Time-Series Observations of pCO_2 and Relevant Parameters at King Sejong Station in the Antarctica

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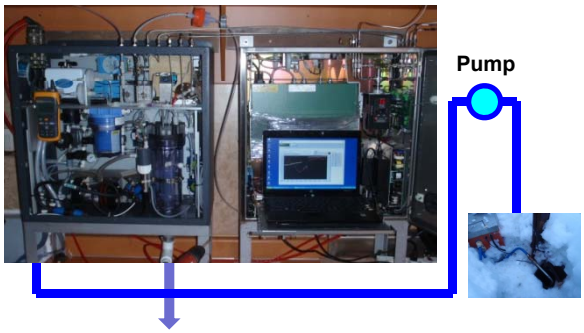


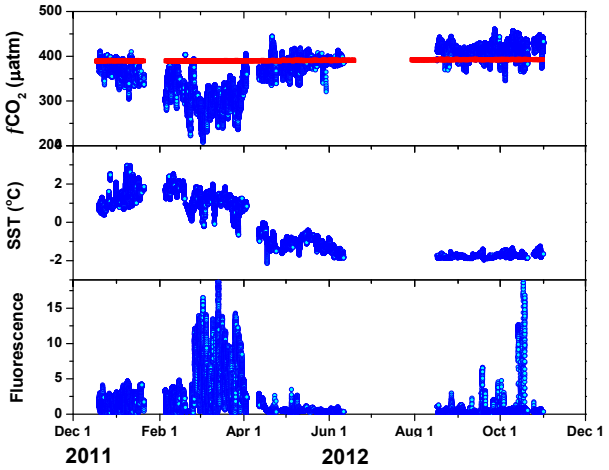
King Sejong Station

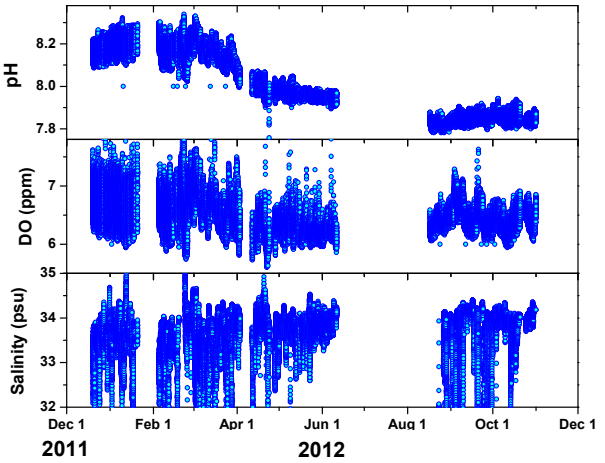
- Located in King George Island (62˚ 13' S, 58˚ 47' W), the largest island among the South Shetland Islands lying at the northern part of the Antarctic Peninsula.
- Surrounded by Maxwell Bay and Marian cove which is connected to the Drake Passage to the north and Bransfield Strait to the south.
- Sea-ice covers the coastal seas surrounding the station during austral winter season (Jul – Oct).
- Wind blows predominantly from north or northwest at ~7 m/s on average. Over 40 m/s of blizzard occasionally strikes the station.

pCO_2 Measurement System

- Seawater was supplied by a series of pumps from the inlet located in the pier of the station.
- The analytical system (General Oceanics Inc.) is composed of 3 modules of dry box, wet box, and deck box for satellite communication (Pierrot et al, 2009, Deep-Sea Res.).
- Seawater enters at 3 – 4 L/min to the two-stage equilibrator through 0.2 mm mechanical filter and auxiliary sensors (temperature, salinity, DO, pH, fluorescence).
- Equilibrated head space air was circulated through NDIR detector (LI-7000, LiCor Inc.) of close loop at ~100 mL/min
- The analytical system is calibrate with zero air and 3 standard gases whose concentrations were adjusted to NOAA scale.
- in-situ temperature, salinity, and fluorescence of seawater is monitored by immersing the sensors under the seawater at the pier.

Preliminary Results





• **fCO_2** (blue on top panel) ranges between 200 and 450 µatm, lower values being observed during austral fall season (Feb – Mar) when phytoplankton bloom took place based on in-situ measurements of chlorophyll fluorescence at the pier (bottom panel). Change in seawater temperature does not influence seasonality of fCO_2, indicating minimal impact of solubility pump. Seawater was supersaturated during austral winter and spring season (May – Nov). Since floating sea-ice or iceberg cover the coastal area during this season, CO_2 emission from the seawater would be minimal.

• Atmospheric dry mole fraction of **CO_2** (red on top panel) varied between 389 and 393 ppm, lower values during the late austral summer (Feb) and high values late winter (Oct)

• In-situ seawater surface temperature (**SST**) reached up to 2.5 °C at early February and then decreased down to seawater freezing point of ~-2 °C in winter.

• According to the In-situ **fluorescence**, phytoplankton was high during summer and early fall (Dec – Mar) with blooming in March. fCO_2 was recorded at low during the same period indicating active biological pump in the coastal area of King George island. High fluorescence was occasionally detected early spring (Oct), but fCO_2 did not change proportionally.

• **pH** of seawater was monitored at the in-line flow system before the pCO_2 equilibrator. The annual trend of pH mirrors that for fCO2 in general, although it is visible that increase of seawater temperature increases pH early February

• Dissolved oxygen (**DO**) was also monitored at the in-line system. High frequent noise does not allow to isolate short-term variation. However, it is visible that high DO coincides with low fCO_2 and high pH, and vice versa in the long-term variation, which supports biological pump to be main driver of fCO_2 in the coastal seas surrounding the King Sejong Station.

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