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TITLE: Biogeochemical variations at the Porcupine Abyssal Plain sustained Observatory in the northeast Atlantic Ocean, from weekly to inter-annual timescales

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ABSTRACT:

Abstract. We present high-resolution autonomous measurements of carbon dioxide partial pressure $p(\text{CO}_2)$ taken in situ at the Porcupine Abyssal Plain sustained Observatory (PAP-SO) in the northeast Atlantic (49° N , 16.5° W ; water depth of 4850 m) for the period 2010–2012. Measurements of $p(\text{CO}_2)$ made at 30 m depth on a sensor frame are compared with other autonomous biogeochemical measurements at that depth (including chlorophyll *a* fluorescence and nitrate concentration data) to analyse weekly to seasonal controls on $p(\text{CO}_2)$ flux in the inter-gyre region of the North Atlantic. Comparisons are also made with in situ regional time series data from a ship of opportunity and mixed layer depth (MLD) measurements from profiling Argo floats. There is a persistent under-saturation of CO_2 in surface waters throughout the year which gives rise to a perennial CO_2 sink. Comparison with an earlier data set collected at the site (2003–2005) confirms seasonal and inter-annual changes in surface seawater chemistry. There is year-to-year variability in the timing of deep winter mixing and the intensity of the spring bloom. The 2010–2012 period shows an overall increase in $p(\text{CO}_2)$ values when compared to the 2003–2005 period as would be expected from increases due to anthropogenic CO_2 emissions. The surface temperature, wind speed and MLD measurements are similar for both periods of time. Future work should incorporate daily CO_2 flux measurements made using CO_2 sensors at 1 m depth and the in situ wind speed data now available from the UK Met Office Buoy.

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