Methods from: Tortell, P. D., Asher, E. C., Ducklow, H. W., Goldman, J. A. L., Dacey, J. W. H., Grzymski, J. J., Young, J. N., Kranz, S. A., Bernard, K. S., & Morel, F. M. M. (2014). **Metabolic balance of coastal Antarctic waters revealed by autonomous pCO_2 and $\Delta O_2/Ar$ measurements.** Geophysical Research Letters, 41(19), 6803– 6810. doi:10.1002/2014GL061266

Dissolved gases were measured using membrane inlet mass spectrometry (MIMS), [Tortell, 2005] in seawater from the unfiltered seawater pump supply (SWP) drawn from 6 m depth in Arthur Harbor, adjacent to the PAL-LTER laboratories (Figure S1 in the supporting information). Temperature-controlled seawater standards were used to calibrate pCO2 and biological O2 saturation (ΔO2/Ar) measurements [Tortell et al., 2011]. ΔO2/Ar represents the percent deviation in the seawater O2/Ar ratio from air equilibrium, with Ar normalization used to remove physical (e.g., temperature dependent) effects on O2 saturation state [Craig and Hayward, 1987]. We used a simple mass balance approach to derive estimates of NCP from daily mixed layer changes in ΔO2/Ar [Kaiser et al., 2005]. In the absence of strong lateral and vertical inputs (discussed below), the change in mixed layer ΔO2/Ar represents the combined effects of NCP (J_{bio}) and sea-air gas exchange (J_{ex}).

$dO_2/Ar/dt = J_{bio} + J_{ex}$ (1)

Using a 1 h averaging time step, we computed the rate of change in surface ΔO2/Ar (i.e., [ΔO2/Art ΔO2/Art1]/Δt), and the associated sea-air flux term using a wind speed dependent gas exchange coefficient [Wanninkhof, 1992]. Hourly rates of NCP were derived from the observed change in ΔO2/Ar, corrected for sea-air flux, and integrated over a 24 h period to obtain daily NCP estimates (mmol O2 m3 d1). NCP was converted into C units assuming a photosynthetic quotient of 1.0, derived from an analysis of diel changes in O2 and dissolved inorganic carbon (DIC) concentrations (described below) during each daily cycle.

Additional measurements were collected in semiweekly samples at PAL-LTER Station B (Figure S1), located 1 km from the SWP intake. Depth profiles of temperature and salinity were obtained using a Seabird SBE 19plus SeaCAT Profiler, while macronutrient and chlorophyll a (Chl a) concentrations (used as a metric of total phytoplankton biomass) were measured in 10 m depth seawater samples following standard Joint Global Ocean Flux Study protocols [Knap et al., 1996]. Total alkalinity was measured via potentiometric titration of HgCl2-preserved samples [Brewer et al., 1986], calibrated against certified standards (supplied by Dr. Andrew Dickson, Scripps Institution of Oceanography). Dissolved inorganic carbon was computed from measured pCO2 and alkalinity using CO2SYS [Pierrot et al., 2006] with the equilibrium constants of Mehrbach et al. [1973] refit by Dickson and Millero, [1987].

Measurements of the maximum quantum yield of Photosystem II (PSII) charge separation (Fv/Fm) were performed using an in situ Fluorescence Induction and Relaxation system (FiRe, Satlantic) following published methodologies [Gorbunov et al., 1999]. The instrument was connected in flow-through mode to the SWP in parallel with the MIMS sampling line. Net primary production was measured in ~10 m depth seawater samples from Station B using 24 h 14C incubations [Knap et al., 1996]. Incubation bottles for productivity measurements were held in an outdoor flow-through incubator with one layer of neutral density screening (~50% of surface irradiance). Surface PAR levels (i.e., photosynthetically active radiation; 400–700 nm wavelength) and wind speed data were obtained from the meteorological sensors on top of the Palmer Station Terra Laboratory.

Krill abundances were determined between December and February using acoustic surveys [Bernard and Steinberg, 2013] along a standard set of transects around Palmer Station. Daily krill grazing rates (mg Chl a m2 d1) were estimated as the product of depth-integrated abundances and a mean specific ingestion rate (3.6 µg Chl a ind.1 d1 [Bernard et al., 2012]). Additional measurements of microzooplankton grazing rates were obtained from five dilution experiments [Landry et al., 1995] conducted over the course of the sampling season.