

Supporting Information for

Impact of North Brazil Current rings on air-sea CO₂ fluxes variability in winter 2020 in the north-western tropical Atlantic

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Introduction

The supporting information contains text and figures aiming to detail methods, uncertainties and results presented in the paper. First, the interpolation method used is detailed by text S1. Figure S1 compares the relationship linking salinity and alkalinity used in this paper with the fCO₂ measured during the cruise. Figure S2 presents the repartition of nutrients in the area of interest, and figure S3 follows the evolution of a coastal upwelling along the coast of Guiana.

Text S1.

The $f\text{CO}_2$ associated to the surface T-S-Chl a diagram computed from the ship measurement (and collocated satellite Chl a) is interpolated using a linear 3D interpolation on a grid of SST, SSS and Chl a . The linear 3D interpolation of this scattered dataset on a regular grid is obtained through the `griddata` matlab function. The method is based on a Delaunay triangulation of the data, often used to generate meshes for space-discretized solvers. The Delaunay triangulation for a given set P of discrete points in a general position is a triangulation $\text{DT}(P)$ such that no point in P is inside the circumcircle (circumsphere in 3D) of any triangle (pyramid) in $\text{DT}(P)$. In the case of the 3D interpolation, for each query point, the method finds in triangulation data structure the pyramid that encloses the point. The value is then computed from a weighted sum of values of the 4 vertices of the enclosing pyramid (linear interpolation). First averaging data in classes of 0.1°C , 0.1 in SSS and 0.1 in $\log_{10}(\text{Chl}a)$ (yielding about 1000 gridded data points compared with ~ 20000 original data) did not modify significantly the results of the Delaunay triangulation. This suggests that the resulting 3D interpolation is not strongly influenced by noise and natural variability at small scale in T-S- $\log_{10}(\text{Chl}a)$ space. This dependency on the dataset sampling is further reduced by time averaging the resulting fields over an over 20-day period as is presented in the paper.

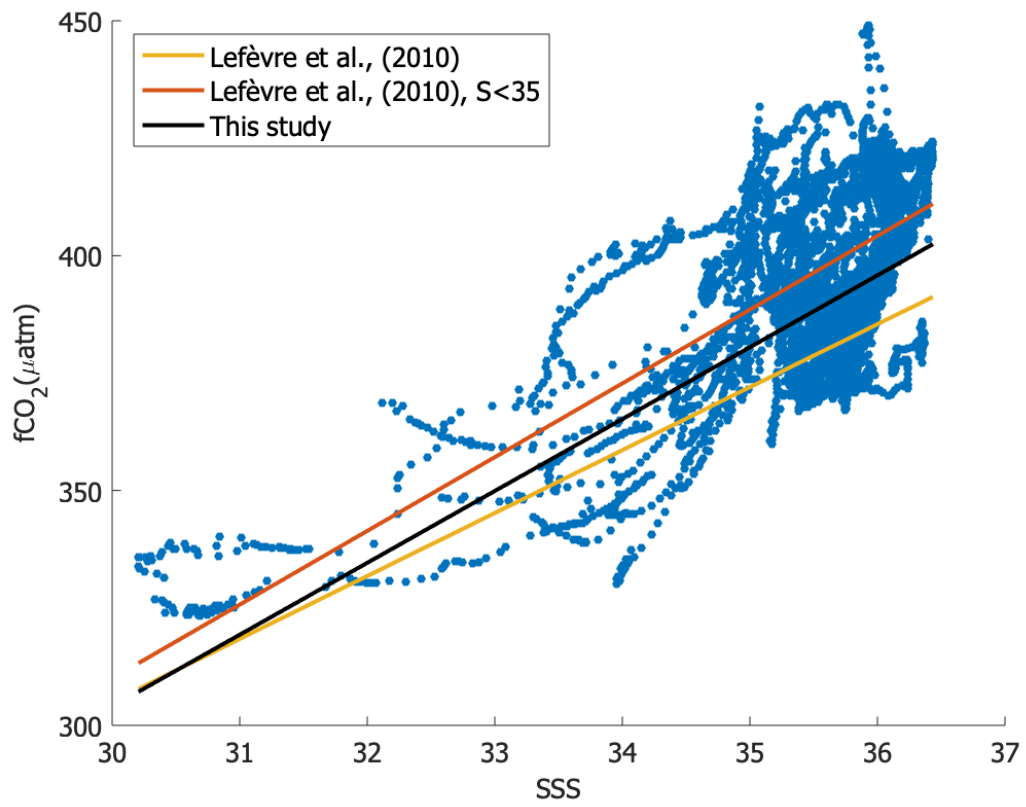


Figure S1. SSS- fCO₂ relation and comparison to Lefèvre et al., (2010)

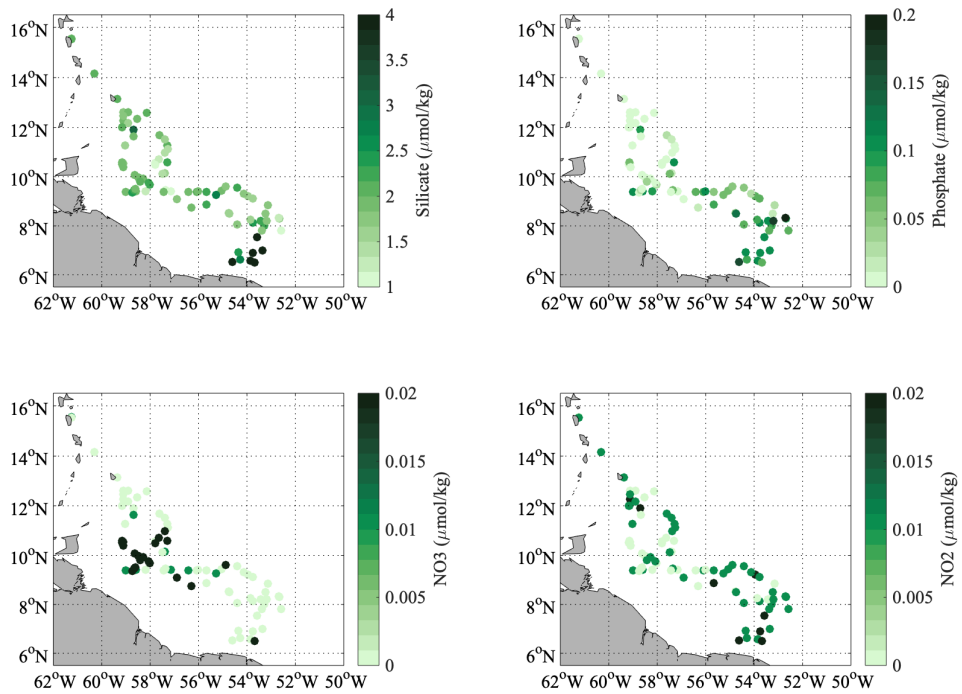


Figure S2. Nutrients (Silicate, Phosphate, Nitrite and Nitrate) measured during the EUREC⁴A-OA cruise from underway water samples.

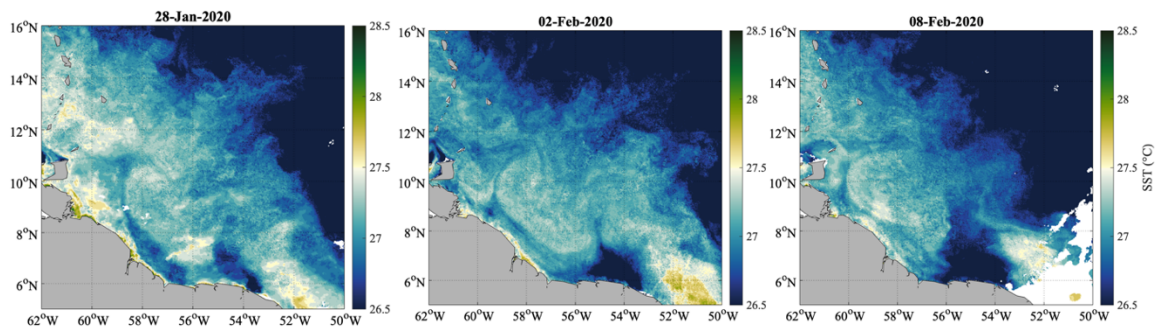


Figure S3. Evolution over 9 days of a local upwelling along the Guyana coast based on SST. SST maps for the 28/01/2020, 02/02/2020 and 08/02/2020.