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# Atmospheric oxygen and carbon dioxide observations from two European coastal stations 2000–2005: continental influence, trend changes and APO climatology

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Abstract. Seeking for baseline conditions has biased the atmospheric carbon dioxide ($CO_2$) and later on also oxygen ($O_2$) monitoring networks towards remote marine stations, missing part of the variability that is due to regional anthropogenic as well as land biotic activity. We present here a five-year record of atmospheric $CO_2$ concentrations and oxygen/nitrogen ($O_2/N_2$) ratio measurements from the coastal stations Lutjewad (LUT), The Netherlands and Mace Head (MHD), Ireland, derived from flask samples. $O_2/N_2$ ratios, a proxy for $O_2$ concentrations, concurrently measured with $CO_2$ concentrations, help determine regional $CO_2$ fluxes by separating land fluxes from sea fluxes. Mace Head is the closest marine baseline station to Lutjewad, located at the same latitude, and therefore is taken as a reference. During the studied period, from 2000 until 2005, we observed an average increase of $CO_2$ in the atmosphere of (1.7±0.2) ppm $y^{-1}$, and a change of the $O_2/N_2$ ratio of (−20±1) per meg $y^{-1}$. The difference between the $CO_2$ summer minimum and the winter maximum is 14.4 ppm and 16.1 ppm at Mace Head and Lutjewad, respectively, while the paraphase variation in the $O_2$ signal equals 113 per meg and 153 per meg, respectively. We also studied the atmospheric potential oxygen (APO) tracer at both stations. By this analysis, evidence has been found that we need to be careful when using APO close to anthropogenic $CO_2$ sources. It could be biased by combustion-derived $CO_2$, and models need to take into account daily and seasonal variations in the anthropogenic $CO_2$ production in order to be able to simulate APO over the continents.

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