

Sensitivity of marine heatwaves metrics to SST products, focusing on the Tropical Pacific

C. Chevillard¹, R. Le Gendre^{2,3}, C. Menkes⁴, T. Izumo⁵, B. Pagli⁵, S. Van Wynsberge¹ and S. Cravatte³

¹ Ifremer, UMR 241 SECOPOL (Ifremer, IRD, ILM, UPF), Vairao, Tahiti, French Polynesia

² Ifremer, UMR 9220 ENTROPIE (Institut de Recherche pour le Développement, Université de la Réunion, Ifremer, CNRS, Université de la Nouvelle-Calédonie), Nouméa, New Caledonia.

³ Université de Toulouse, LEGOS (IRD, CNES, CNRS, UT3), Toulouse, France.

⁴ IRD, UMR 9220 ENTROPIE (Institut de Recherche pour le Développement, Ifremer, Université de la Réunion, Université de la Nouvelle-Calédonie), Nouméa, New Caledonia

⁵ IRD, UMR 241 SECOPOL (Ifremer, IRD, ILM, UPF), Faa'a, Tahiti, French Polynesia

Correspondence to: Carla Chevillard (carla.chevillard@ifremer.fr)

Supplementary Information

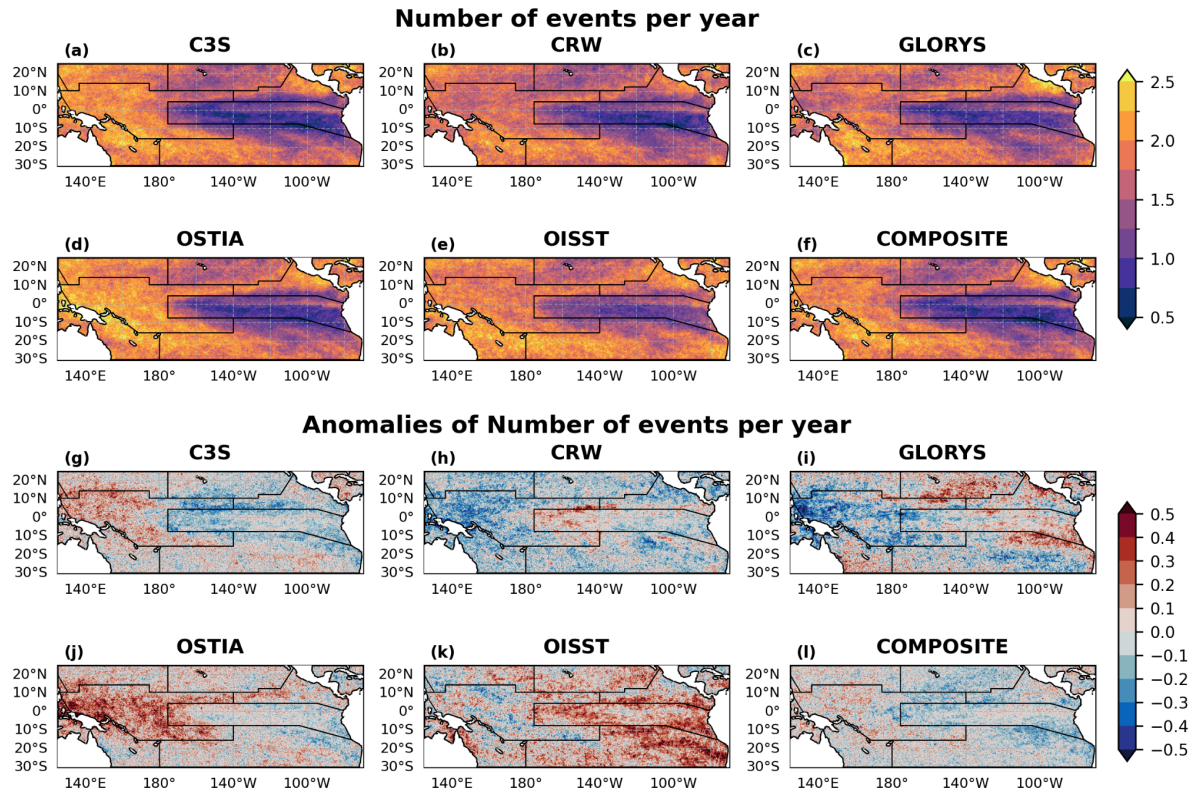


Figure S1: (a-f) Number of MHW events per year over the period 1993-2021 for the six SST products. (g-l) Anomalies of MHW events per year for each product relative to the ensemble mean (section 2.3.1). Black lines indicate regions' limits.

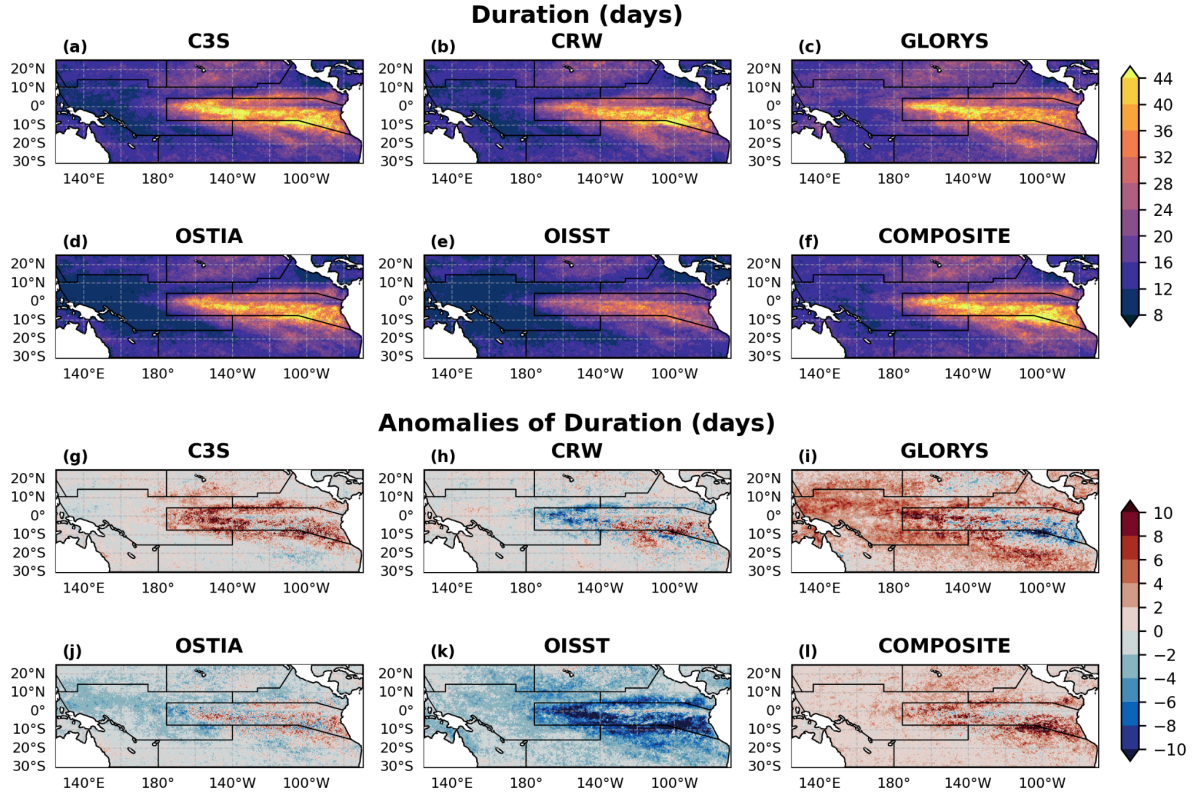


Figure S2: Same as Fig. S1 for the duration metric.

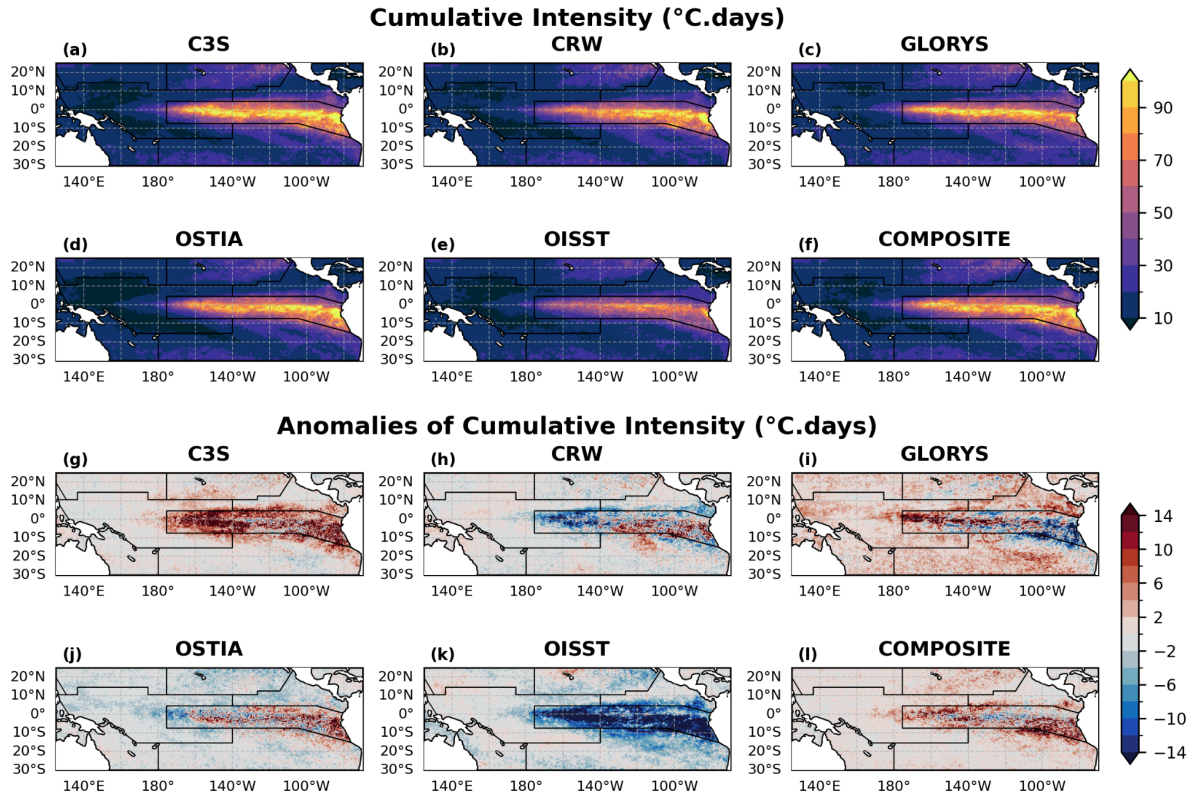


Figure S3: Same as Fig. S1 for the cumulative intensity metric.

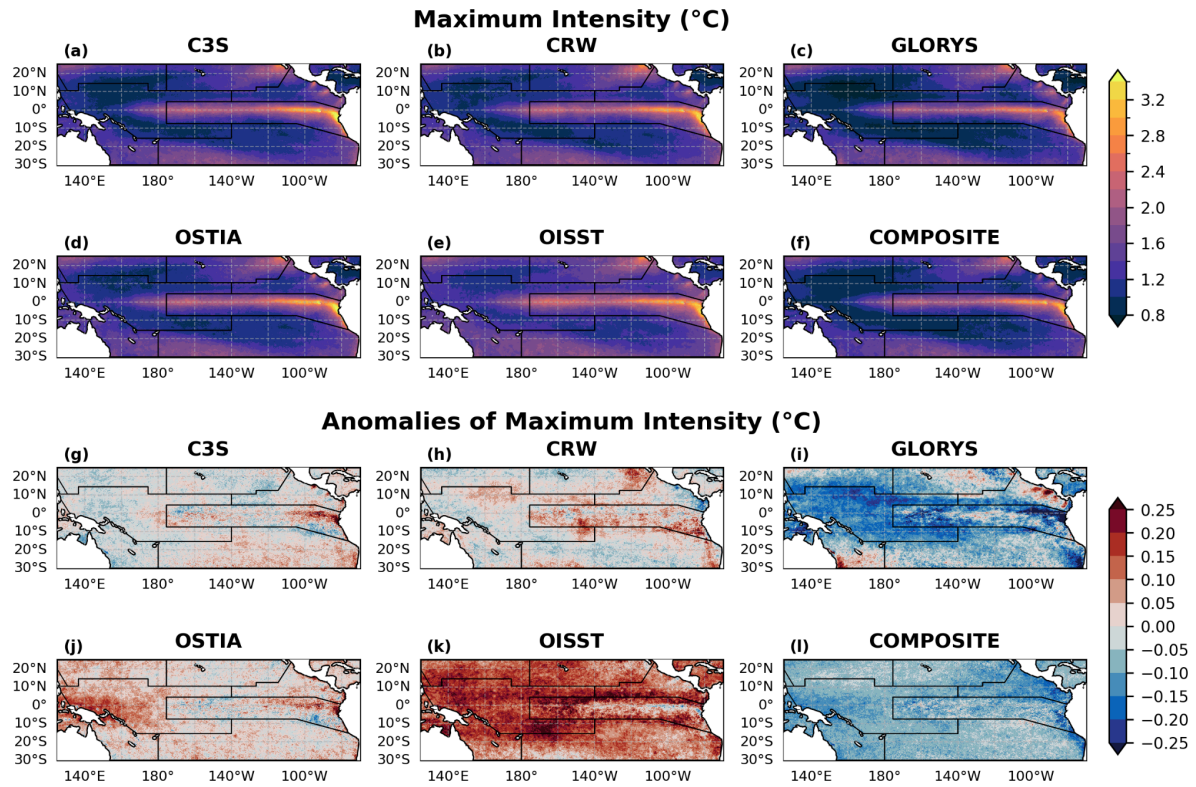


Figure S4: Same as Fig. S1 for the maximum intensity metric.

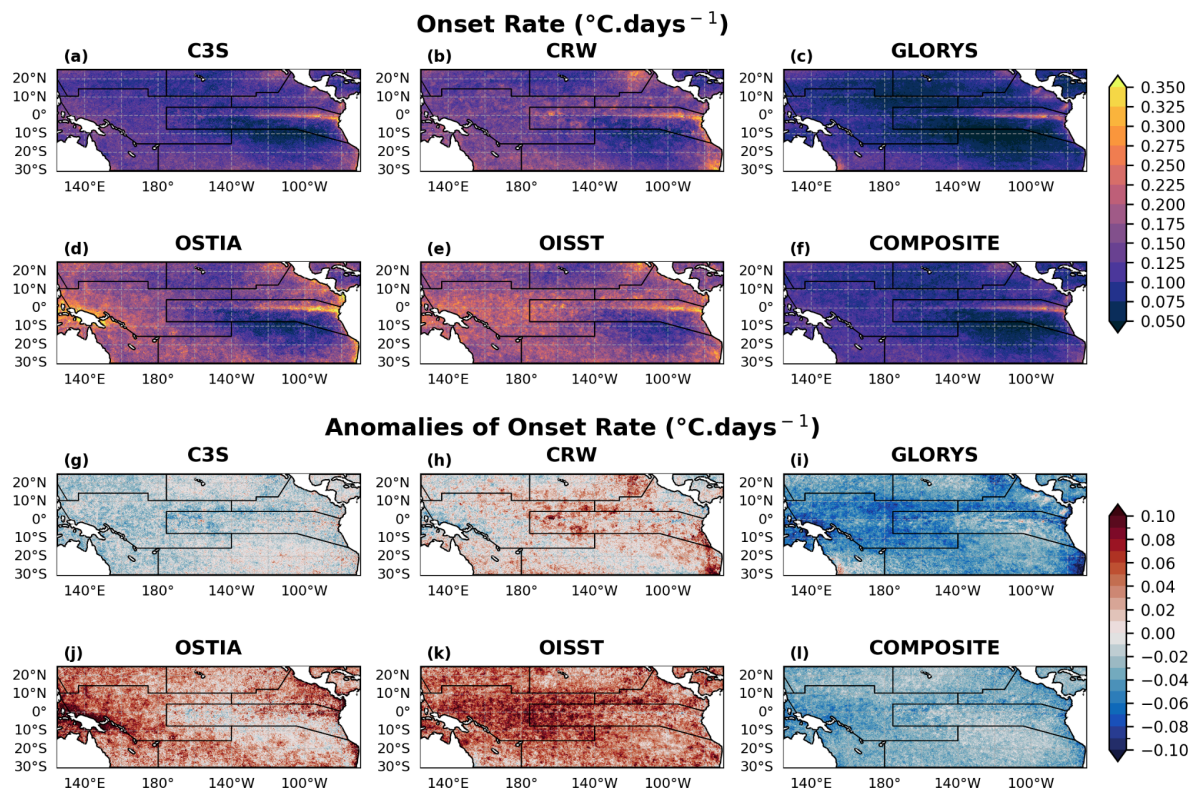


Figure S5: Same as Fig. S1 for the onset rate metric.

Supplementary on Fig. S1-S5

Maps of the total number of events per year for all products (Fig. S1) show the highest differences in the Warm Pool area, with OSTIA reaching more than 2 events per year and CRW ~1 event per year. Anomalies regarding the ensemble mean metric range between ± 0.5 events per year, the strongest positive anomalies being observed in the Western tropical Pacific for OSTIA and in the eastern tropical Pacific for OISST. The strongest negative anomalies are observed in the Warm Pool area for GLORYS12v1. For this metric, the COMPOSITE product shows the most neutral anomalies over the whole basin. Contrary to the total MHW days per year, anomalies for this metric significantly vary spatially, and can be either positive or negative in the tropical Pacific for the same product. C3S and OSTIA show positive anomalies on the western part of the tropical Pacific with negative anomalies in the eastern part, while OISST and GLORYS12v1 show the opposite (positive anomalies in the eastern tropical Pacific and negative anomalies in the western part).

Inter-product differences on MHW duration (Fig. S2) can reach more than 20 days in some parts of the tropical Pacific : mean duration is equal to ~25 days for OISST in the PEQD, while it goes up to 50 days for the COMPOSITE. Anomalies for this metric range between -10 and +10 days per year, GLORYS and the COMPOSITE products (OISST) showing the strongest positive (negative) anomalies in the PEQD (area of influence of ENSO). CRW and OSTIA show the most neutral anomalies. Anomalies vary spatially for OSTIA, and CRW, with a tendency to show low negative anomalies over the basin but higher positive anomalies in the central eastern part. The opposite is observed for GLORYS12v1. OISST and the COMPOSITE show spatially uniform anomalies over the tropical Pacific. Same results are observed for the cumulative intensity metric (Fig. S3), which can vary from 60°C.days near the Equator for OISST to more than 100°C.days with GLORYS12v1 or the COMPOSITE in the same zone.

For MHW maximum intensity (Fig. S4), the largest differences are observed in the coastal area of the PEQD, where the maximum intensity reaches its highest values (more than 3°C for all products). There, differences of more than 0.5°C are observed, the highest positive (negative) anomalies being observed for C3S and OSTIA (GLORYS). While anomalies are uniform spatially for OISST (positive anomalies) and the COMPOSITE product (negative anomalies), they vary spatially for the other products. GLORYS12v1 shows negative anomalies in most parts of the basin with hotspots of strong positive anomalies off the Australian and Central American coasts.

The onset rate of MHW shows significant differences as illustrated in Fig. S5. The highest inter-product differences are observed close to the Indonesian Coast, where OSTIA detected onset rates of more than 0.35°C/days while they reached 0.1°C/days with GLORYS12v1. High positive (negative) anomalies are also observed for OISST (COMPOSITE). Over the basin, C3S shows the most neutral anomalies. Anomalies for CRW and C3S vary spatially while they are uniform for the other products.

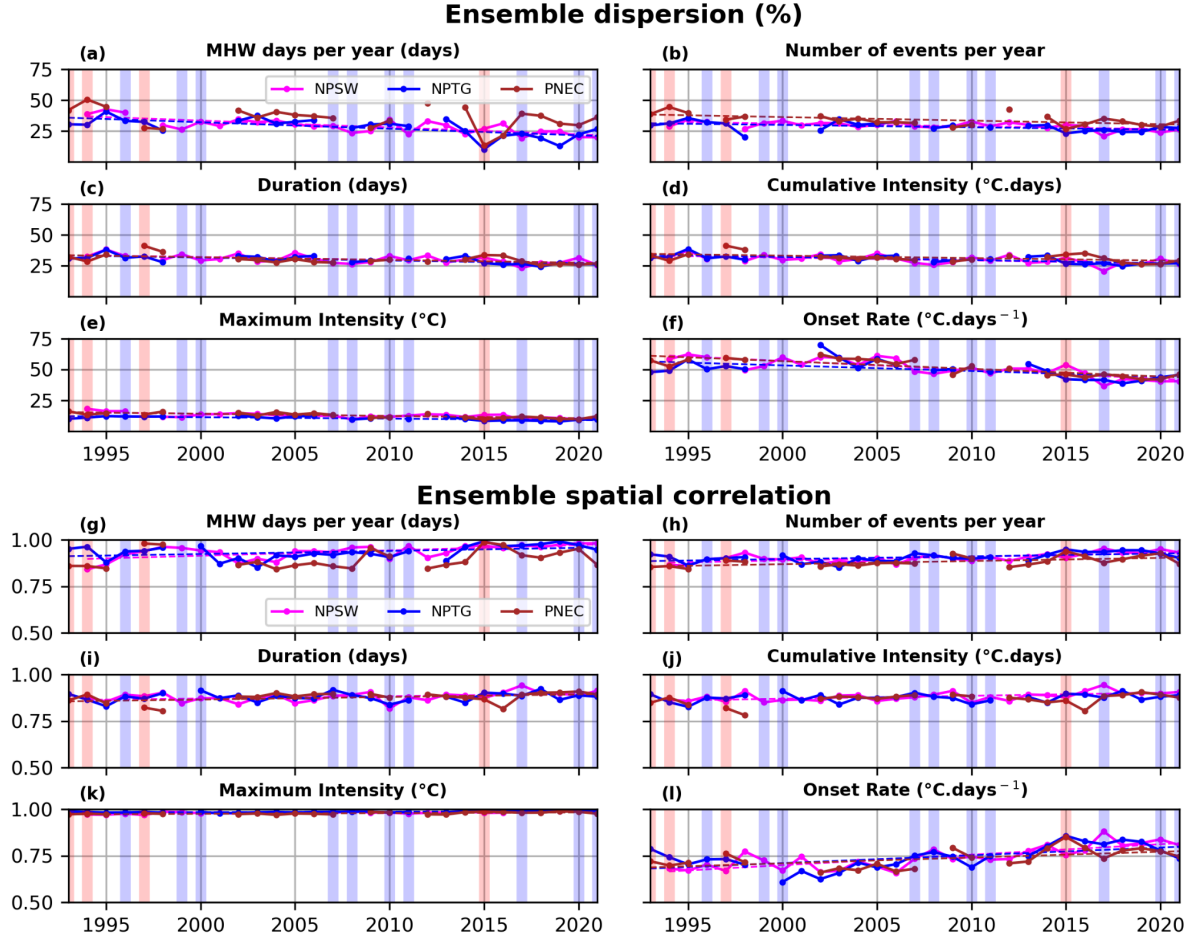


Figure S6: (a-f) Yearly time series of ensemble dispersion (in percentage) for NPSW, NPTG and PNEC. The dashed lines indicate the linear trends, when significant ($p_{\text{value}} < 0.05$). The red and blue backgrounds indicate years of strong El Niño and La Niña, respectively, according to the Meiv2 index. (g-l) Same as (a-f) for the ensemble spatial correlation (section 2.2.3). Time series in the PNEC, NPTG and NPSW are represented in Supplementary Fig. S6.