

A large, jagged iceberg floats in the dark blue ocean under a bright blue sky with scattered white clouds. The iceberg's surface is textured with ridges and shadows, showing its massive scale. The water around the base of the iceberg is a lighter, turquoise color.

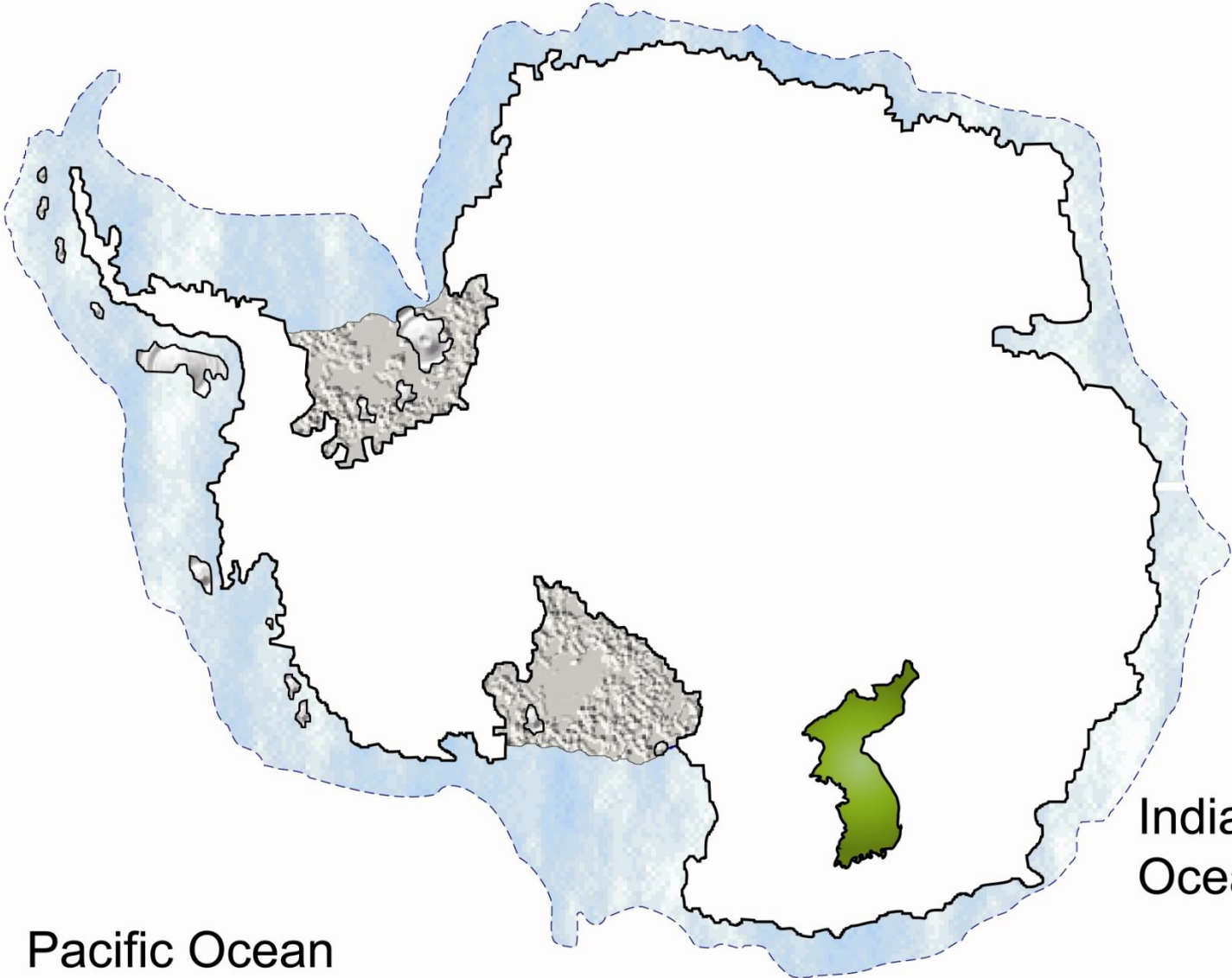
Measurements of CO₂ Concentration at Antarctic Peninsula

Taejin CHOI, Namyi CHAE,
Young Joon YOON and Bang Yong Lee

Korea Polar Research Institute

한국해양연구원 부설 극지연구소

Atlantic Ocean

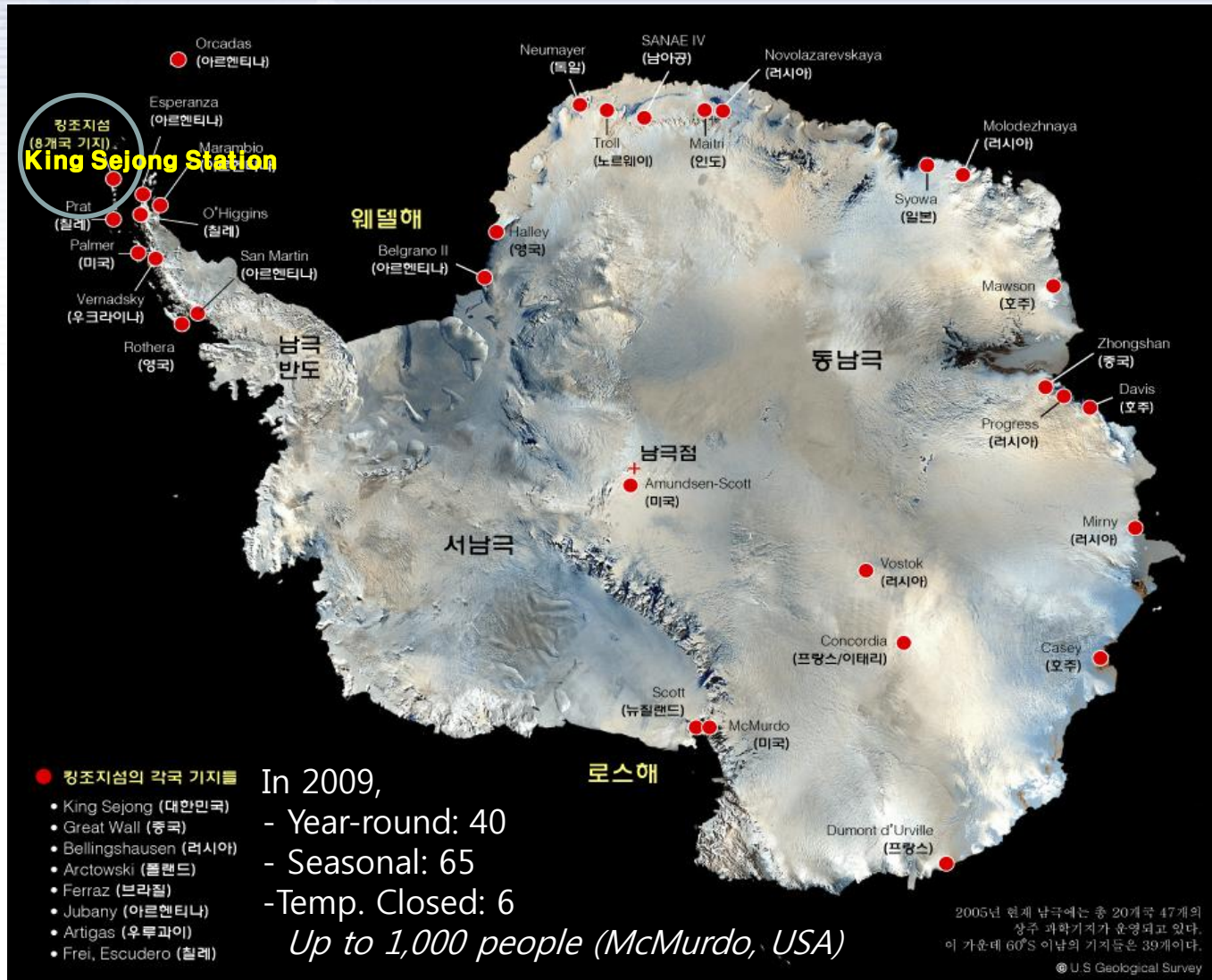


Pacific Ocean

Indian Ocean



Stations on Antarctica (60 ~ 90°S)





GAW SIS

STATION INFORMATION SYSTEM

by QA/SAC Switzerland

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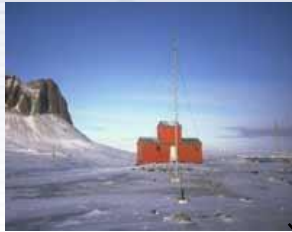
Stations matching criteria (total: 36)

WMO RA / Country	Station	GAWID	Station Type	Operating Status	Coordinates	Elevation (m a.s.l.)	Details
VII - Antarctica							
Argentina	Belgrano II		Regional	full operation	77.88°S 34.63°W	255	
Argentina	Doctor Sobral		Regional	closed	81.07°S 40.50°W	100	
Argentina	Jubany	JBN	Regional	full operation	62.24°S 58.67°W	15	
Argentina	Marambio	MBI	Regional	full operation	64.24°S 56.62°W	198	
Argentina	San Martin		Regional	full operation	68.13°S 67.10°W	30	
Australia	Casey	CYA	Regional	full operation	66.28°S 110.5°E	51	
Australia	Davis		Regional	full operation	68.58°S 77.47°E	15	
Australia	Law Dome	LAD	Regional	unknown	66.73°S 112.8°E	1390	
Australia	Mawson	MAA	Regional	unknown	67.60°S 62.87°E	20	
Australia	Wilkes		Regional	closed	66.25°S 110.5°E	12	
Belgium	Base King Baudoin	BKB	Regional	closed	70.43°S 24.32°E	38	
Chile	Marsh (King George Island)		Regional	closed	62.18°S 58.30°W	20	
China	Zhong Shan	ZOS	Contributing	full operation	69.37°S 76.37°E	71	
France	Concordia, Dôme C	DCC	Contributing	full operation	75.10°S 123.3°E	3233	
France	Dumont d'Urville	DDU	Regional	full operation	66.67°S 140.0°E	40	
Germany	Neumayer	NMY	Global	full operation	70.65°S 8.25°W	42	
India	Maitri		Regional	full operation	70.46°S 11.45°E	330	
Japan	Mizuho	MZH	Contributing	closed	70.70°S 44.30°E	2230	
Japan	Syowa	SYO	Regional	full operation	69.00°S 39.58°E	21	
Korea, R. of	King Sejong	KSG	Non-GAW (national)	full operation	62.22°S 58.78°W	0	
New Zealand	Arrival Heights	ARH	Regional	full operation	77.83°S 166.7°E	184	
New Zealand	Hallett		Regional	closed	72.32°S 170.2°E	5	
New Zealand	Scott Base	SBS	Regional	full operation	77.85°S 166.8°E	16	
Russian Federation	Mirny	MIR	Regional	closed	66.55°S 93.00°E	30	
Russian Federation	Novolazarevskaya-Forster	NLZ	Regional	closed	70.77°S 11.87°E	110	
Russian Federation	Vostok	VST	Regional	closed	78.27°S 106.5°E	-1	
Ukraine	Faraday-Vernadsky	FAD	Regional	full operation	65.15°S 64.16°W	10	
United Kingdom	Argentine Islands		Regional	full operation	65.25°S 64.27°W	10	
United Kingdom	Halley	HBA	Regional	full operation	75.58°S 26.71°W	30	
United Kingdom	Rothera	ROT	Contributing	full operation	67.57°S 68.12°W	30	
United States	Byrd	BYR	Regional	closed	80.03°S 119.5°W	1528	
United States	Little America	LAM	Regional	closed	78.00°S 162.0°W	44	
United States	McMurdo	MCM	Regional	full operation	77.83°S 166.6°E	11	
United States	Palmer Station	PSA	Regional	full operation	64.92°S 64.00°W	10	
United States	South Pole	SPO	Global	full operation	90.00°S 24.80°W	2841	
Uruguay	Artigas		Regional	full operation	62.18°S 58.90°W	10	



- Full operation: 23
- Global: 2
- Regional: 16

Background CO₂ Conc.



Jubany(Argentina)



Halley VI(United Kingdom)



Neumayer III(Germany)



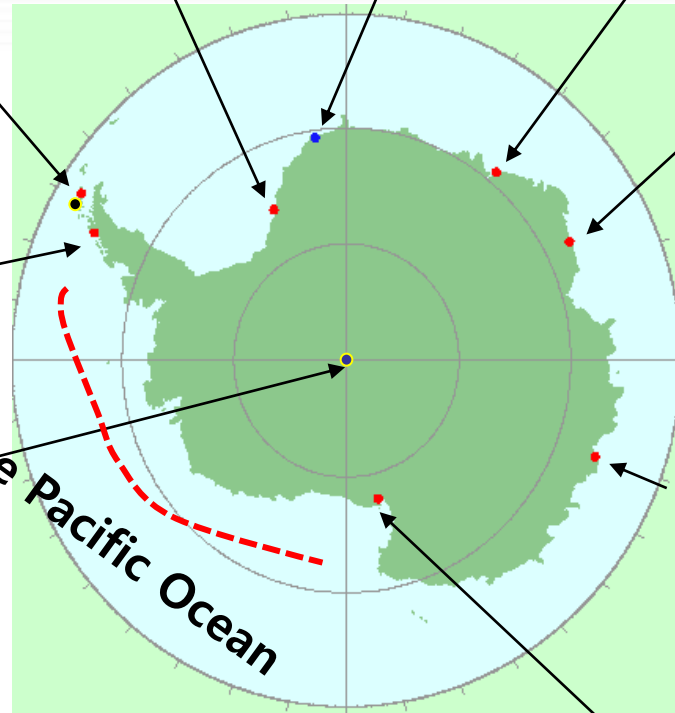
Syowa (Japan)



Palmer (United States)



South pole (United States)



Mawson (Australia)

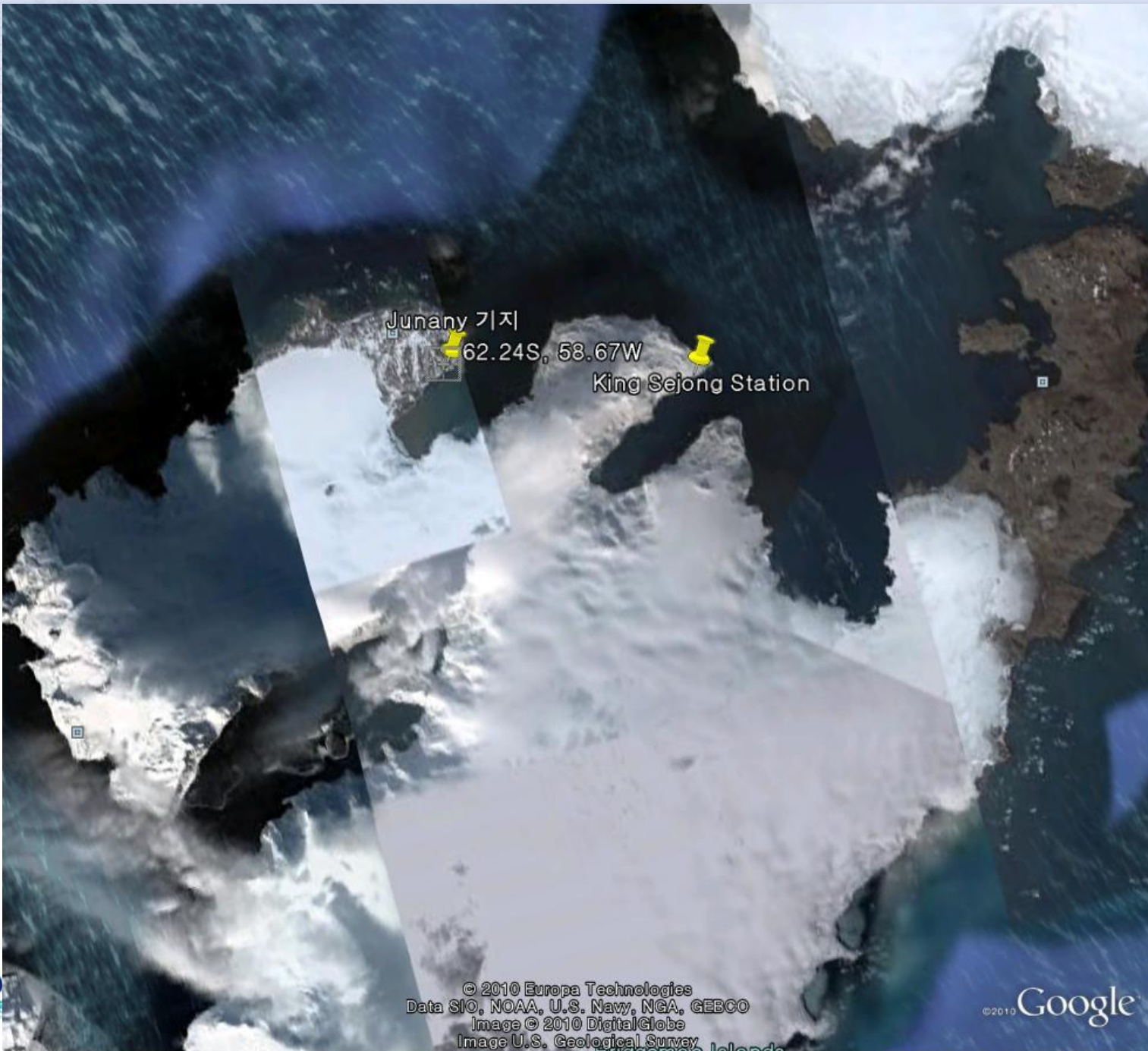


Casey (Australia)



McMurdo (United States)

/Arrival Heights (New Zealand)



Junany 기지

62.24S, 58.67W

King Sejong Station



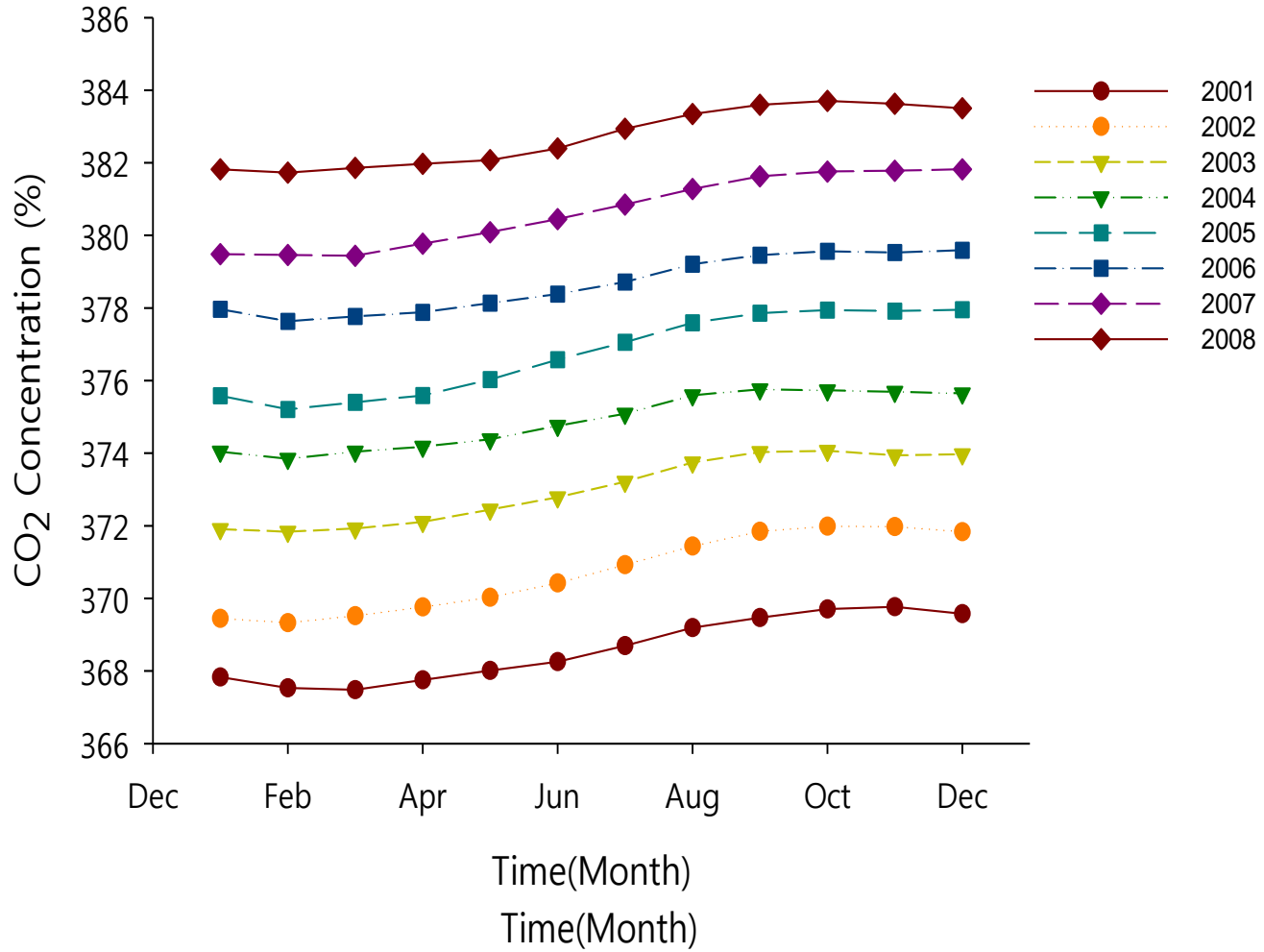
© 2010 Europa Technologies
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image © 2010 Digital Globe
Image U.S. Geological Survey

©2010 Google

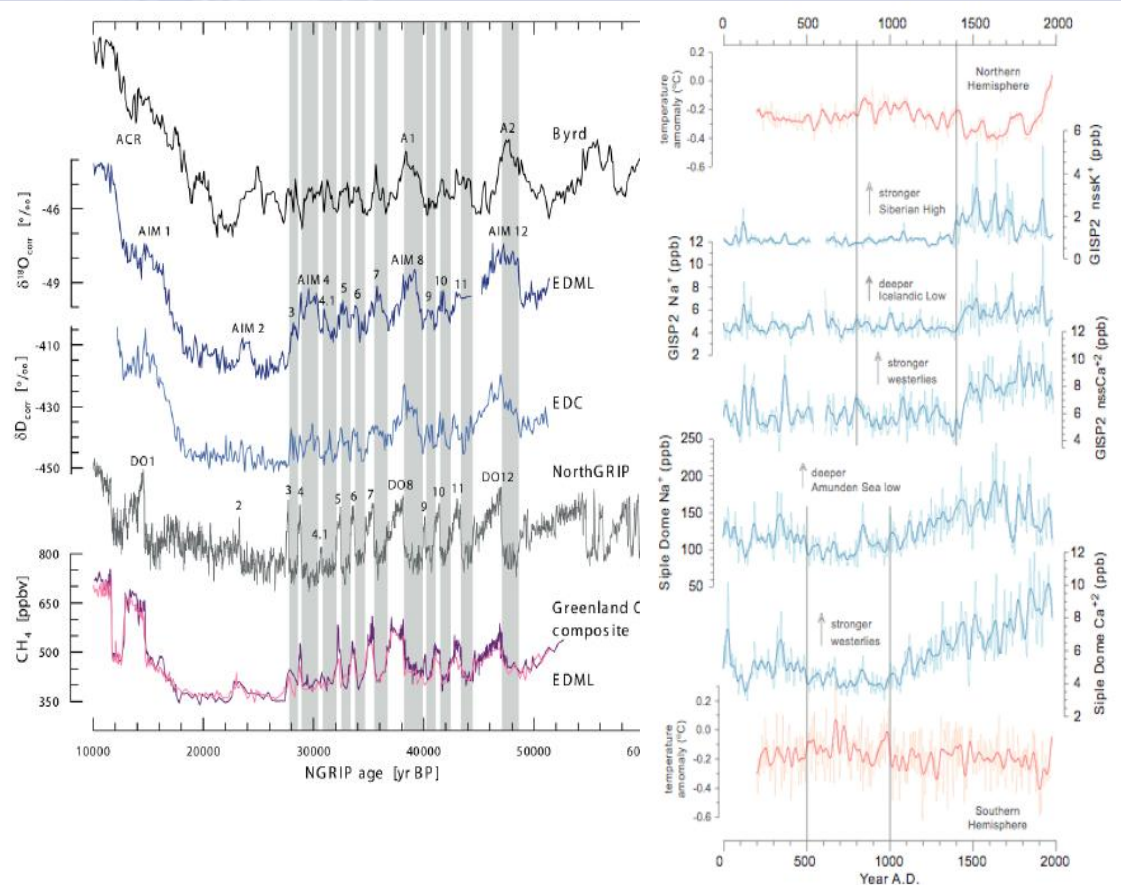
이미지 날짜: 1999. 3월. 5-2008. 9월. 4 62°11'36.69"남 58°42'39.13"서 고도 302 m

내려다보는 높이 25.24 km

Amundsen-Scott Station(South Pole, USA)



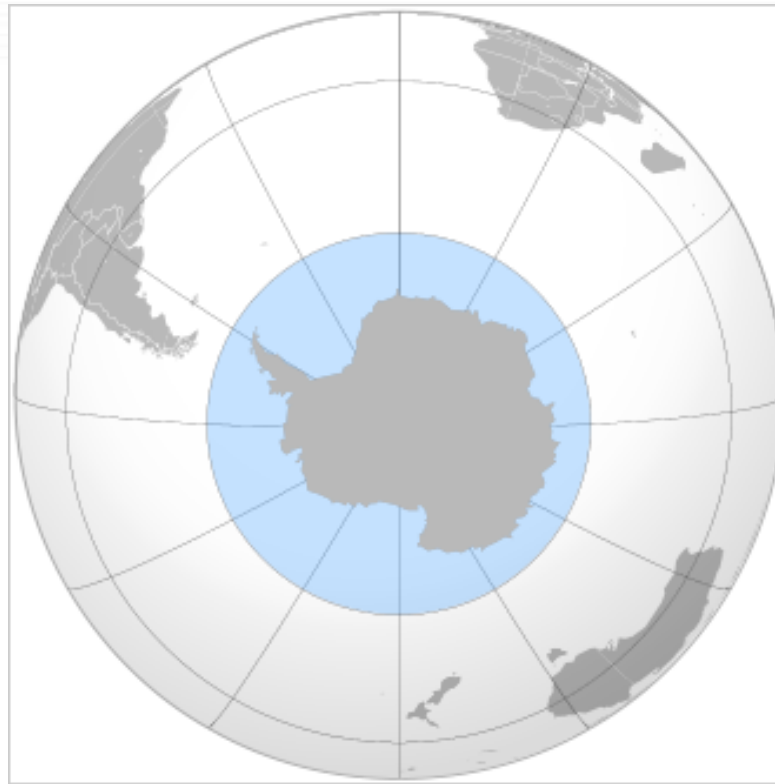
Understanding of past climate



Ideal to study on the composition and temporal change of the background atmosphere without any direct impact of civilization
The main part of atmospheric trace compounds must be advected by long-range transport to Antarctica

Monitoring of the change in the Southern Ocean

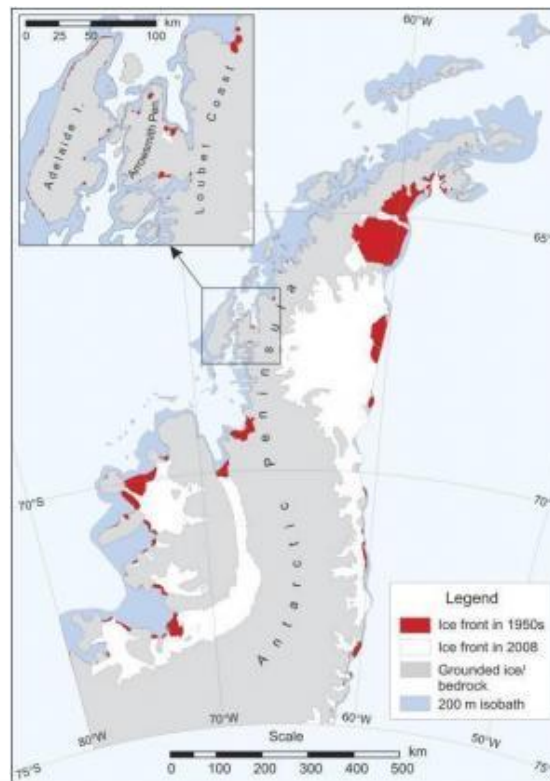
- The Southern Ocean plays a critical role in driving, modifying, and regulating global change.
- It comprises the southernmost waters of the World Ocean south of 60°S latitude
- Its area is about 6% of the total ocean area, but making a critical role in up-taking the atmospheric CO₂ (~ 35%)



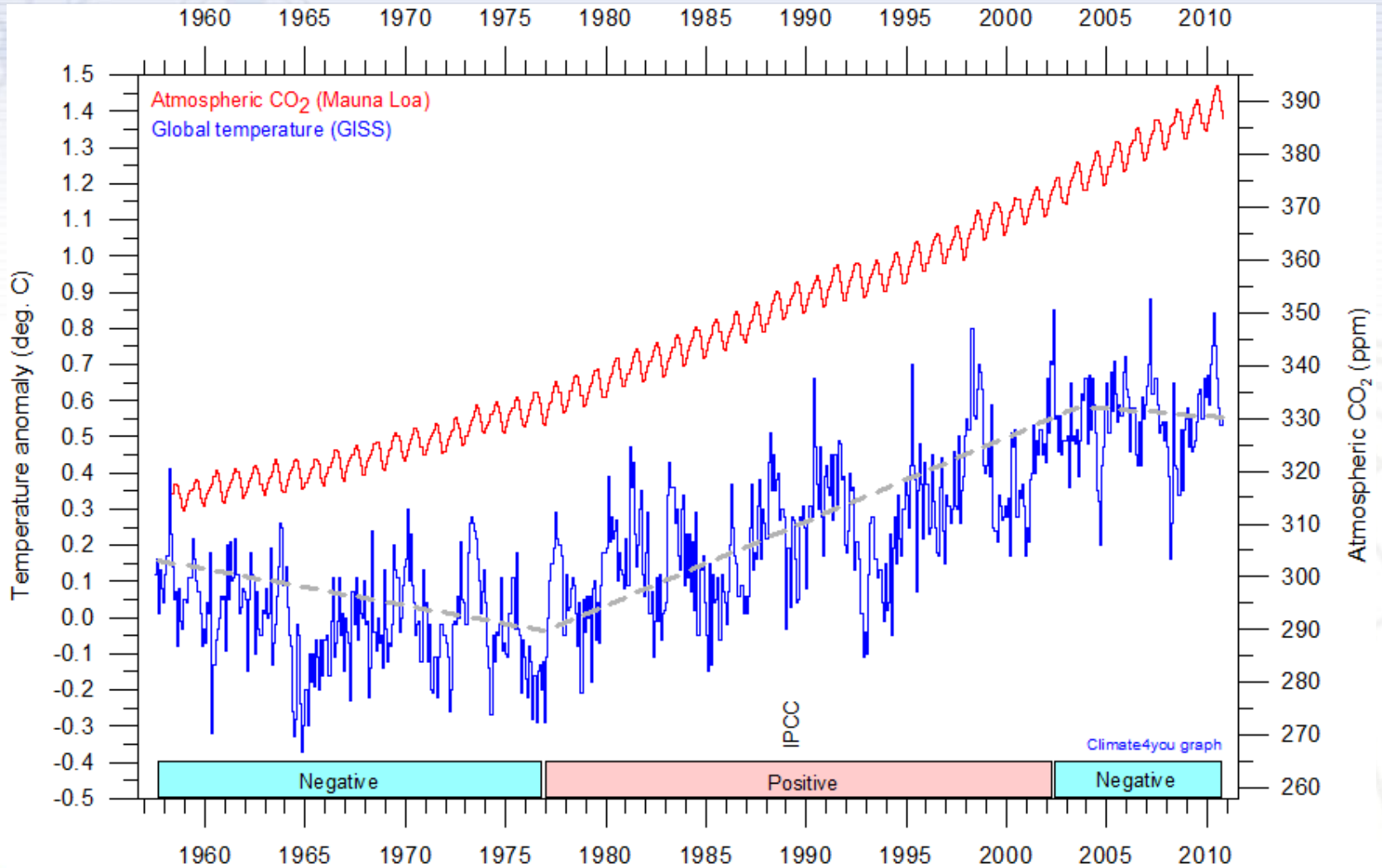
Antarctica Glacier Retreat Creates New Carbon Dioxide Store; Has Beneficial Impact on Climate Change

: the recent and rapid melting of ice shelves and glaciers around the Antarctic Peninsula → open water → large blooms of tiny marine plants called phytoplankton are flourishing → plankton dies and sinks to the seabed

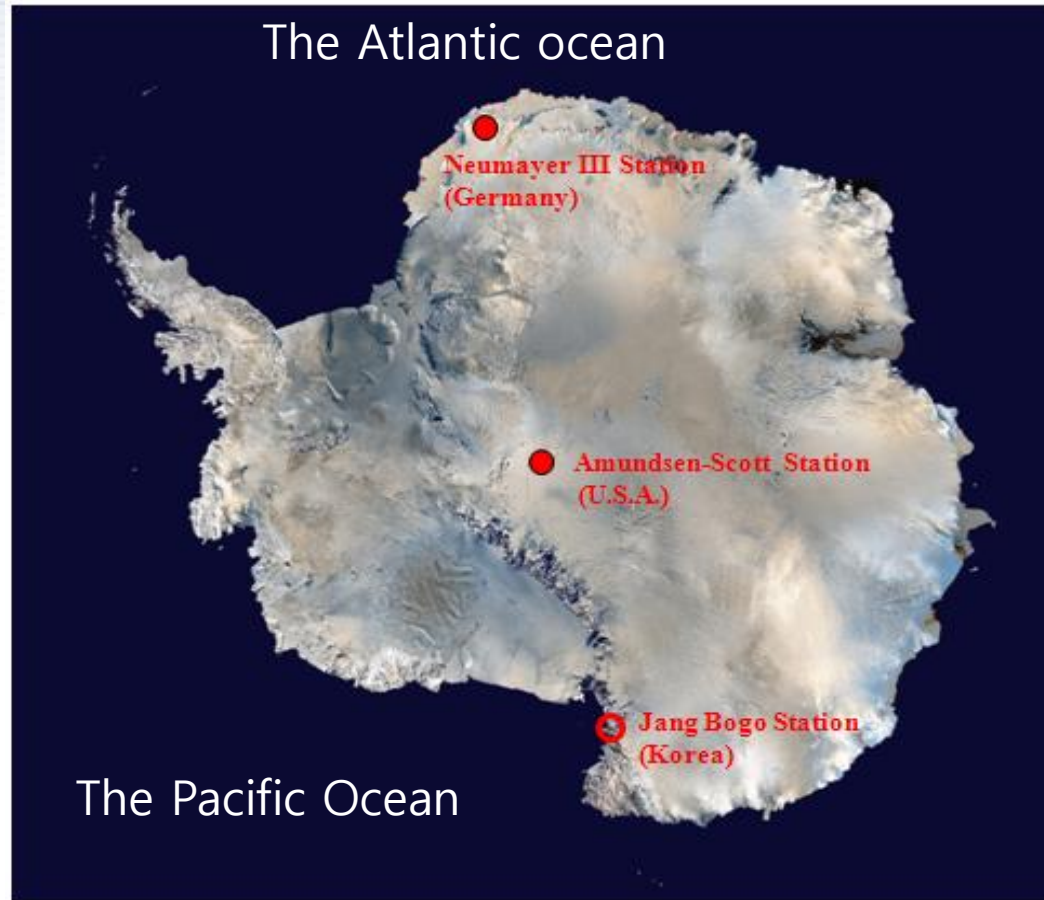
New natural sink of an estimated 3.5 million tones of carbon from the ocean and atmosphere each year



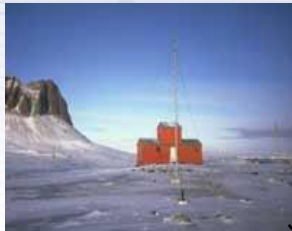
Public education



Preparation for the measurements
at the Korean 2nd Antarctic Station



Contribution of Korean to GAW Programs



Jubany(Argentina)



Halley VI(United Kingdom)



Neumayer III(Germany)



Syowa (Japan)



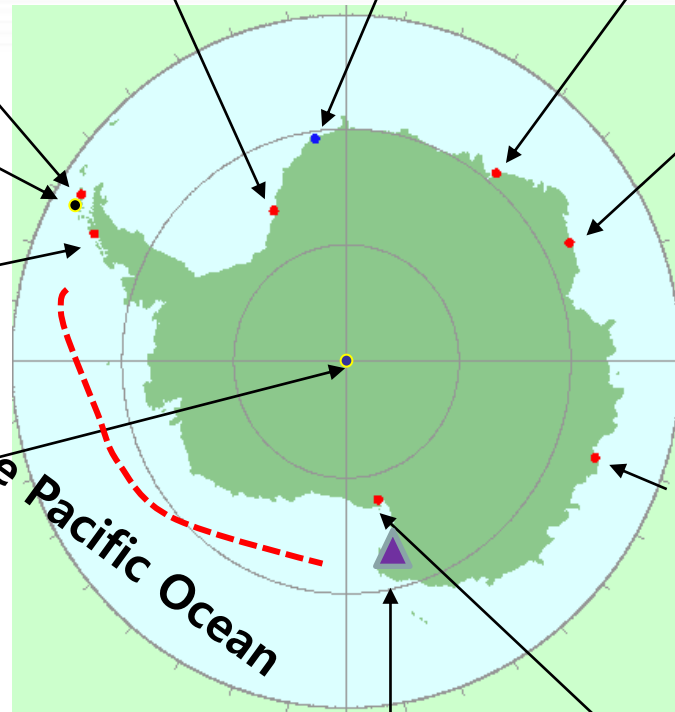
King Sejong (Korea, 2010 ~)



Palmer (United States)



South pole (United States)



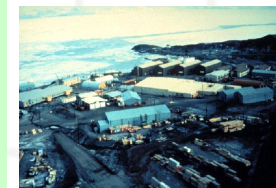
The Pacific Ocean



Mawson (Australia)



Casey (Australia)



McMurdo (United States)

The Korean 2nd Antarctic Stn.
(Jang Bogo, 2014 ~)

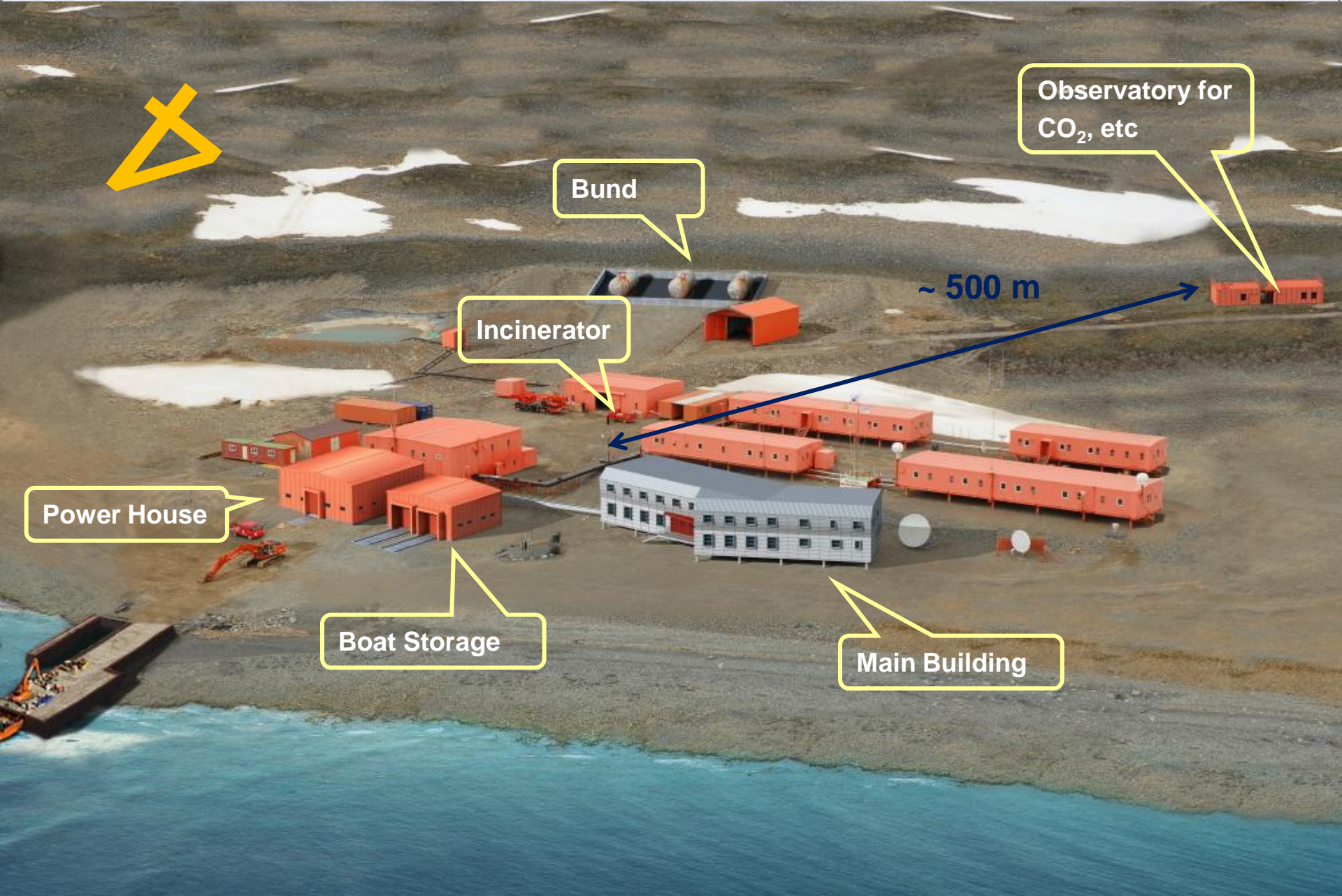
/Arrival Heights (New Zealand)

1. The Site



- The King Sejong Station ($62^{\circ}13'S/58^{\circ}47'W$)
- Temperature: $-1.7^{\circ}C$
- Wind speed: 7.9 m/s
- Wind direction: NW~E
- Pressure: 989.3 hPa





Observatory for
CO₂, etc

Bund

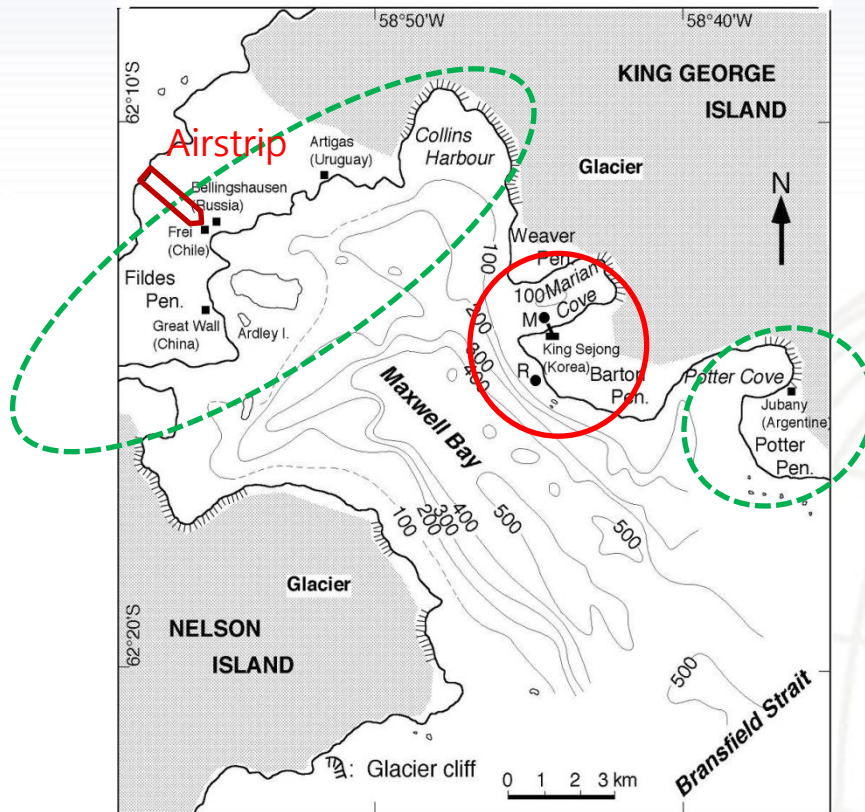
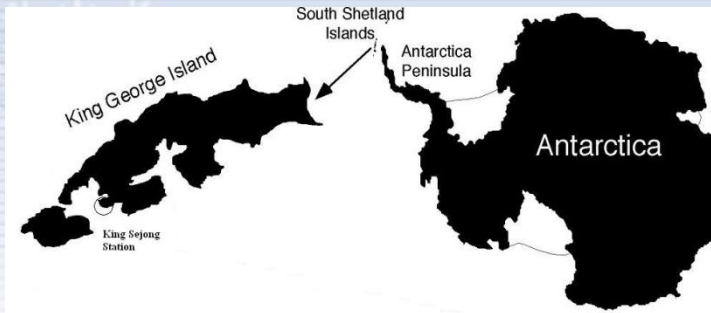
~ 500 m

Incinerator

Power House

Boat Storage

Main Building



2. Measurements

- Instrument: Cavity Ring-Down Spectrometer(G-1200)
- Variables: CO₂
- Installed on December in 2009
- Sampling rate: < 0.5 Hz
- Flow rate: 300 ml/min.
- Calibration: the National Standard CO₂ Gases of 361.68 and 383.69 ppm at an intervals of 15 days
- Raw data to be corrected numerically by using the obtained linear regressions

CRDS Measurements System

Inlet



Dehumidification



CO₂ Calibration
flow controller



CRDS



Pump



Other Measurement Systems

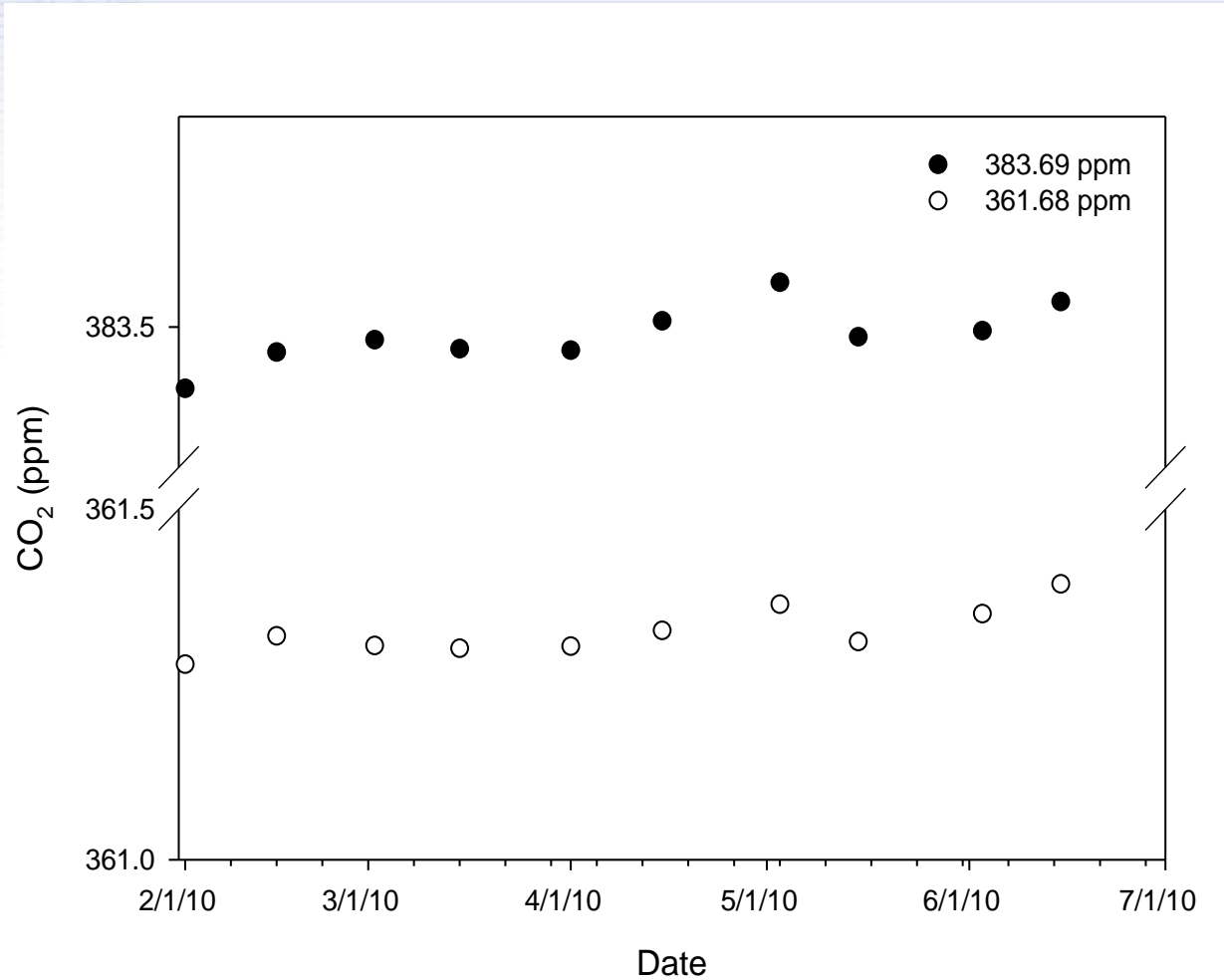


CO₂ concentration measurements
based on NDIR

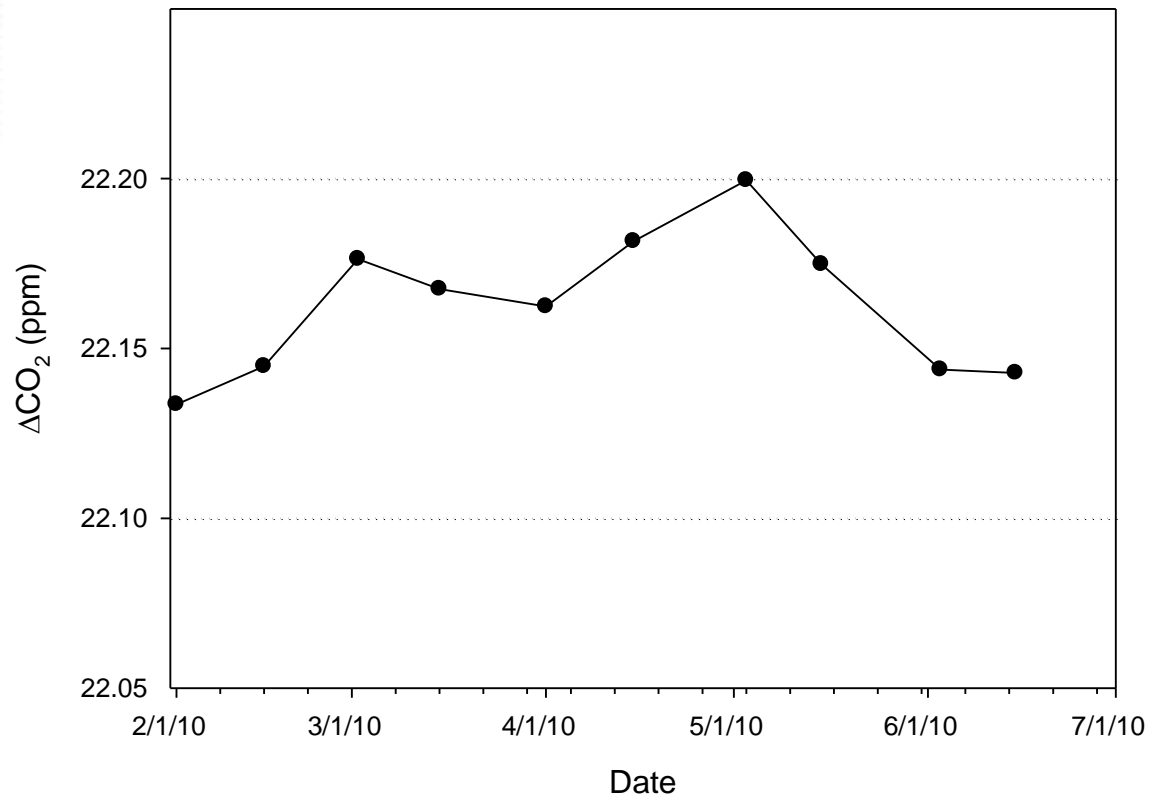


Aerosol measurements

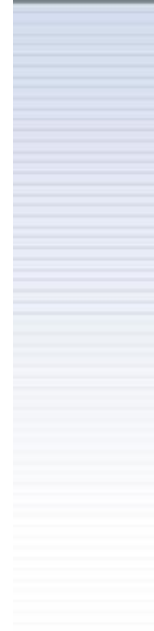
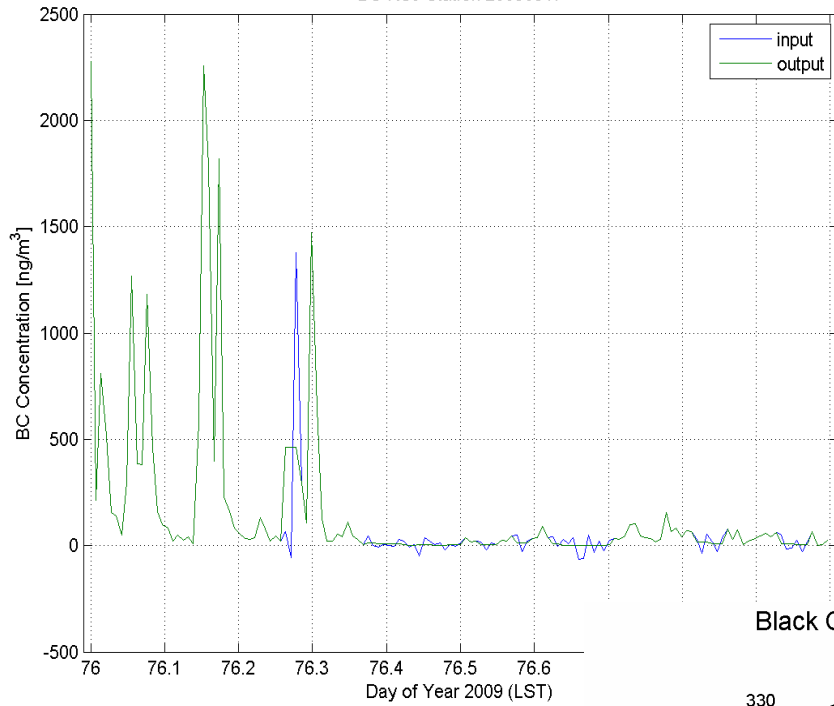
3. Results



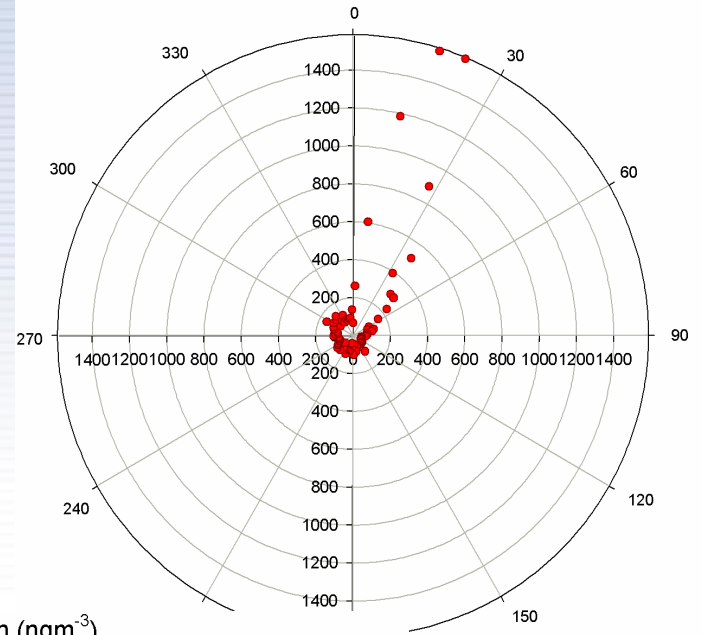
The variation of the measured two CO₂ concentration difference over six months (< 0.1 ppm)



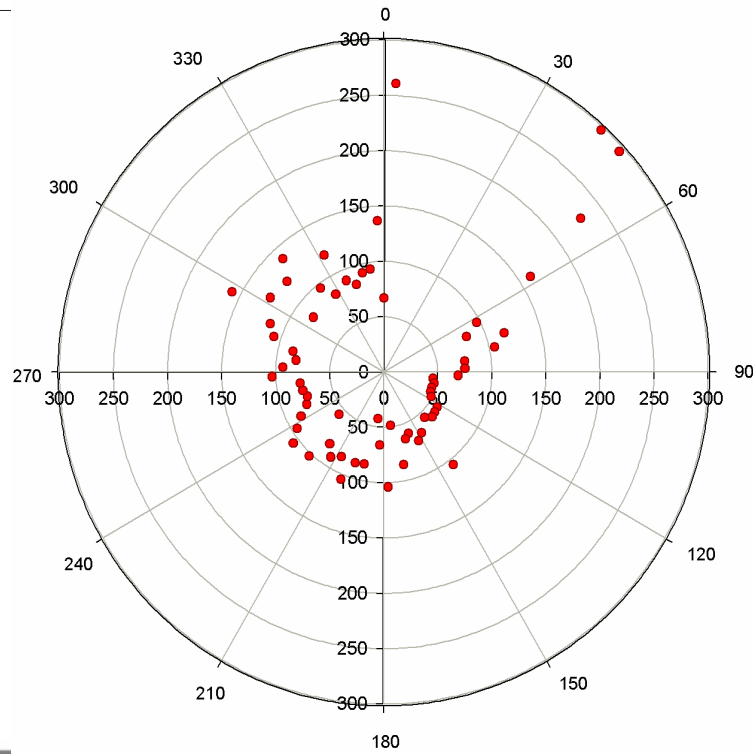
BC KSJ Station 20090317



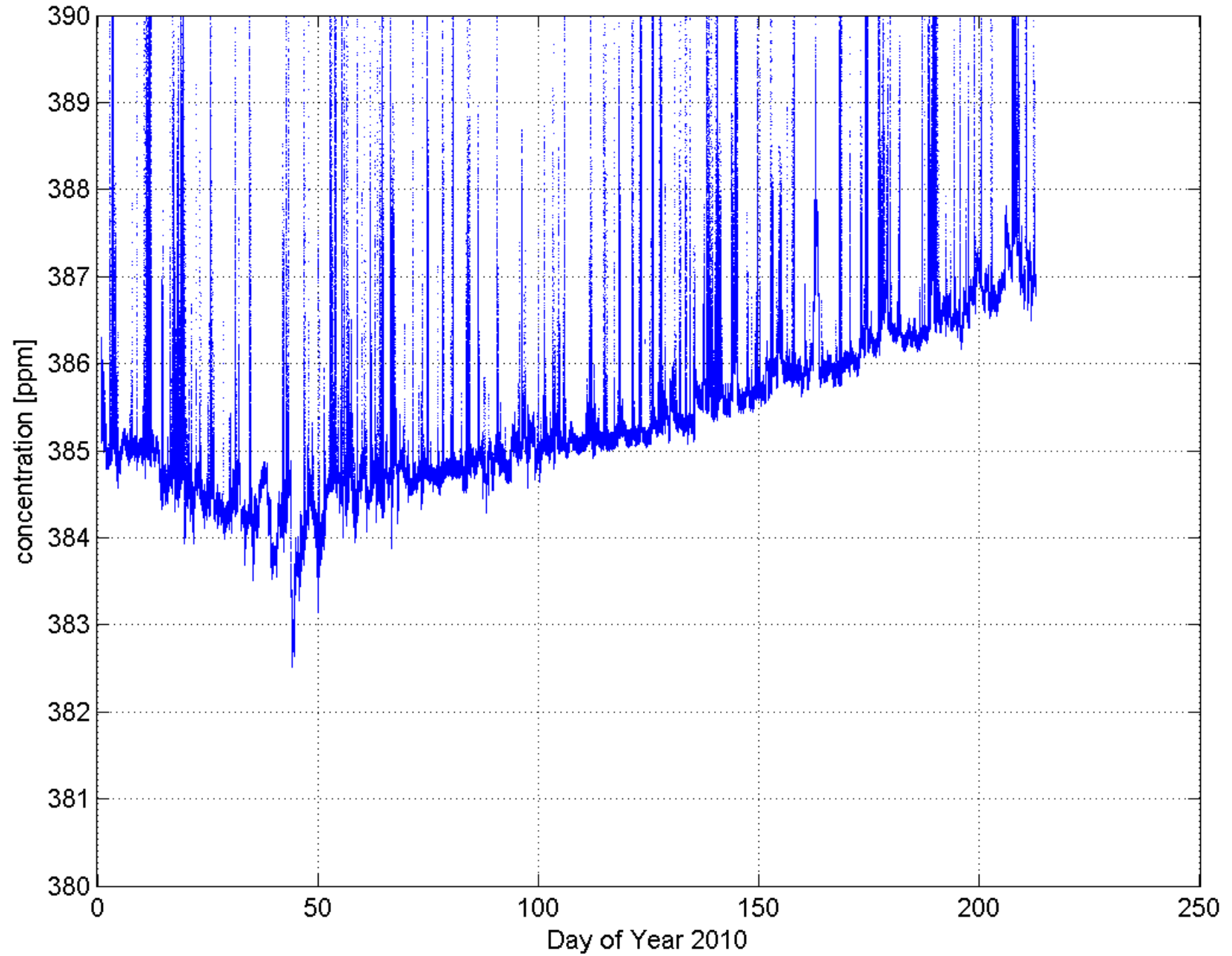
Black Carbon concentration (ngm^{-3})



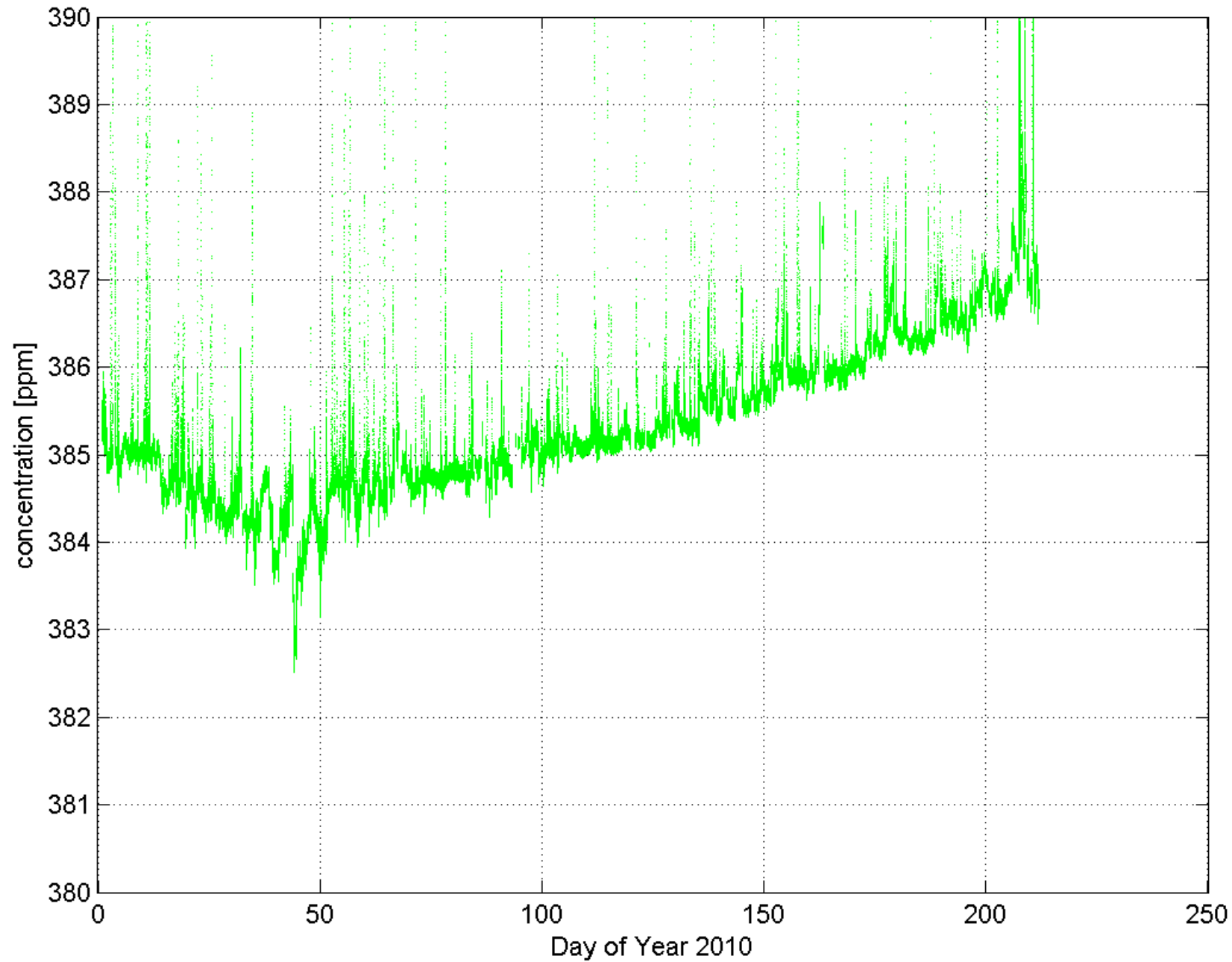
Black Carbon concentration (ngm^{-3})



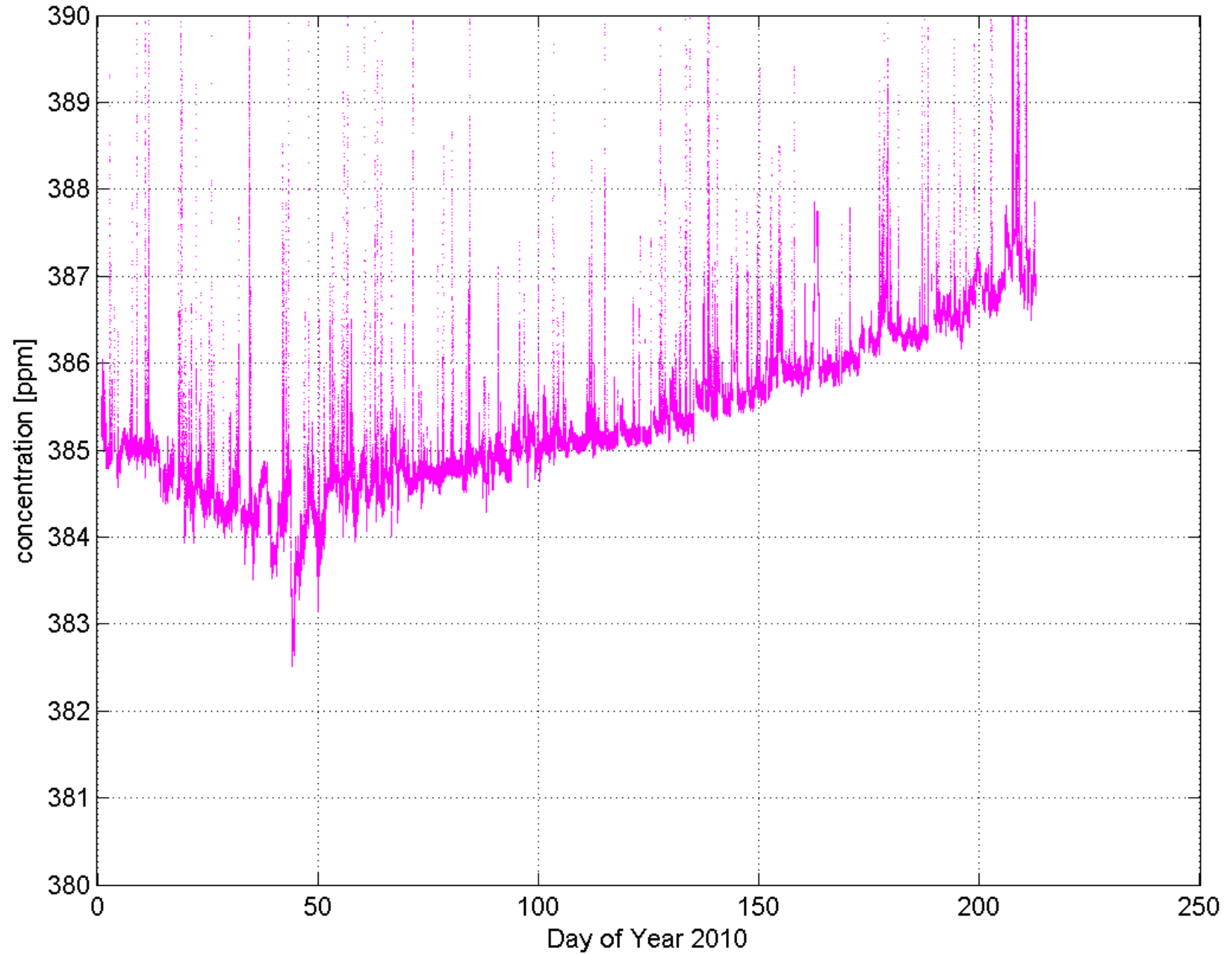
KSJ CO₂ 2010.



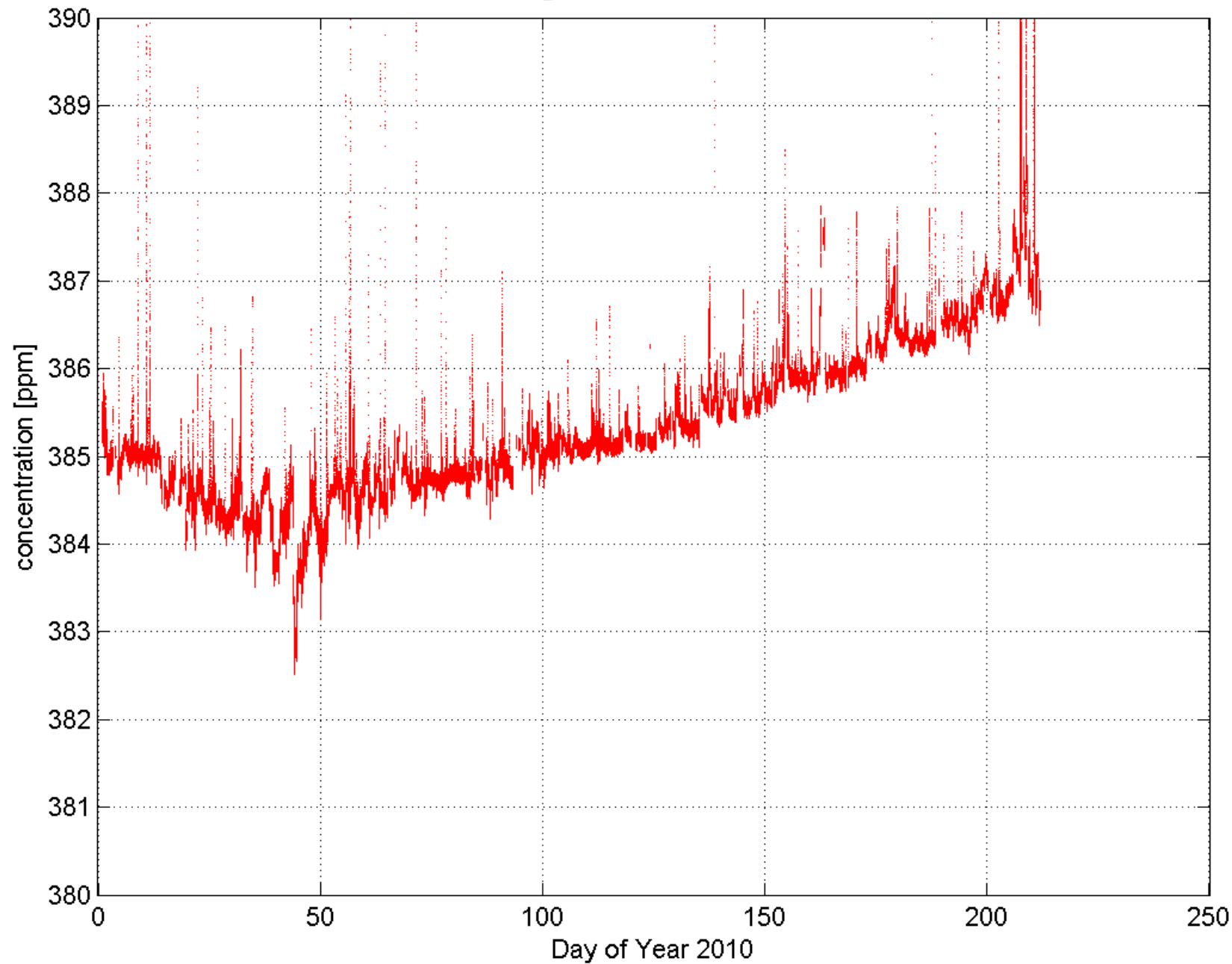
KSJ CO₂ 2010. BC filtering



KSJ CO₂ 2010. Wind filtering



KSJ CO₂ 2010. BC & Wind filtering



4. Plans

- Registration of GAW Regional Station in 2010
- Air Sampling at the KSJ and Analysis for the manufacture of accurate and precision standard gases
- Data submission to GAW in 2011

- Installation and Test of Fast response CRDS on the IBRV, ARAON
- Strategy on measurements at the Korean 2nd Antarctic Station

Ice-Breaking Research Vessel "ARAON"

Multi-species Analysis

The Global
Gold
Standard.

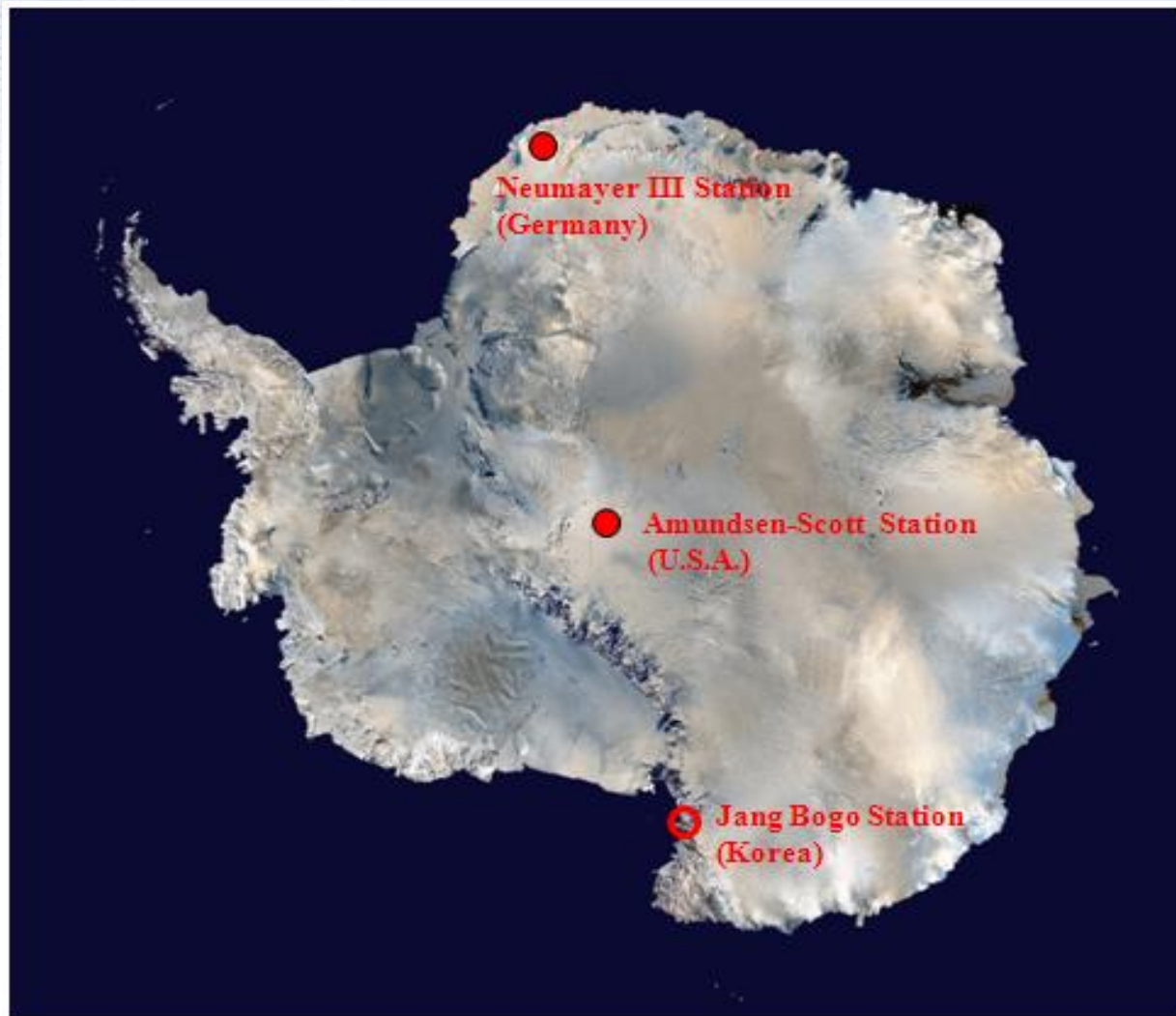


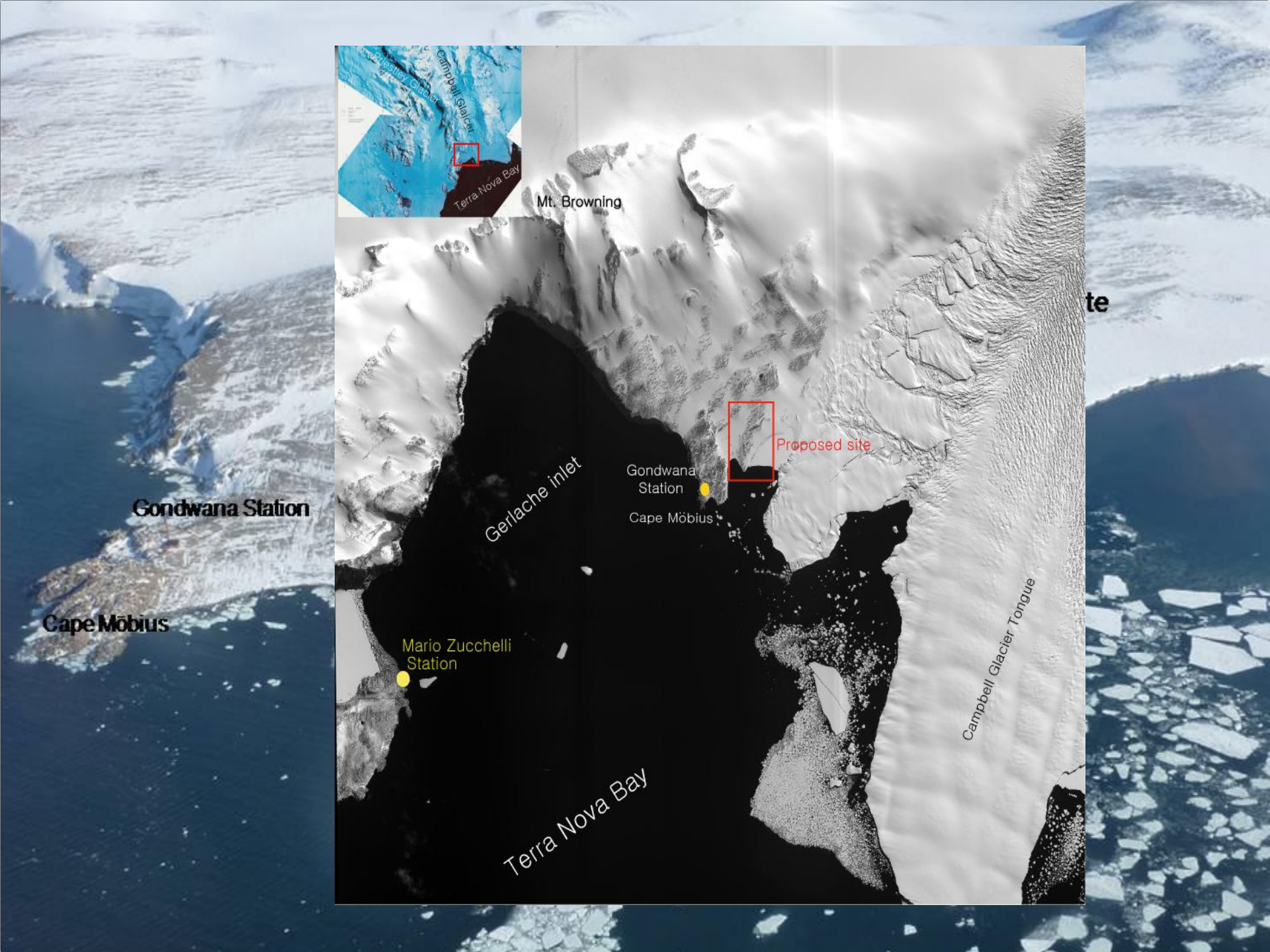
[Home](#)

CRDS Analyzer for CO₂/CH₄/H₂O in air - Model G2301

Air-Sea Fluxes/Background Concentration

Jang Bogo Antarctic Research Station





Gondwana Station

Cape Möbius

Mario Zucchelli
Station

Gondwana
Station
Cape Möbius

Proposed site

Gerlache inlet

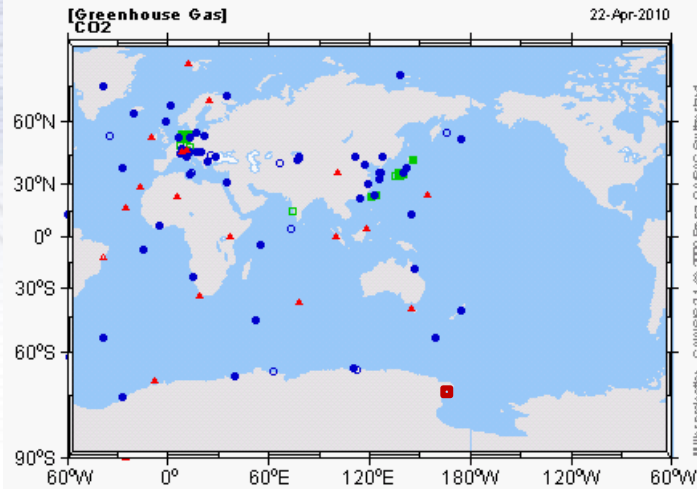
Mt. Browning

Terra Nova Bay

Campbell Glacier Tongue



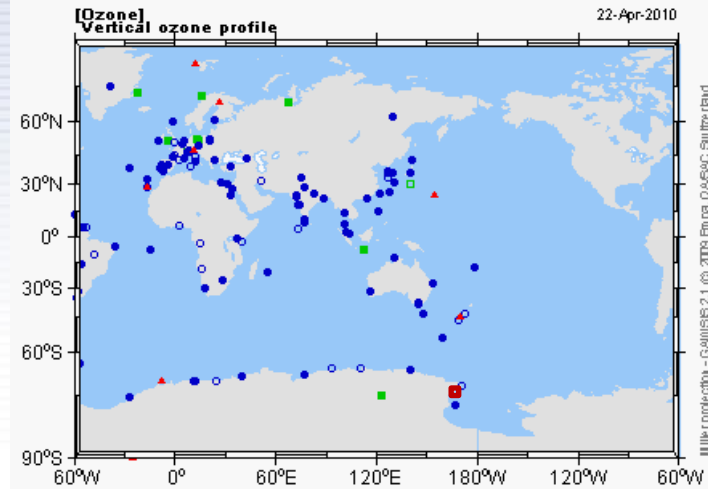
Global and Regional GAW stations



■ The Korean New Stn.



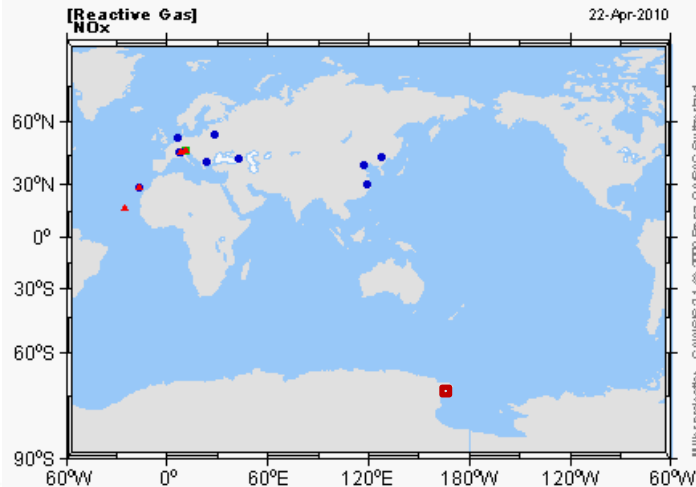
- ▲ GAW Global Station
 - GAW Regional Station
 - Contributing Station
- Open symbols denote closed or inactive stations.



■ The Korean New Stn.



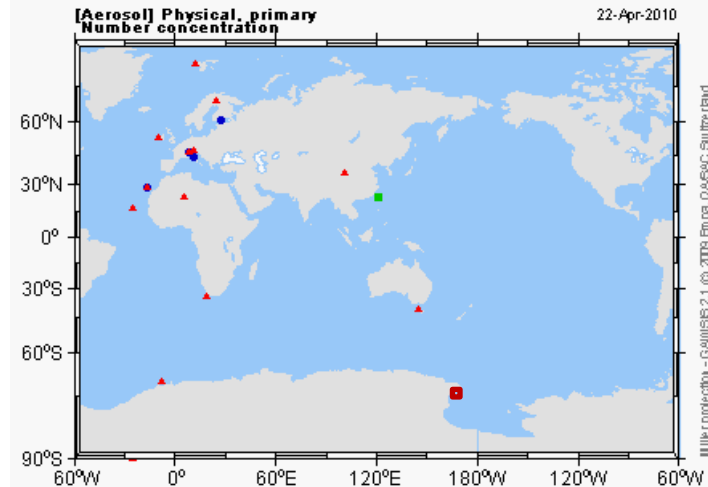
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■ The Korean New Stn.



- ▲ GAW Regional Station
 - Contributing Station
- Open symbols denote closed or inactive stations.

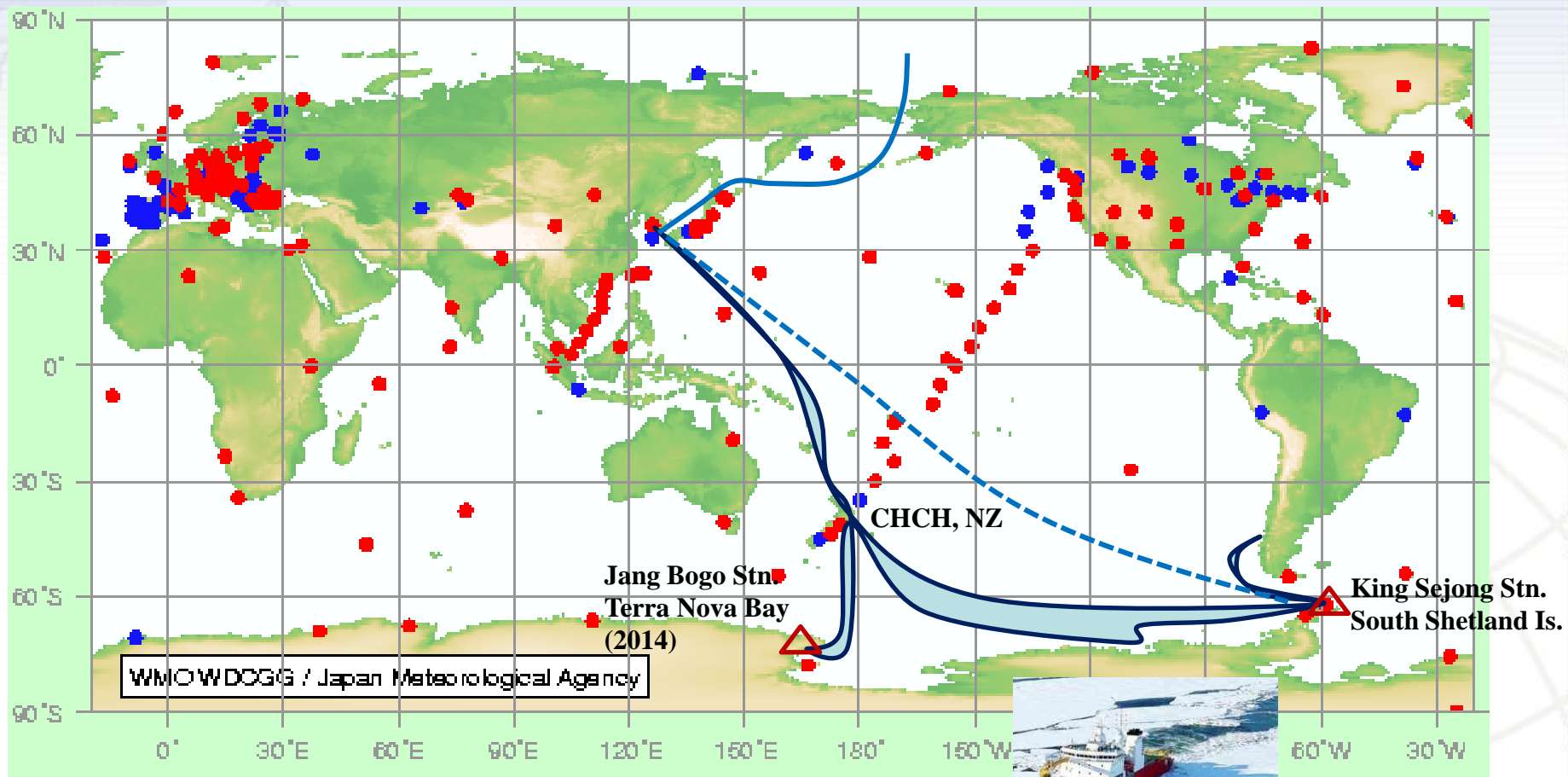


■ The Korean New Stn.

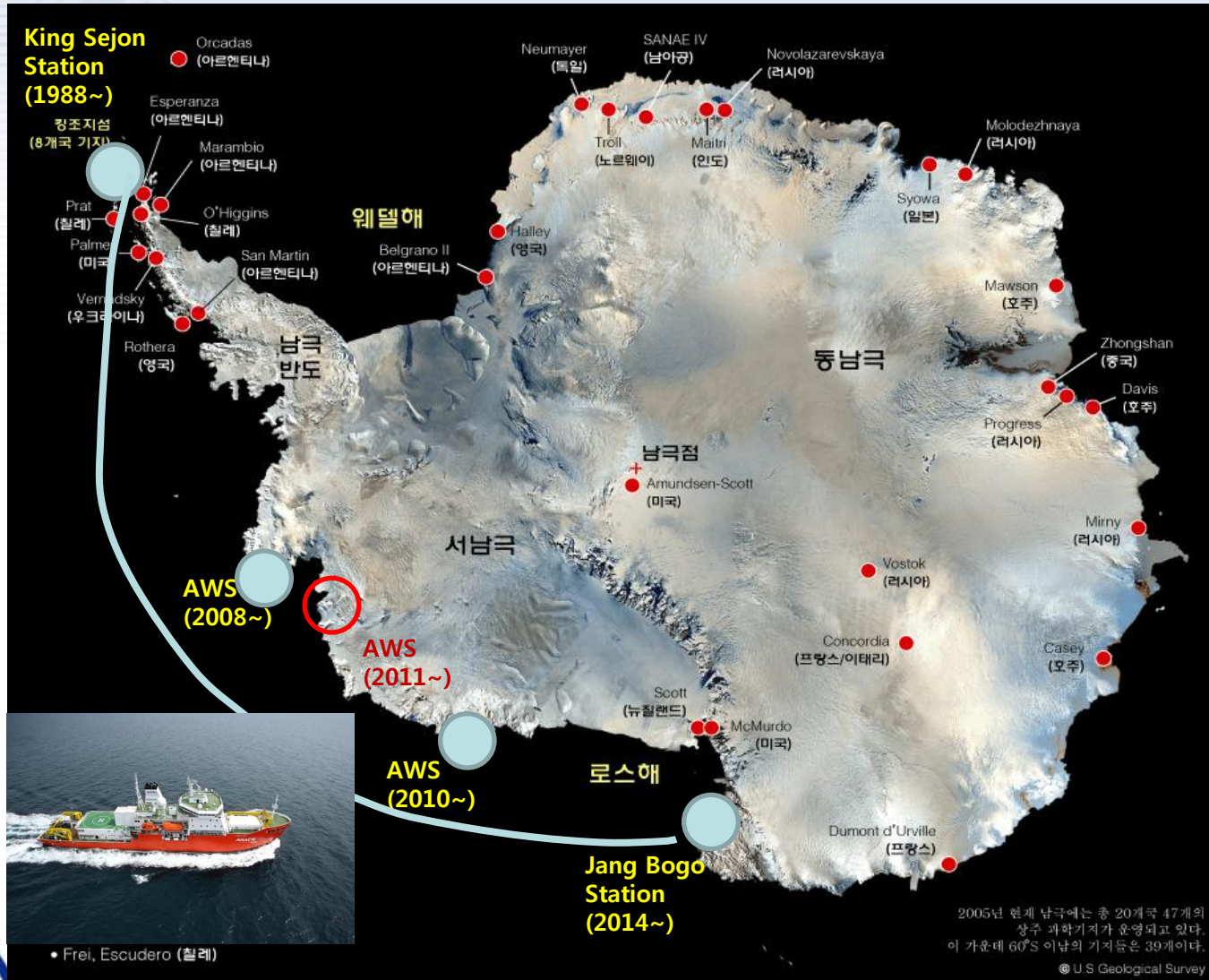


- ▲ GAW Global Station
 - GAW Regional Station
 - Contributing Station
- Open symbols denote closed or inactive stations.

Enhanced measurements on the Pacific side of Antarctica



Antarctic Research Infrastructure of KOPRI



Timeline

<p>Intercomparison experiment between CRDS and NDIR at KMA GAW Station →</p> <p>CRDS setup at the King Sejong Station →</p>	<p>2009</p>	<p>IBRV (ARAON)</p>
<p>Continuous measurements of CO₂ concentration at the King Sejong Station →</p> <p>Registration of King Sejong Station as a GAW station →</p>	<p>2010</p>	<p>← Development of on-board eddy covariance technique</p>
<p>Antarctic Stations</p>	<p>2011</p>	<p>← Fast response CRDS setup at the ice-breaking R/V</p> <p>← On-board CO₂ flux/Concentration measurements</p>
	<p>2012</p>	<p>← Continuous measurements of CO₂ concentration at the Icebreaker</p> <p>← Intensive measurements of CO₂ flux at the Icebreaker</p>
	<p>2013</p>	<p>← Registration of the Icebreaker as a GAW station</p>
<p>CRDS installation at the 2nd Korean Antarctic Station →</p>	<p>2014</p>	

Thank you !

