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Supplement of

Intensified upwelling: normalized sea surface temperature trends expose climate change in coastal areas

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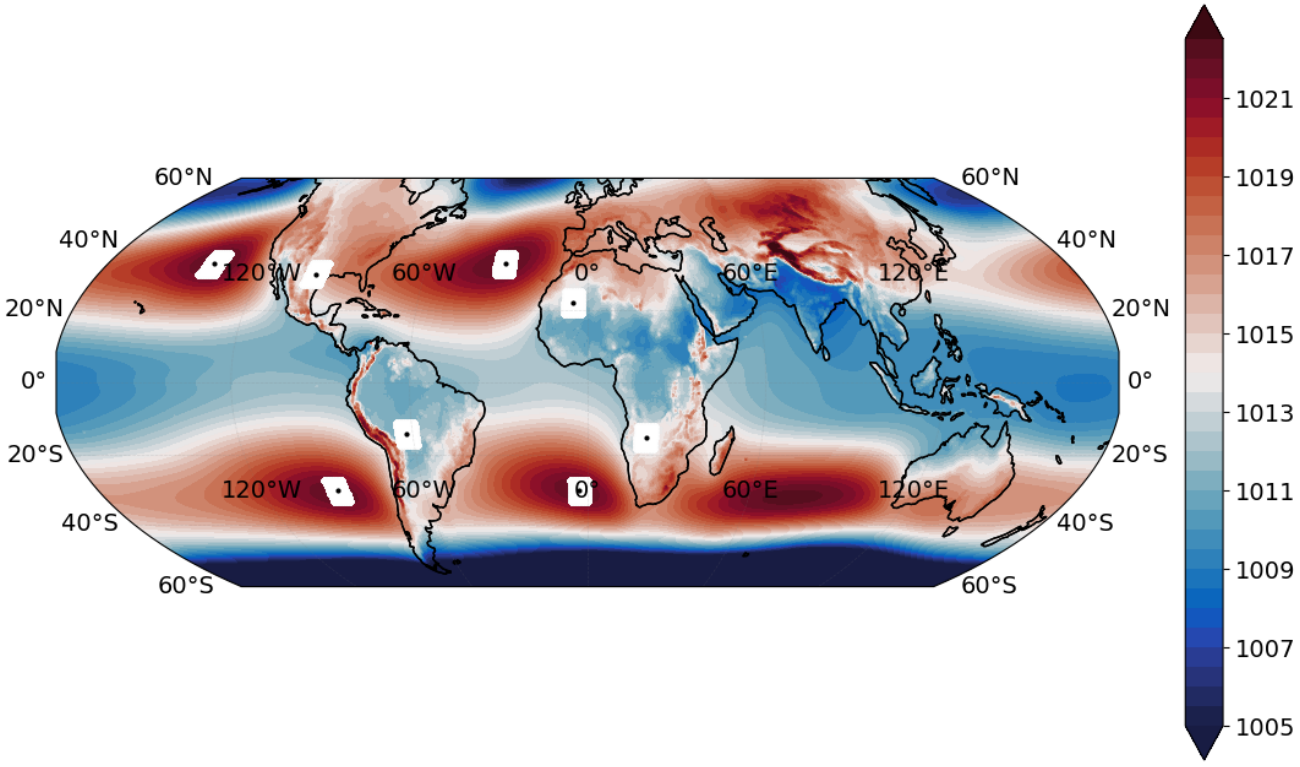
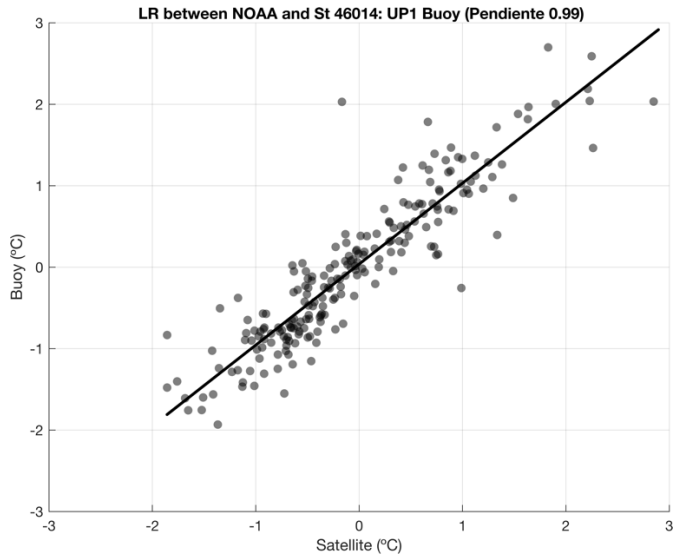
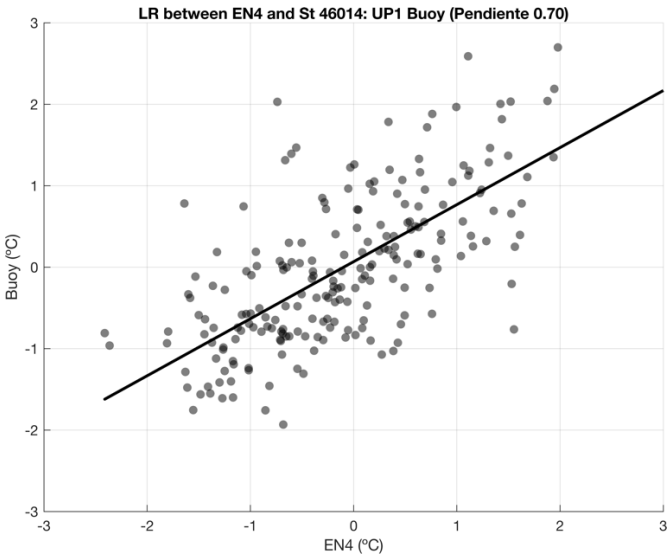
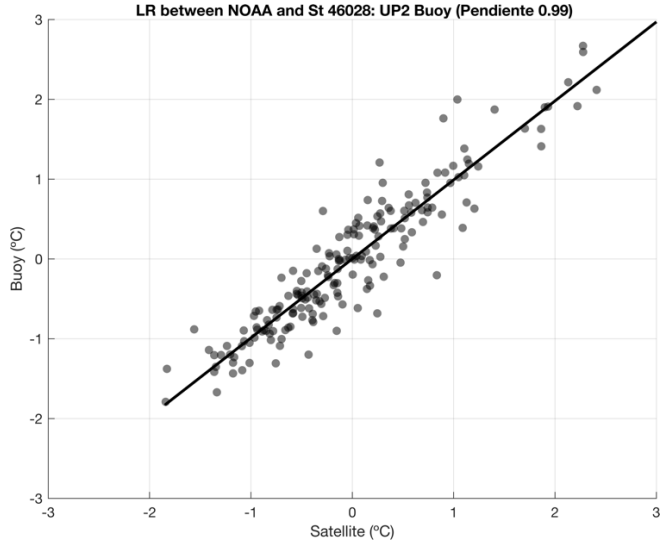
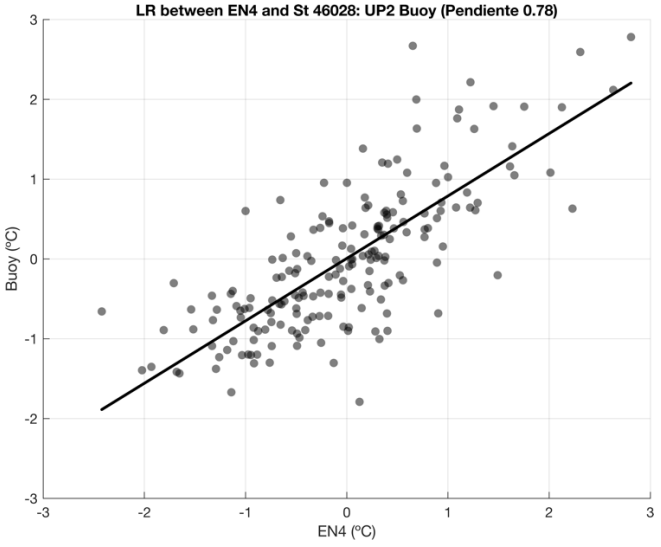


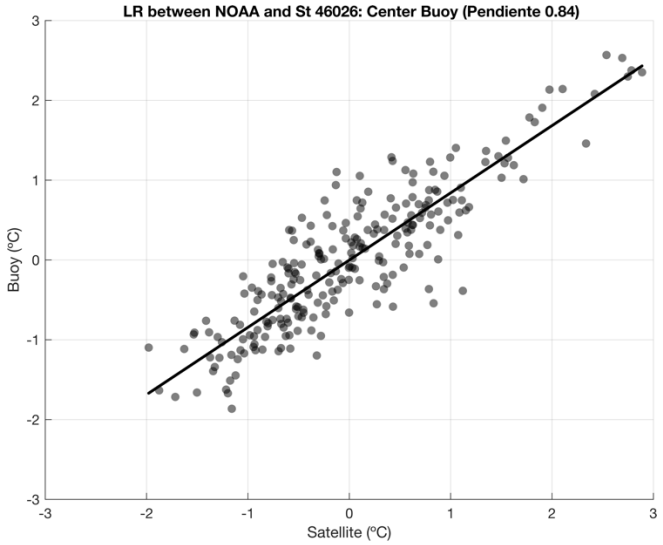
Fig S1: Mean field of SLP (1982-2023) from the ERA5 datasets. Black dots indicate the core of the pressure systems, while white points denote the area used for calculating the standard deviation

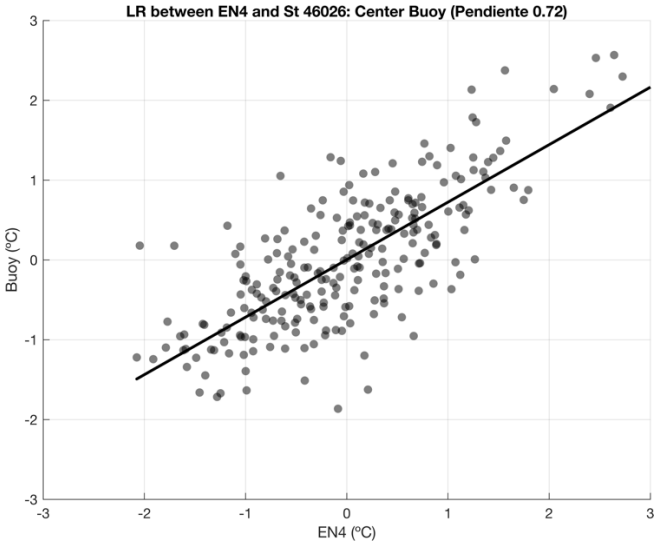

LR between NOAA and St 46014: UP1 Buoy (Pendiente 0.99)
Buoy (ºC)
Satellite (ºC)

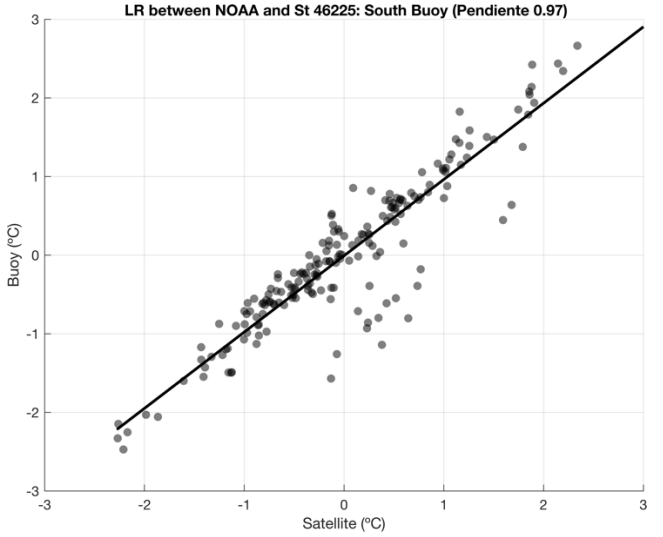

LR between EN4 and St 46014: UP1 Buoy (Pendiente 0.70)
Buoy (ºC)
EN4 (ºC)

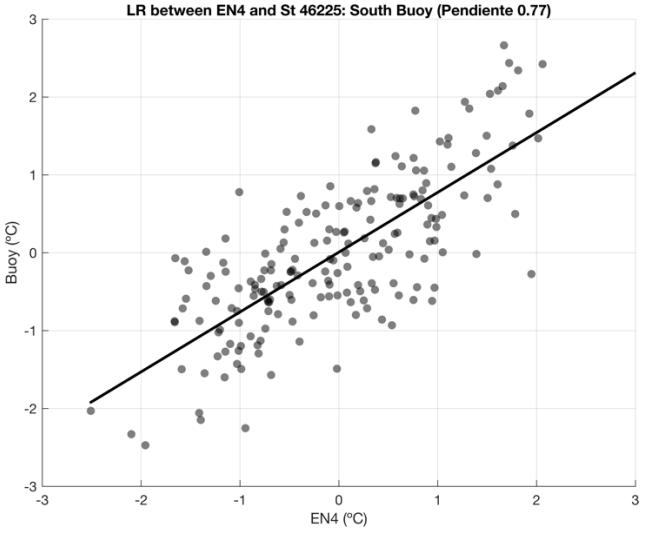

LR between NOAA and St 46028: UP2 Buoy (Pendiente 0.99)
Buoy (ºC)
Satellite (ºC)


LR between EN4 and St 46028: UP2 Buoy (Pendiente 0.78)
Buoy (ºC)
EN4 (ºC)


LR between NOAA and St 46026: Center Buoy (Pendiente 0.84)
Buoy (ºC)
Satellite (ºC)


LR between EN4 and St 46026: Center Buoy (Pendiente 0.72)
Buoy (ºC)
EN4 (ºC)


LR between NOAA and St 46225: South Buoy (Pendiente 0.97)
Buoy (ºC)
Satellite (ºC)


LR between EN4 and St 46225: South Buoy (Pendiente 0.77)
Buoy (ºC)
EN4 (ºC)

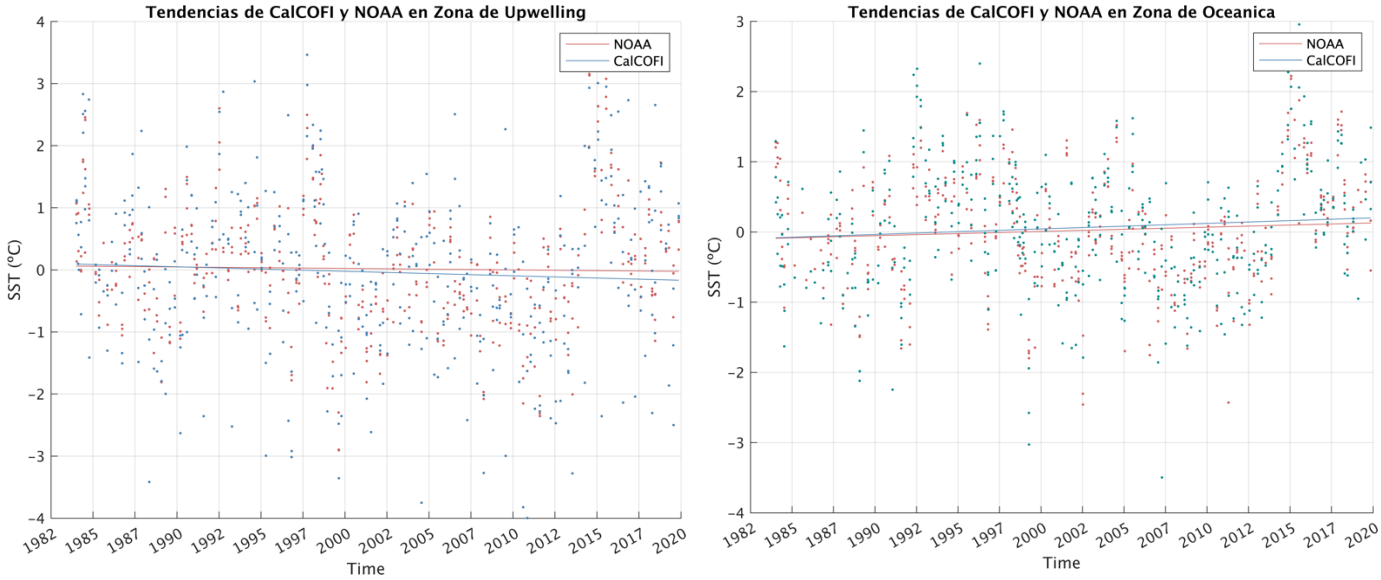
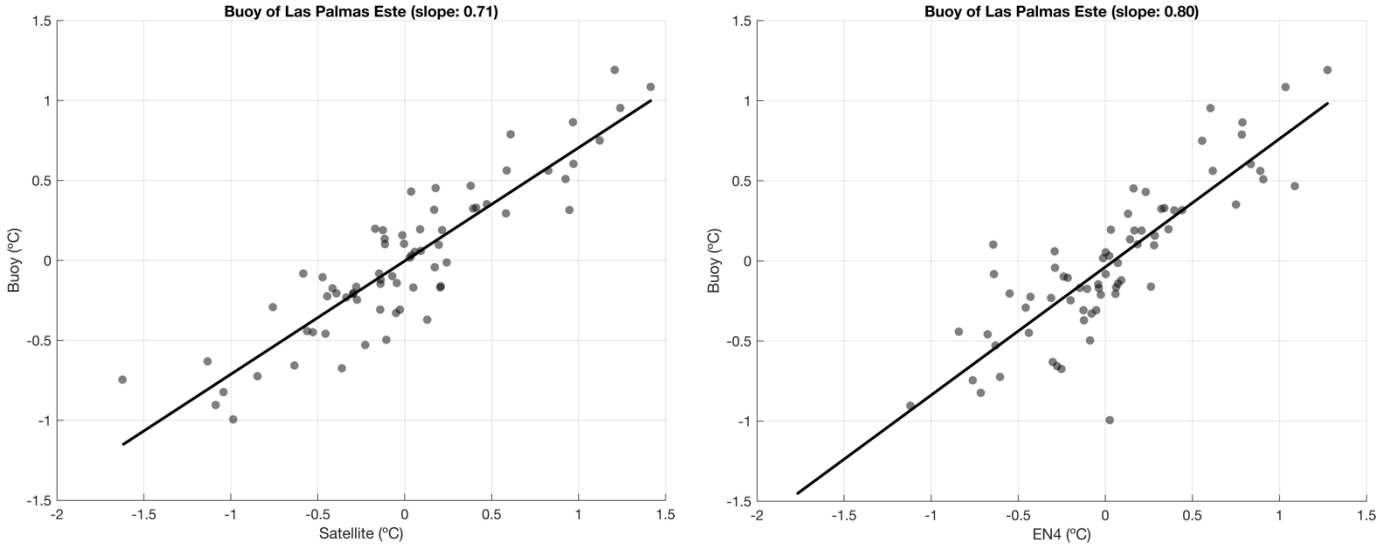
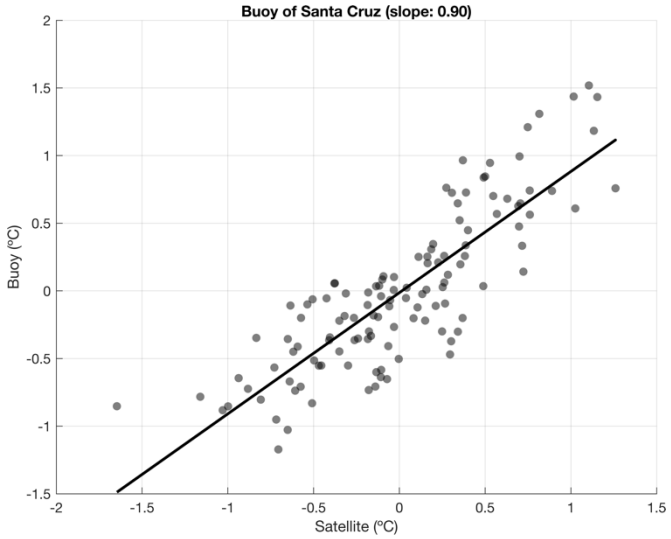
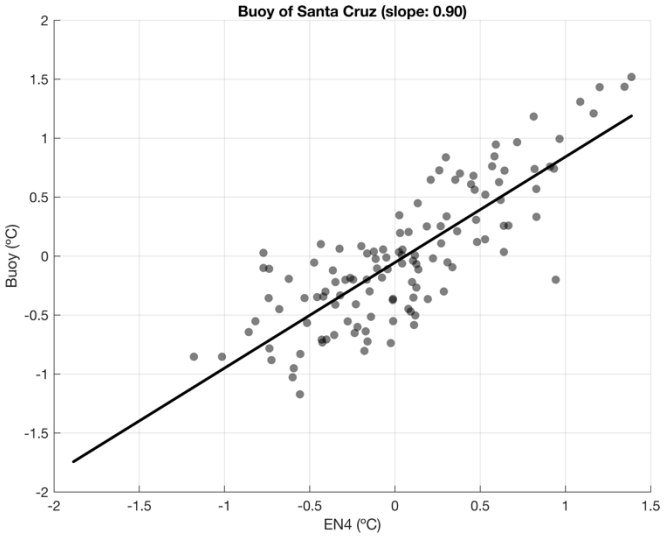
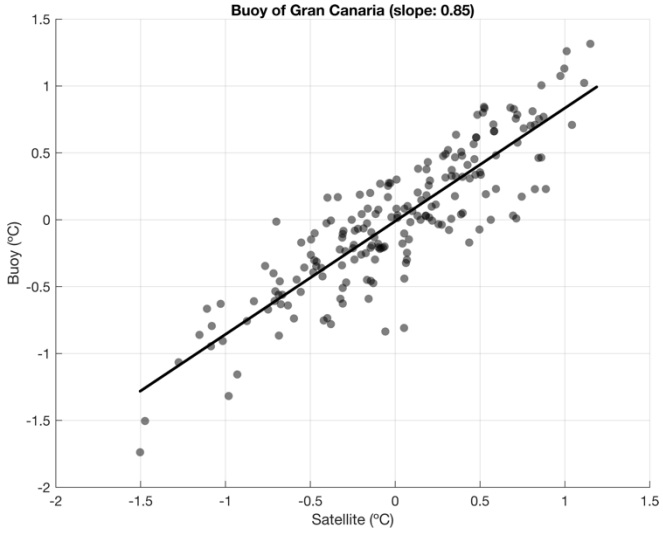


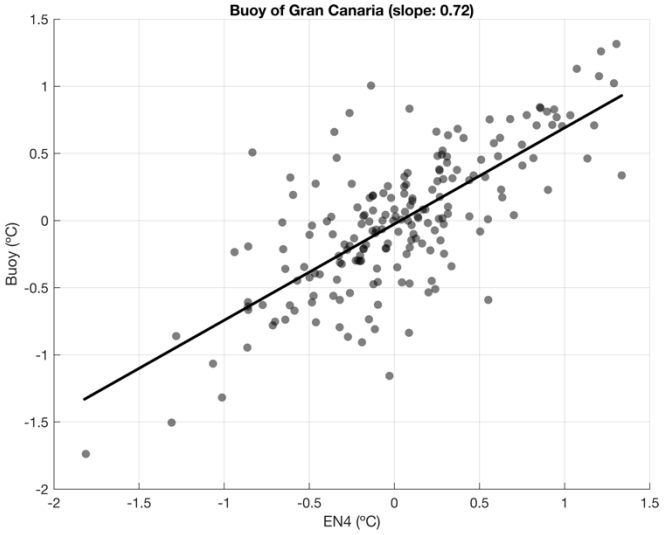
Fig S2: Validation of the reanalysis data with in-situ for the Pacific Ocean. These plots complement Table 1.




Buoy of Santa Cruz (slope: 0.90)
Buoy (ºC)
Satellite (ºC)


Buoy of Santa Cruz (slope: 0.90)
Buoy (ºC)
EN4 (ºC)


Buoy of Gran Canaria (slope: 0.85)
Buoy (ºC)
Satellite (ºC)


Buoy of Gran Canaria (slope: 0.72)
Buoy (ºC)
EN4 (ºC)

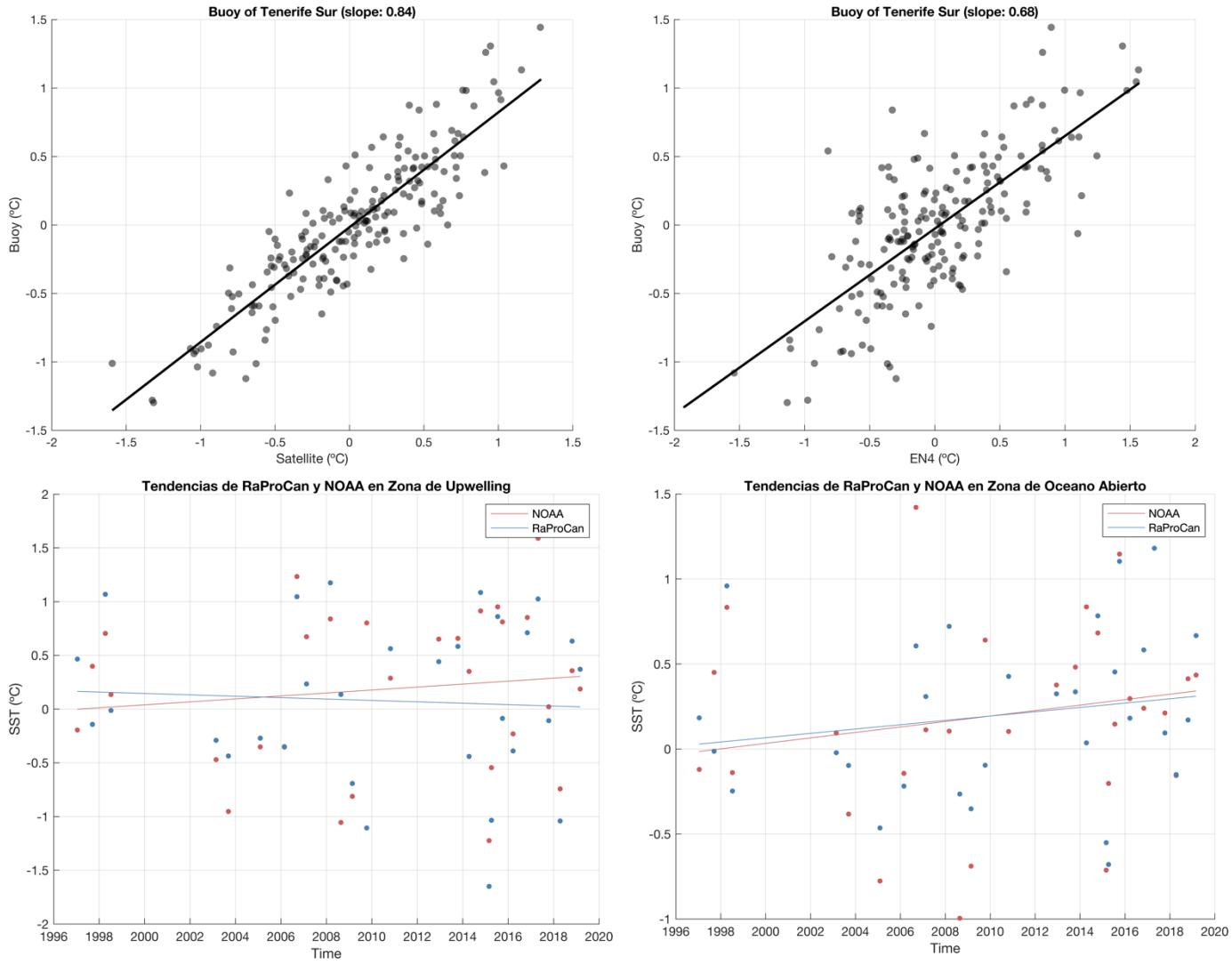
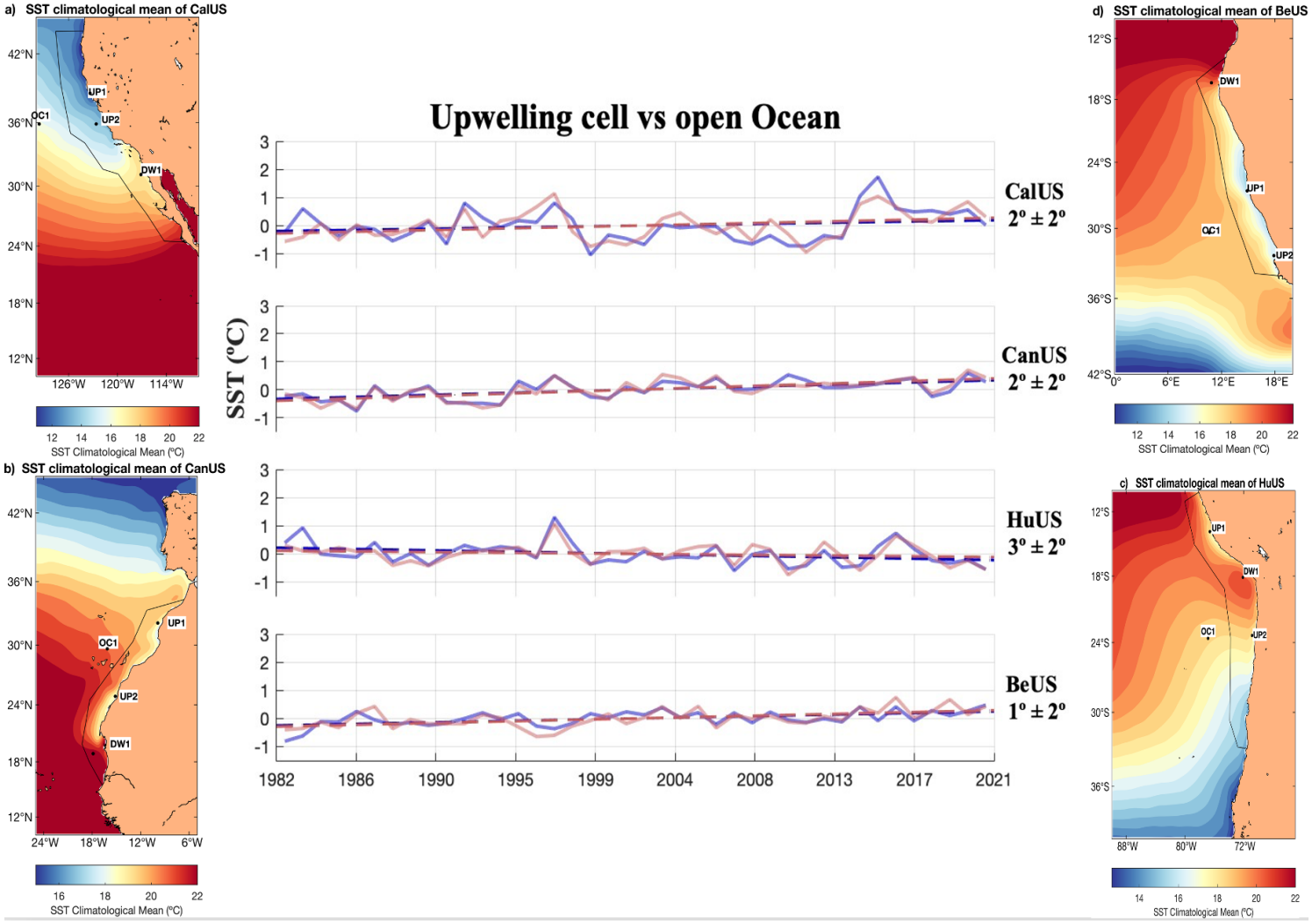
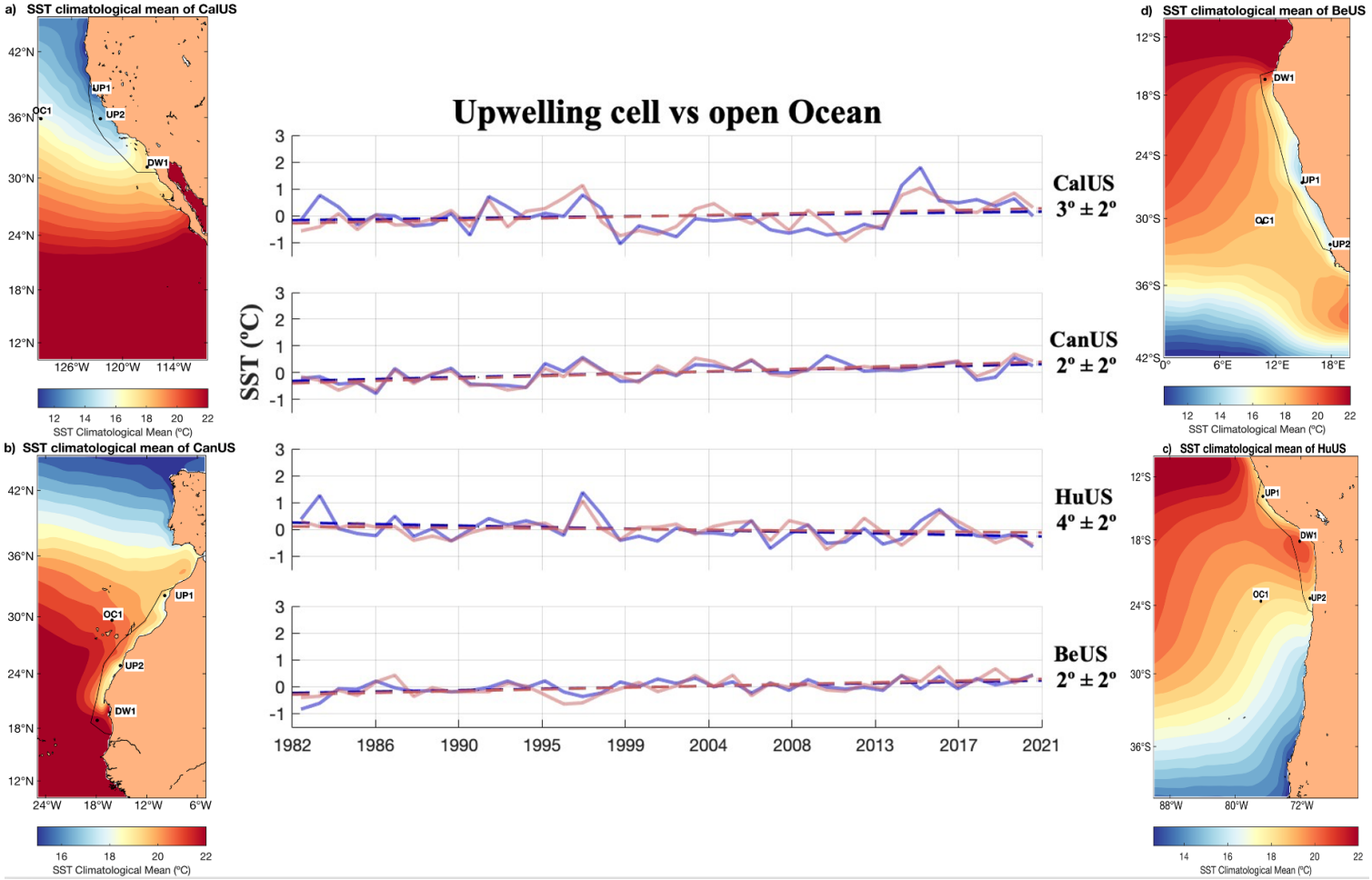
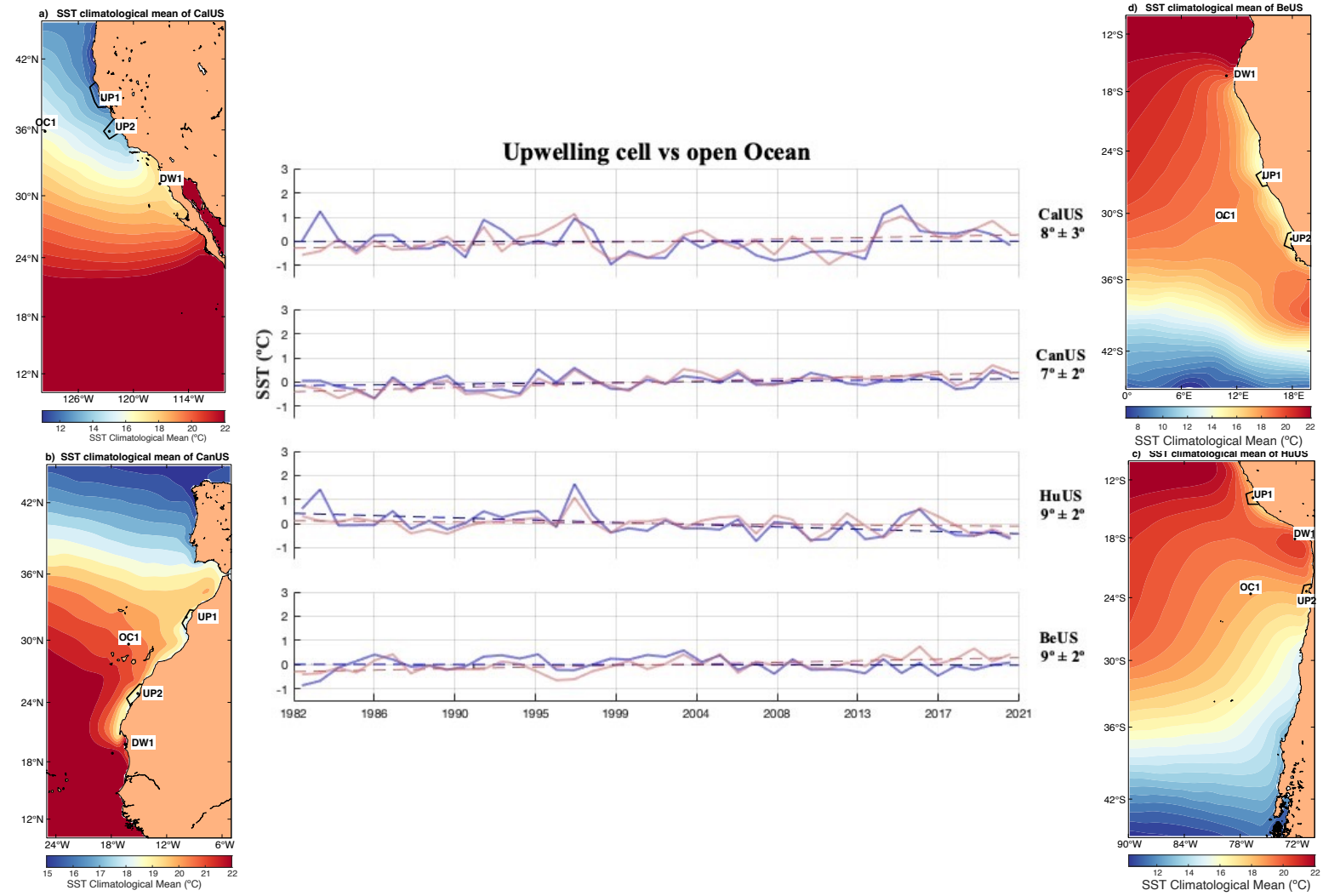


Fig S3: Validation of the reanalysis data with in-situ for the Atlantic Ocean. These plots complement Table 2.


a) SST climatological mean of CalUS
b) SST climatological mean of CanUS
c) SST climatological mean of HuUS
d) SST climatological mean of BeUS
Upwelling cell vs open Ocean
SST (°C)
CalUS
2° ± 2°
CanUS
2° ± 2°
HuUS
3° ± 2°
BeUS
1° ± 2°
1982
1986
1990
1995
1999
2004
2008
2013
2017
2021
UP1
UP2
OC1
DW1
SST Climatological Mean (°C)


a) SST climatological mean of CalUS
b) SST climatological mean of CanUS
c) SST climatological mean of HuUS
d) SST climatological mean of BeUS
Upwelling cell vs open Ocean
SST (ºC)
CalUS
3º ± 2º
CanUS
2º ± 2º
HuUS
4º ± 2º
BeUS
2º ± 2º
1982
1986
1990
1995
1999
2004
2008
2013
2017
2021
UP1
UP2
OC1
DW1
SST Climatological Mean (ºC)


a) SST climatological mean of CalUS
b) SST climatological mean of CanUS
c) SST climatological mean of HuUS
d) SST climatological mean of BeUS
UP1
UP2
OC1
DW1
SST Climatological Mean (°C)
Upwelling cell vs open Ocean
SST (°C)
CalUS
8° ± 3°
CanUS
7° ± 2°
HuUS
9° ± 2°
BeUS
9° ± 2°
1982
1986
1990
1995
1999
2004
2008
2013
2017
2021

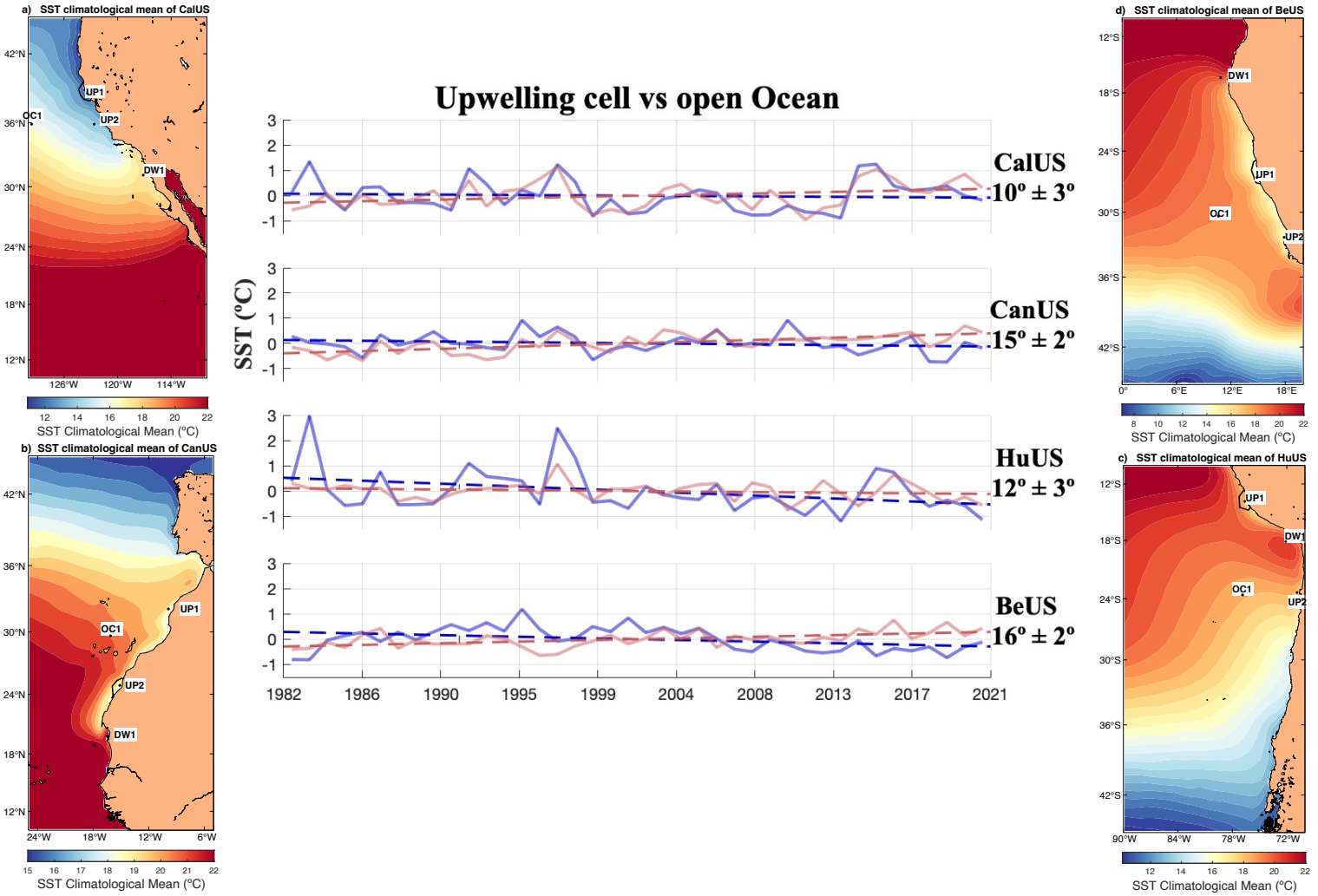


Fig S4: Same as Fig 5, but with α_{UI} recalculated for different averaged coastal regions (from Zone A at the top panel to Zone D at the bottom panel) compared to the OC1 point. The side maps display the averaged coastal areas outlined by black lines.

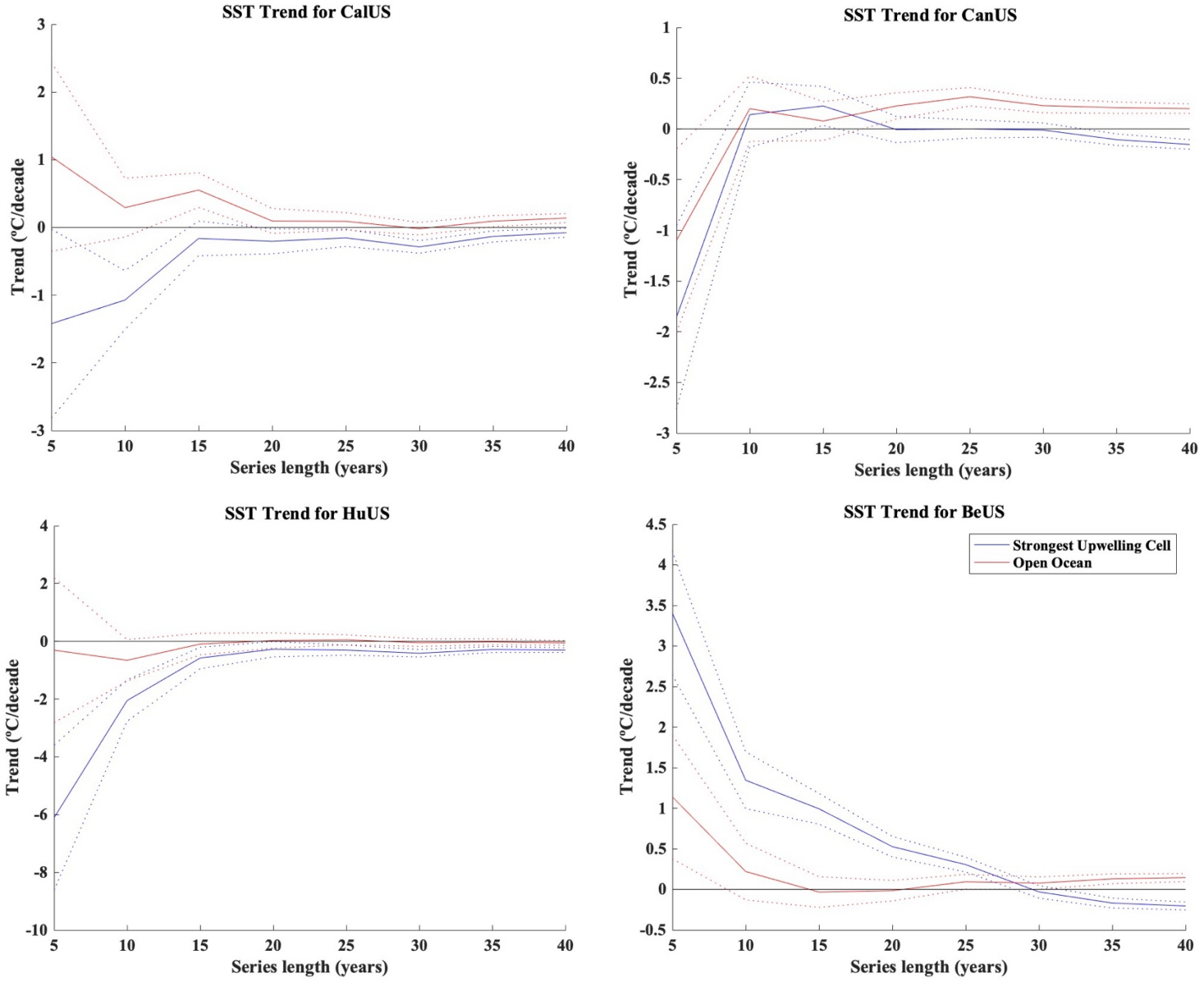


Fig S5: Trend values calculated as a function of series length for SST trends in the higher upwelling cell and open ocean areas. Trend values are shown as solid lines and 90% confidence limits as broken lines.

Zone	CalUS	CanUS	HuUS	BeUS
A	2º±2º	2º±2º	3º±2º	1º±2º
B	3º±2º	2º±2º	4º±2º	2º±2º
C	8º±3º	7º±2º	9º±2º	9º±2º
D	10º±3º	15º±2º	12º±3º	16º±2º
This Study	11º±3º	20º±2º	14º±3º	21º±2º

Table S1: α_{UI} estimation for different portions of the coastal region: the whole coastal area, Zone A, covered an area just large enough to include the three main coastal upwelling areas (UP1, UP2 and DW1), Zone B, focused around the two main upwelling centers of each region, and Zone C, and targeted only the strongest upwelling center, Zone D. Last Row show the results obtained in Fig 5.