Supporting Information for "Introducing a new metrics for the atmospheric pressure adjustment to thermal structures at the ocean surface"

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Introduction

In this Supporting Information, the figures showing some relevant distributions for the ANML_HALF, CNTRL and ANML_DOUBLE set of simulations are presented. In particular, they show the bi-dimensional distributions of ΔSLP and ΔSST (figure S1), the bi-dimensional and the percentile distributions of the SST Laplacian and the wind divergence (figure S2) and of the across-wind SST Laplacian and the across-wind divergence (figure S3).

Figure S1 proves that the PA mechanism strongly affect the atmospheric dynamics on short time scales, O(hours). In fact, the ΔSLP and ΔSST fields are highly anti-correlated in all three simulations considered. The Pearson ρ correlation coefficients are all around

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-0.93 and the slope of the least square fits is roughly -1.3×10^{-2} hPa/K. This means that even if the SST gradients get weaker, the small-scale secondary circulations controlled by the SST-driven SLP gradients through the PA are well established.

Concerning the SST Laplacian and the wind divergence, shown in figure S2, both series of the bi-dimensional distributions and of the percentile distributions do not show significant correlations. Only the Spearman r of the percentile distribution of the ANML_DOUBLE experiment appears significant at the 99% level, as in figure S2(f). However, it is associated with a distribution whose left tail is higher than expected. Instead, by removing the masking effect of the advection and by focusing on the across-wind direction, as in figure S3, a more symmetric wind divergence response is found, both in terms of bi-dimensional distribution, as in figure S3(a)-(c), and of percentile distributions, as in figure S3(d)-(f). Despite the Pearson ρ of the bi-dimensional distributions are low and non-significant, all Spearman r of the percentile distributions are statistically significant at the 99% level.
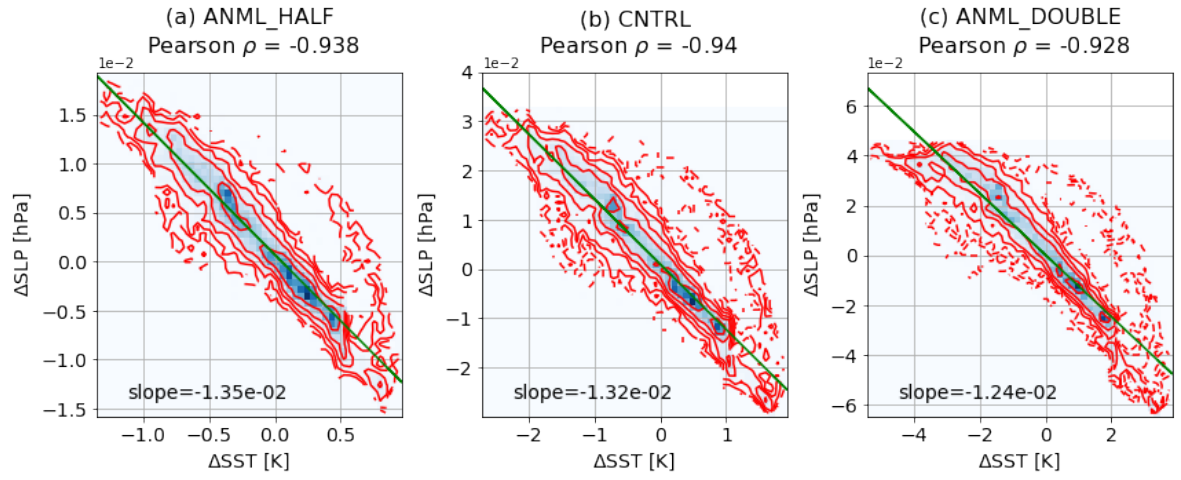
Figure S1.   Bi-dimensional distribution of ΔSLP with respect to ΔSST from (a) ANML_HALF, (b) CNTRL and (c) ANML_DOUBLE simulations. Blue shading indicate the PDF and red lines indicate the contours of the logarithm of the PDF.
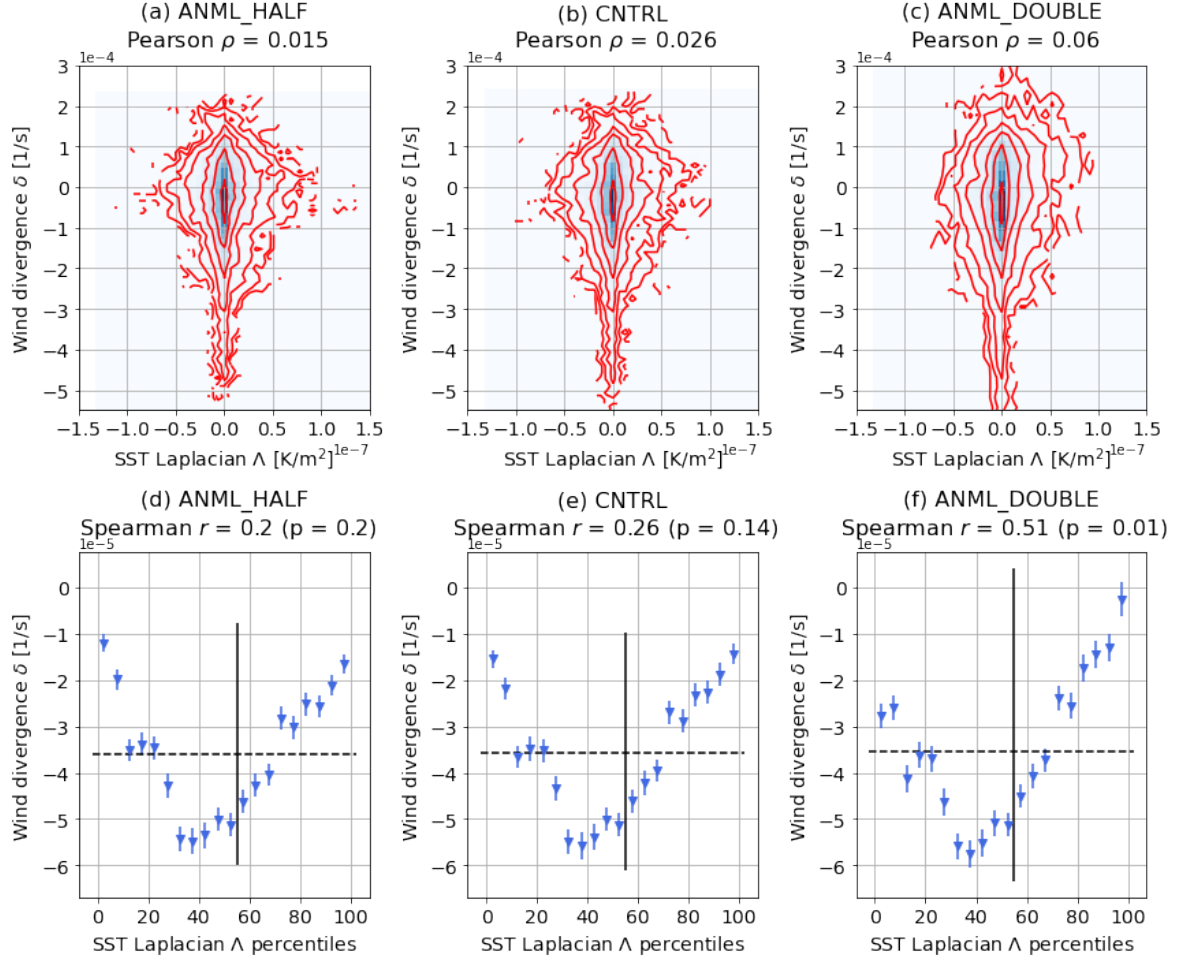
Figure S2.   (a)-(c) Bi-dimensional distribution of the SST Laplacian and the wind divergence from the ANML_HALF, CNTRL and the ANML_DOUBLE simulations, respectively. (d)-(f) Percentile distributions of the same fields, with the vertical lines indicating the change of sign of the SST Laplacian and the horizontal dashed lines indicating the mean wind divergence.
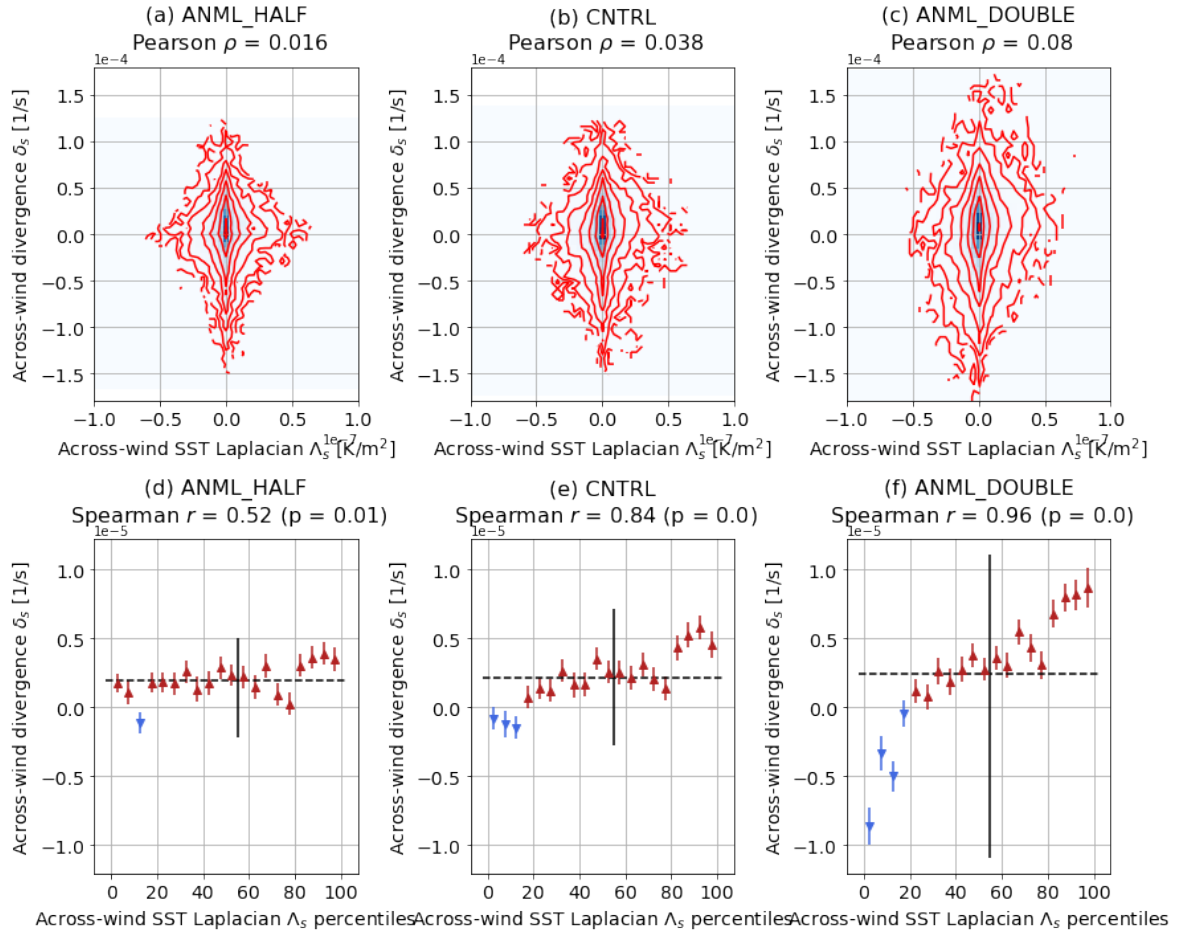
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Figure S3.   As in the previous figure, but with the across-wind variables.