Jul 13th, 8:50 AM - 9:10 AM

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*International Environmental Modelling and Software Society (iEMSs)*
*8th International Congress on Environmental Modelling and Software*
*Toulouse, France, Sabine Sauvage, José-Miguel Sánchez-Pérez, Andrea Rizzoli (Eds.)*
*http://www.iemss.org/society/index.php/iemss-2016-proceedings*

# Machine Learning in Surface Ocean CO2 Mapping

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**Abstract:** Carbon dioxide (CO2) is a major greenhouse gas affecting long term global climate change. According to the Global Carbon Budget 2013 (Quéré et al., 2014, Earth Syst. Sci. Data, 6, 235–263), total global carbon emissions increased from 3.9 GtC/yr in 1959 to 10.7 GtC/yr in 2012, of which approximately 43% remained in the atmosphere, 30% went to terrestrial sinks, and 27% to the oceans. A method to estimate the oceanic sink is by calculating the air-sea CO2 exchange rate of CO2. While obtaining accurate distributions of the surface ocean CO2 (SOC) is critical to minimize uncertainty for this method, it is still a challenging task to achieve the goal due to scarce measurements and large temporal and spatial variability of SOC. Here we present monthly SOC maps for 1990-2015 with a spatial resolution of 1 by 1 degree. The results were obtained by three machine learning methods: feed-forward neural network, self-organization map, and support vector machine. They agree well with those submitted to the inter-comparison of Rödenbeck et al. (2015, Biogeosciences, 12, 7251–7278). We compare the differences of the methods and discuss their advantages and disadvantages.

***Keywords****: CO2, Ocean, SVM, Neural Networks.*