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Air-sea CO2 exchange estimation by reconstructing pCO2 distribution in the North Pacific using a neural network

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The North Pacific plays an important role for the anthropogenic CO_2 uptake due to biogeochemical effect. In order to estimate air-sea CO_2 flux in the North Pacific, National Institute for Environmental Studies (NIES) has operated comprehensive surface ocean CO_2 measurement in the mid-/high-latitude of North Pacific since 1995 utilizing volunteer observing ships, as well as in the western Pacific Ocean since 2006. In this study, we hypothesize that pCO_2 can be estimated through Self Organizing Map (SOM) with 4 parameters of SST, MLD, CHL and SSS datasets. SOM is a kind of Neural Network technique and it offers a kind of function which can express non linear and discontinuous relationships. As for applying to pCO_2 mapping, Telszewski et al. (2009) first applied to reconstruct monthly pCO_2 distribution in the North Atlantic for 3 years using with SST, MLD and CHL dataset as well as their observed pCO_2 dataset. In this study, over 73000 in situ pCO_2 data are used for reconstructing pCO_2 distribution from 2002 to 2008 using SOM technique. The values of reconstructed pCO_2 agree well with those of in situ measurements especially in the low/mid latitude area of the North Pacific. After the estimation, monthly air-sea CO_2 flux is calculated in each grid by using the equation that Sweeney et al. (2006) proposed. The averaged amount of annual air-sea CO_2 exchange for 7 years is estimated to be about -0.46 PgC yr^{-1} which is close to that of Takahashi et al. (2009) and the amplitude of its interannual variation is about 0.04 PgC yr^{-1}.

Now, we plan to apply this technique to pCO_2 mapping not only in the Equatorial/South Pacific but also in the coastal region around Japan to reduce the uncertainty of the air-sea CO_2 exchange estimation. Therefore, some of the results concened with interannual variation of pCO_2 in these areas will be presented in this session.

Keywords: pCO2, air-sea CO2 flux, North Pacific, interannual variation, Self Organizing Map