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Supplement of

Skin sea surface temperature schemes in coupled ocean–atmosphere modelling: the impact of chlorophyll-interactive *e*-folding depth

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Supplementary materials

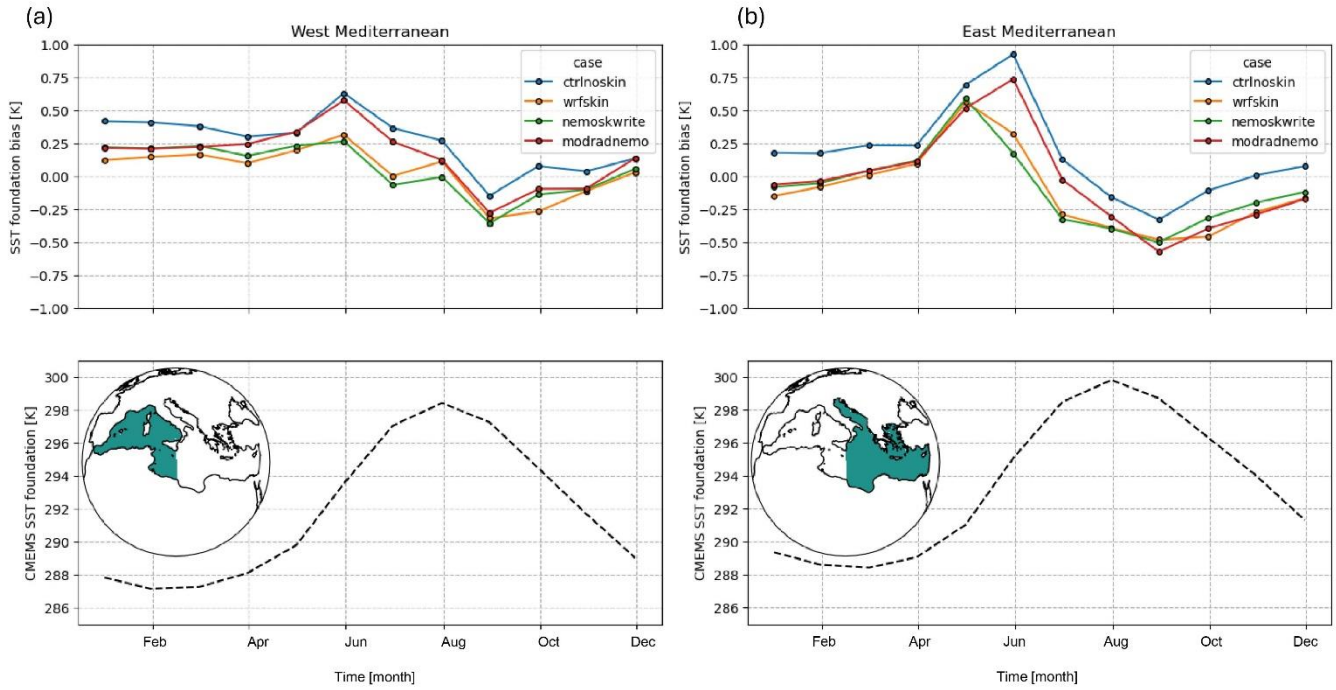

Figure S1. Basic validation of foundation SST averaged over the Western and Eastern Mediterranean Sea, respectively on left and right panels. Upper panels show the bias with respect to CMEMS monthly averaged foundation SST, while lower panels show the reference CMEMS absolute values.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
allday	35534	32528	39890	222996	32781	26298	21505	24353	20990	23537	37768	37739
h00:00	1486	1370	1676	9480	1469	1201	949	1060	899	986	1581	1599
h01:00	1494	1364	1672	9829	1481	1217	982	1071	891	982	1567	1596
h02:00	1480	1355	1669	9578	1478	1226	953	1068	887	966	1561	1574
h03:00	1491	1353	1675	9785	1475	1222	962	1069	900	984	1583	1558
h04:00	1489	1364	1671	9730	1475	1173	954	1073	900	988	1589	1562
h05:00	1486	1349	1663	9574	1448	1227	959	1065	897	995	1573	1555
h06:00	1487	1370	1658	9636	1465	1221	943	1065	899	993	1588	1560
h07:00	1484	1366	1667	10043	1457	1203	978	1069	896	1009	1585	1574
h08:00	1471	1362	1660	10195	1412	1177	967	1081	900	1010	1596	1572
h09:00	1474	1364	1645	10361	1399	1132	942	1058	897	1008	1600	1572
h10:00	1482	1368	1653	9940	1345	1046	875	1023	806	870	1398	1570
h11:00	1469	1350	1638	9298	1244	965	817	903	767	903	1518	1496
h12:00	1476	1335	1605	9186	1229	935	779	904	834	976	1578	1585
h13:00	1485	1332	1631	8649	1197	944	784	901	835	975	1587	1592
h14:00	1476	1335	1630	8325	1205	919	780	905	842	978	1588	1585
h15:00	1466	1348	1642	8303	1194	927	793	910	859	978	1587	1593
h16:00	1481	1340	1630	8236	1223	955	800	939	874	986	1583	1577
h17:00	1474	1364	1644	8199	1258	1002	831	988	884	996	1587	1583
h18:00	1486	1358	1658	8298	1323	1032	859	997	890	985	1594	1577
h19:00	1475	1353	1662	8456	1342	1080	888	1020	891	997	1586	1575
h20:00	1474	1343	1651	8855	1398	1097	920	1031	887	988	1588	1570
h21:00	1479	1357	1715	9585	1395	1122	916	1053	886	1002	1582	1575
h22:00	1491	1367	1762	9805	1424	1115	925	1054	877	989	1590	1572
h23:00	1478	1361	1713	9650	1445	1160	949	1046	892	993	1579	1567

Table S1: Table outlining the number of Drifter's observations in each month, for each hour of the day in that given month: the greatest number of measurements in total is April, with a peak of 10361 measurements at 9:00 am.

Details on cool skin depth and solar fraction in the warm layer

The parameters used follow the choices reported in Zeng and Beljaars 2005 and references therein, with

$$f_s = 0.065 + 11\delta - \frac{6.6 \times 10^{-5}}{\delta}\left[1 - e^{-\frac{\delta}{8\times10^{-4}}}\right],$$

$$\lambda = 6\left[1 + \left(\frac{-16 g \alpha_w \nu_w^3}{u_{*w}^4 k_w^2 \rho_w c_w}(Q + R_s f_s)\right)^{3/4}\right]^{-1/3},$$

$$\delta = \frac{\lambda \nu_w}{(\rho_a/\rho_w)^{1/2} u_{*w}}$$

where ρ_a denotes air density at the interface of separation.

The equation for the prognostic variable ΔT_w is solved, after being discretized in time, as follows:

$$\Delta T_w^{(n+1)} = \left[\Delta T_w^{(n)} + \frac{Q + R_s f_s}{d\rho_w c_w}\frac{\nu+1}{\nu}\Delta t\right] \Big/ \left[1 + \Delta t \frac{(\nu+1)ku_{*w}}{d\phi_t\,(d/L)}\right], \qquad (12)$$

where $\Delta T_w^{(n)}$ is the difference ($T_{-\delta} - T_{-d}$) at time $t_n = n\Delta t$. The warm layer reference depth d is an important parameter in this scheme, since it's very closely linked to solar radiation extinction, which is the main responsible for the diurnal warming. Its redefinition is the starting point of our modification to the existing schemes, as we discussed in the main text.