Geophysical Research Abstracts
Vol. 21, EGU2019-1776, 2019
EGU General Assembly 2019

Fe(II) oxidation kinetics in the North Atlantic along the 59.5° N during 2016

Carolina Santana-González (1), J. Magdalena Santana-Casiano (1), Melchor González-Dávila (1), Angelo Santana-del Pino (2), Sergey Gladyshev (3), and Alexey Sokov (3)

(1) Instituto de Oceanografía y Cambio Global, Universidad de Las Palmas de Gran Canaria, Las Palmas de Gran Canaria, Spain (csantg@live.com), (2) Departamento de Matemáticas, Universidad de Las Palmas de Gran Canaria, Las Palmas de Gran Canaria, Spain. , (3) Shirshov Institute of Oceanology, Russian Academy of Science, Russia.

The Fe(II) oxidation rate was studied in different water masses present in the subarctic North Atlantic ocean along the 59.5° N transatlantic section. Temperature, pH, salinity and total organic carbon (TOC) in natural conditions, fixed temperature conditions and both fixed temperature and pH conditions, were considered in order to understand the combined effects of the variables that control the Fe(II) oxidation kinetics in the ocean. The study shows that in natural conditions, temperature was the master variable, which controlled 75% of the pseudo-first order kinetics rate (k'). This value rose to 90% when pHF (free scale) and salinity were also considered. At a fixed temperature, 72% of k' was controlled by pH and at both fixed temperature and pH, salinity controlled 62% of the Fe(II) oxidation rate. Sources and characteristics of TOC are important factors influencing the oxidation of Fe(II). The organic matter had both positive and negative effects on Fe(II) oxidation. In surface and coastal waters, TOC accelerated k', decreasing the Fe(II) half-life time (t1/2). In Subpolar Mode Water, Labrador Sea Water (for the Irminger Basin) and Denmark Straight Overflow Water, TOC slowed down k', increasing Fe(II) t1/2. This shifting behaviour where TOC affects Fe(II) oxidation depending on its marine or terrestrial origin, depth and remineralization stage proves that TOC cannot be used as a variable in an equation describing k'. The temperature dependence study indicated that the energy requirement for Fe(II) oxidation in surface waters was 32% lower than the required for bottom waters at both pH 7.7 and 8.0. This variability confirmed the importance of the organic matter composition of the selected samples. The Fe(II) oxidation rate constants in the region can be obtained from an empirical equation considering the natural conditions of temperature, pHF and salinity for the area, producing an error of estimation of 0.0072 min^{-1}. This equation should be incorporated in global Fe models.