome C (FRA) reaches a warmer temperature during the austral winter months
- Higher correlations exist between half hour averaged data (Dome C II vs. French AWS) than the 10 minute averaged data (Dome C II vs. Concordia AWS)

### Pressure Measurements

- Dome C II and Concordia AWS record very similar measurements throughout the year
- Dome C (FRA) follows the same trends, but consistently records 3-4hPa lower than other AWS

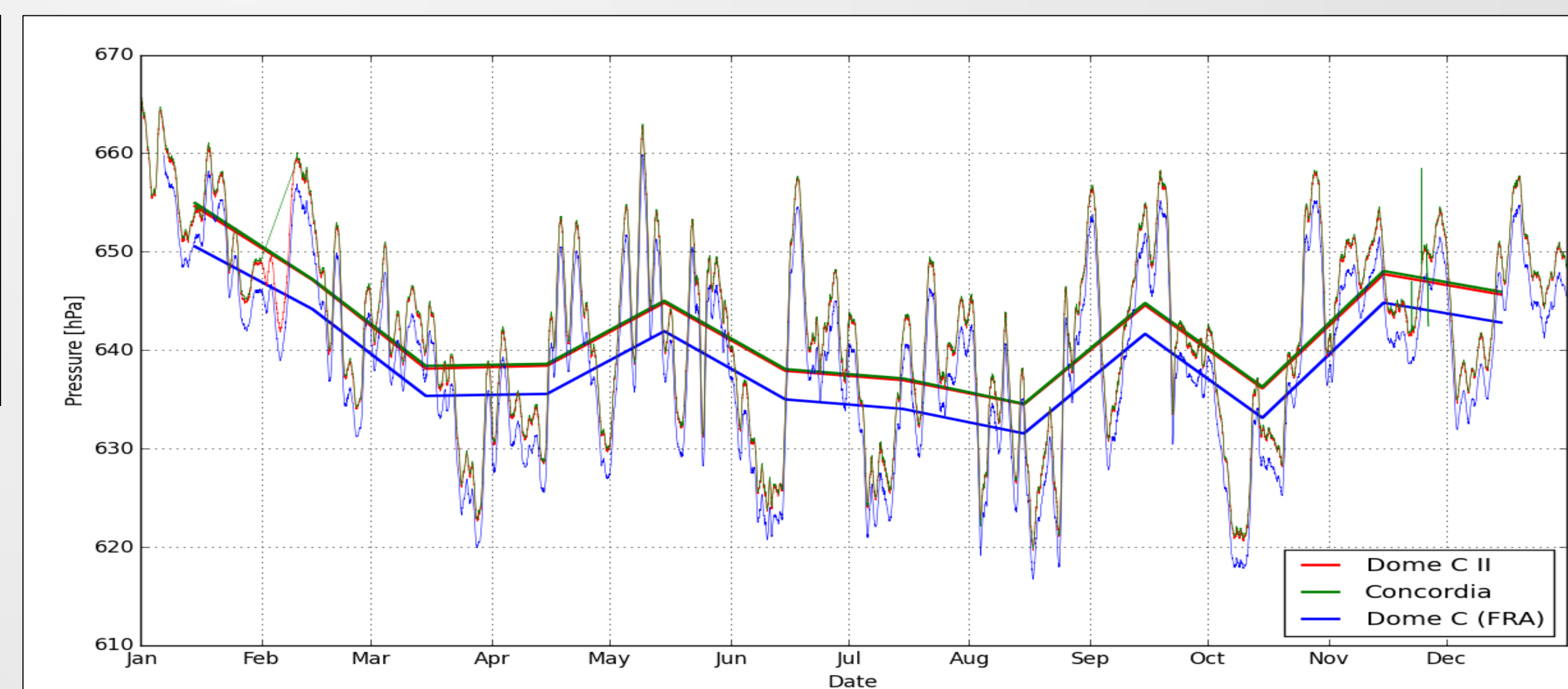
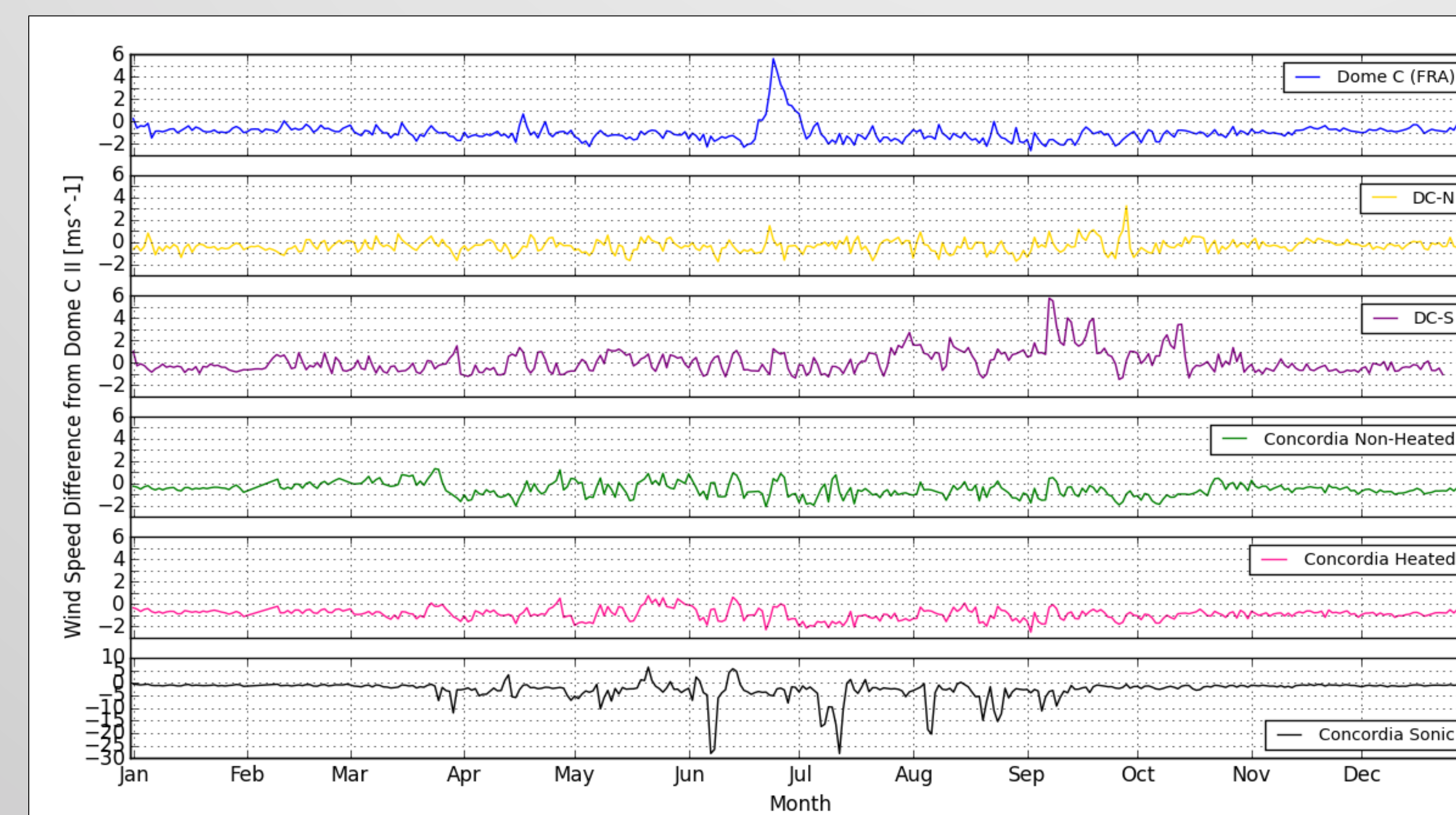


Figure 3: Daily and monthly average pressures from the three AWS that record pressure at Dome C. Note the high correlation between Dome C II and Concordia, as well as the consistently lower pressure recorded by Dome C (FRA).



### Wind Speed Measurements

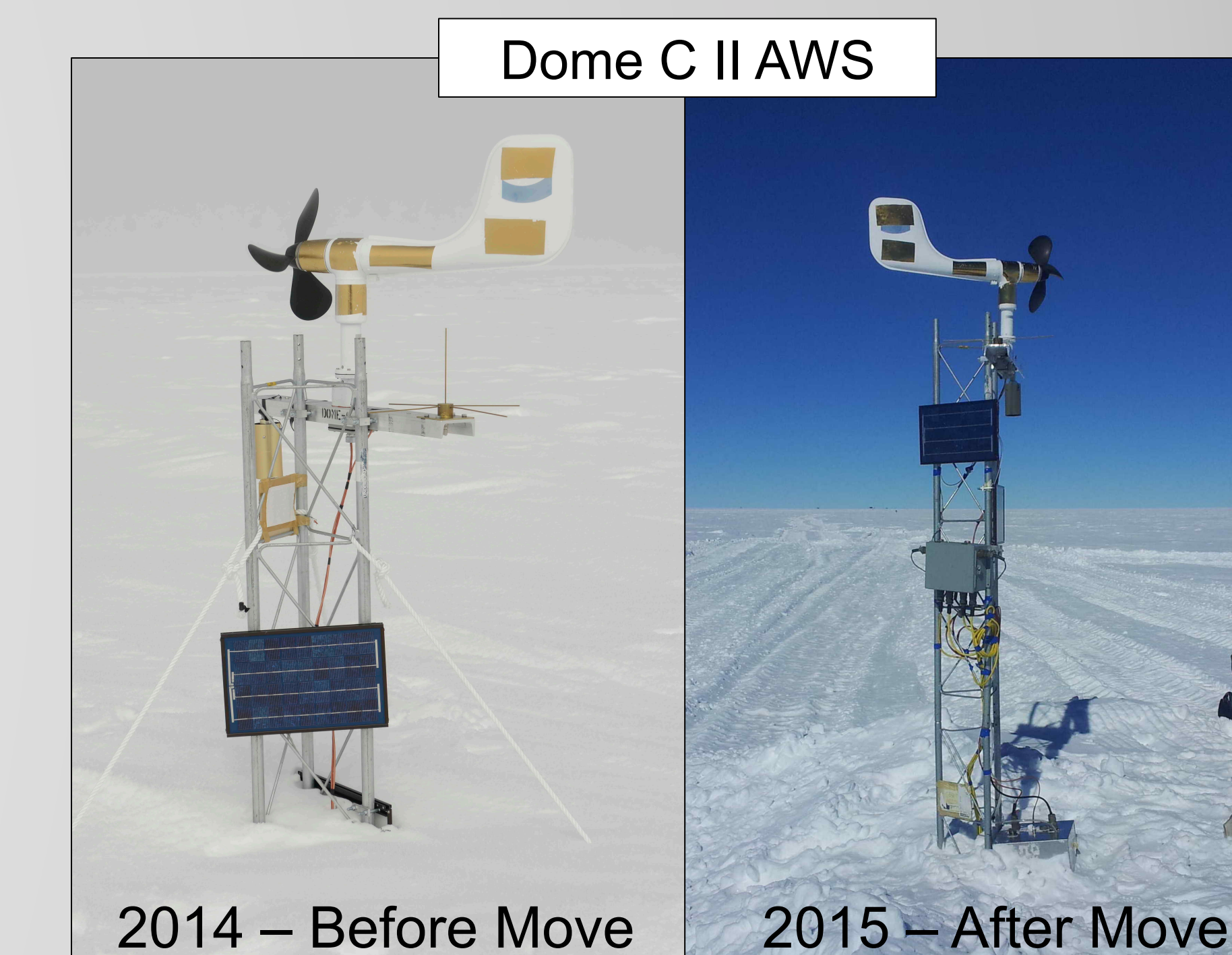
- Dome C II tends to record slightly slower wind speeds than the three French AWS
- Wind speed differences from Dome C II are closer to zero during austral summer months
- Dome C II compares similarly to both the heated and non-heated anemometers on Concordia AWS
- There are significant discrepancies between Dome C II and the sonic anemometer on Concordia AWS

Figure 4: Daily average wind speed differences between Dome C II and the four other AWS (with three anemometers from Concordia AWS)

## Observing/Distribution Methodologies

All three Antarctic programs at Dome C record and disseminate data differently, making it difficult to compare measurements between the AWS.

- AMRC: 10-minute, 1-hour, or 3-hour data from anonymous ftp site
  - PNRA: 1-minute or 1-hour data requiring registration and co-authorship (in case of publication)
  - IPEV: 30-minute averaged data emailed as a .csv file
- Standardized measurement practices would facilitate easier data sharing for many applications, including research and back-up for unplanned AWS outages.



## Conclusions

- Dome C II records a warm bias in temperatures during the austral summer months, likely due to the old style radiation shield and close proximity to the snow surface
- There is a high correlation in pressure measurement trends across all stations, with Dome C (FRA) consistently recording 3-4hPa lower.
- As wind speeds increase, Dome C II records faster wind speeds than the other AWS
- There are no significant differences in wind direction readings
- Many discrepancies in data collection/distribution methodologies exist between the three Antarctic programs with AWS at Dome C

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