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Reconstruction of global surface ocean pCO$_2$ using region-specific predictors based on a stepwise FFNN regression algorithm

Guorong Zhong et al.

Correspondence to: Xuegang Li (lixuegang@qdio.ac.cn) and Jinming Song (jmsong@qdio.ac.cn)

S1 Treatment of training samples near province boundaries for smoother distribution

To obtain a smoother distribution, we defined that the area within 5 1x1 grids of province boundaries as a 'boundary area'. Samples in the boundary area will be used as training samples in all adjacent provinces (Fig. S1). This definition brings more training samples near the province boundary for each province, while these samples originally belong to other provinces. For example, samples in the Area 2, which were originally belong to the province P2, were added as additional training samples of Province P1. However, in the validation process of each province, the validation samples of each province were not change by the definition of boundary area. Samples in the Area 2 would not be used as validation samples of Province P1 (Fig. S1). Also, the interpolation area of each province was not changed. Area 1 was interpolated using FFNN trained in P1 and Area 2 was interpolated using FFNN trained in P2.
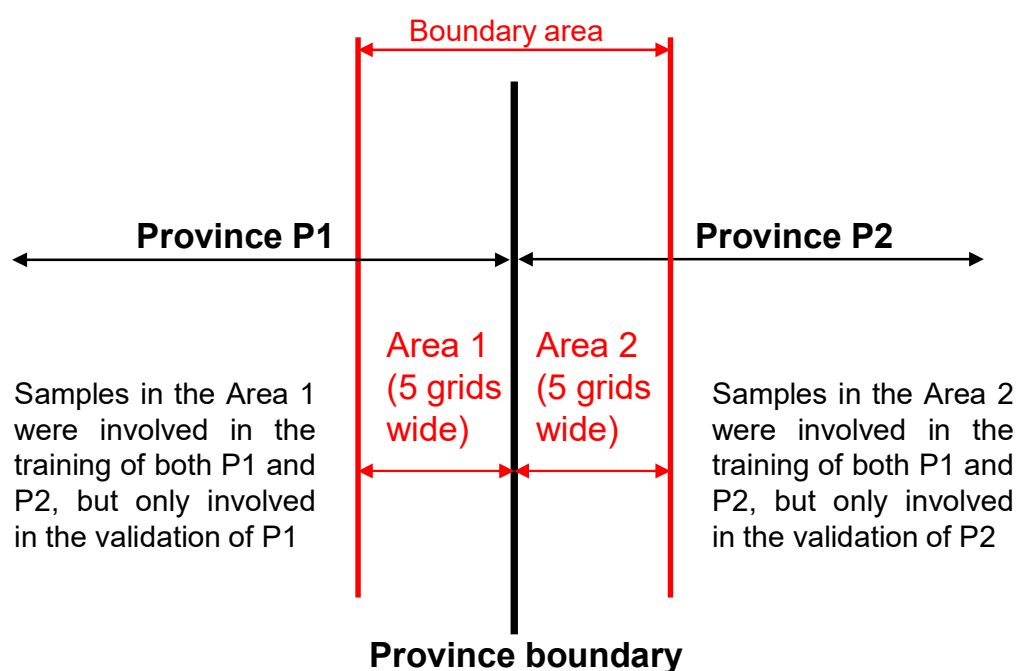

Figure S1. Adding additional training samples near province boundaries

S2 Interannual variability of global pCO_2 from the stepwise FFNN product

Based on stepwise FFNN algorithm in each province, a monthly $1° \times 1°$ gridded surface ocean pCO_2 product from January 1992 to August 2019 was constructed. The interannual variability of global average pCO_2, compared with the atmospheric CO_2, was showed in the Fig. S2. The global open ocean average pCO_2 of the stepwise FFNN product increased about 1.85 µatm per year from 1992 to 2019.
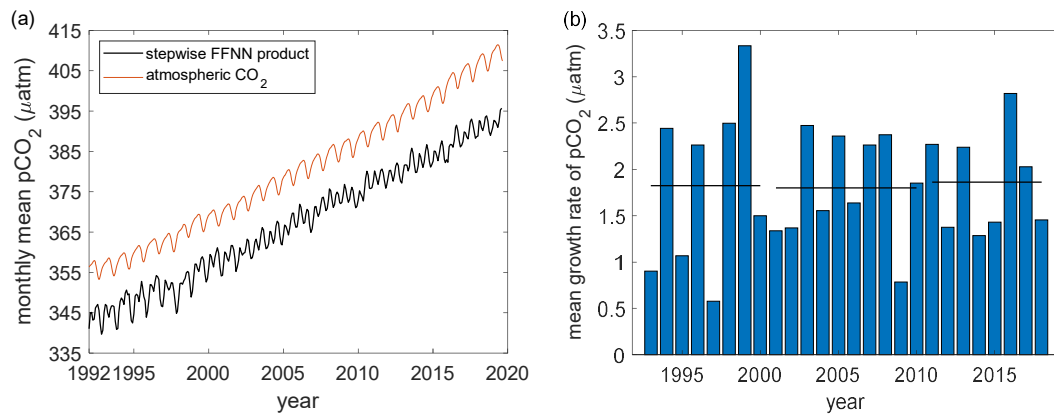
Figure S2. Interannual variability of global open-oceanic pCO_2 during 1992-2019. (a): global monthly mean pCO_2, (b): growth rate of global monthly mean pCO_2, the horizontal line was the average growth rate over each decade. The atmospheric CO_2 data was from GLOBALVIEW-CO2, 2011.

References

GLOBALVIEW-CO2: Cooperative Atmospheric Data Integration Project - Carbon Dioxide [CD-ROM]. NOAA ESRL, B., Colo. (Ed.), [Available at ftp.cmdl.noaa.gov, path: ccg/co2/GLOBALVIEW, 5th January 2013.], 2011.