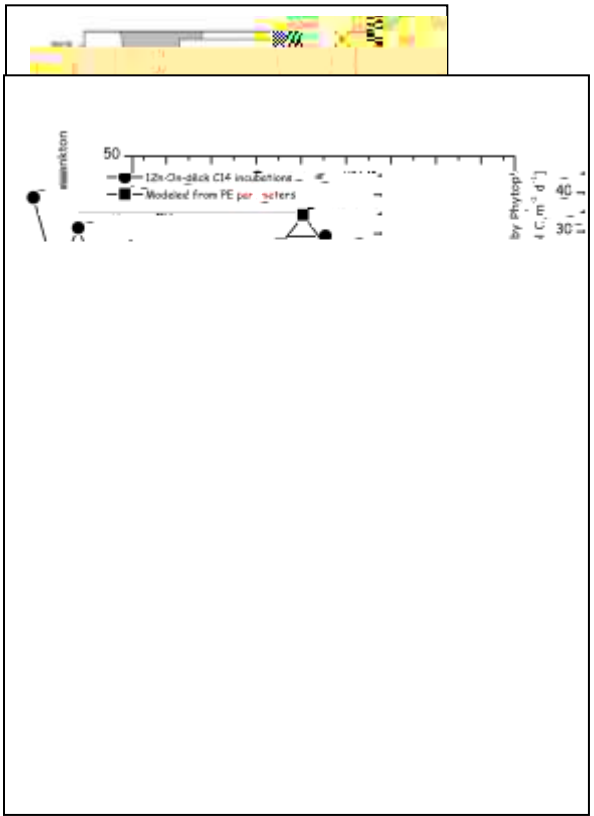
Photosynthesis and carbon dioxide uptake in the Southern Ocean: The Southern Ocean Gas Exchange Experiment (SO GasEX). Dr. Robert Vaillancourt (co-I, J. Marra, P.I., Brooklyn College of NY, and V. Lance, post-doctoral research scientist, LDEO). Funding provided by NASA.

Carbon Dioxide (CO_2) while a minor constituent of Earthôs atmosphere (~0.03%) plays a disproportionally large role in regulating Earthôs surface temperature. For the previous 200 years, humans have been increasing the atmospheric concentration of CO_2 , and thus its effect on climate, through the burning of fossil fuels oil, coal, and natural gas. The world ocean has absorbed a large portion of this óanthropogenic CO_2ô, but the exact rate of uptake is not certain. Dr. Robert Vaillancourt and colleagues recently participated in a multi-investigator program, The Southern Ocean Gas Exchange Experiment (SO GasEx) to study the rate at which CO_2 from the atmosphere enters the ocean. Our study site was at the boundary between the southern Atlantic Ocean and the Southern Ocean, east of the southern tip of South America, aboard the NOAA Research Vessel, the *Ronald H. Brown* (Figure 1). The contribution of our team was to determine the amount of CO_2 drawn down by phytoplankton through the process of photosynthesis. A patch of water was infused with tracer (SF_6 & ^3H) and its biogeochemical properties were analyzed for a 15-day period. We performed daily measurements of CO_2 uptake by phytoplankton using a combination of simulated *in-situ* incubations (Figure 3) and photosynthesis-irradiance experiments (Figure 4), using radioactive carbon dioxide (^{14}C-CO_2) as a tracer. Greater than 95% of the plant biomass and CO_2 uptake by phytoplankton was observed in the surface layer (Figure 2). We observed 3-to-4-fold variations in daily CO_2 draw-down during the 15-day period. Total CO_2 removal by plant photosynthesis is estimated at 439 mmol C m^{-2} and was confined to the surface mixed layer during the 15-day period. A portion of this ófixedô CO_2 wa



C) is maintained by means of circulating water/propylene glycol mixture through the incubation chambers. The photosynthetron can measure CO_2 uptake rate in one hour in 120 samples simultaneously.