This dataset includes high frequency paired measurements of dissolved O2 and CO2 concentrations at the surface (0.5 to 2 m depth) of 11 lakes in the Northern Hemisphere. Measurements were taken every 2 hours in summer (July and August) of various years depending on lakes (between 2011 and 2014). The dataset is used to test a conceptual framework on the controls of coupling and decoupling of these two gases. In all lakes dissolved CO2 was measured with infrared analyzer coupled with a diffusion membrane and dissolved O2 with optodes. All gas measurements are paired with water temperature provided by one of the gas probe (usually from the O2 probe).