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Supplement of

On mode water formation and erosion in the Arabian Sea: forcing mechanisms, regionality, and seasonality

Estel Font et al.

Correspondence to: Estel Font (estel.font.felez@gu.se)

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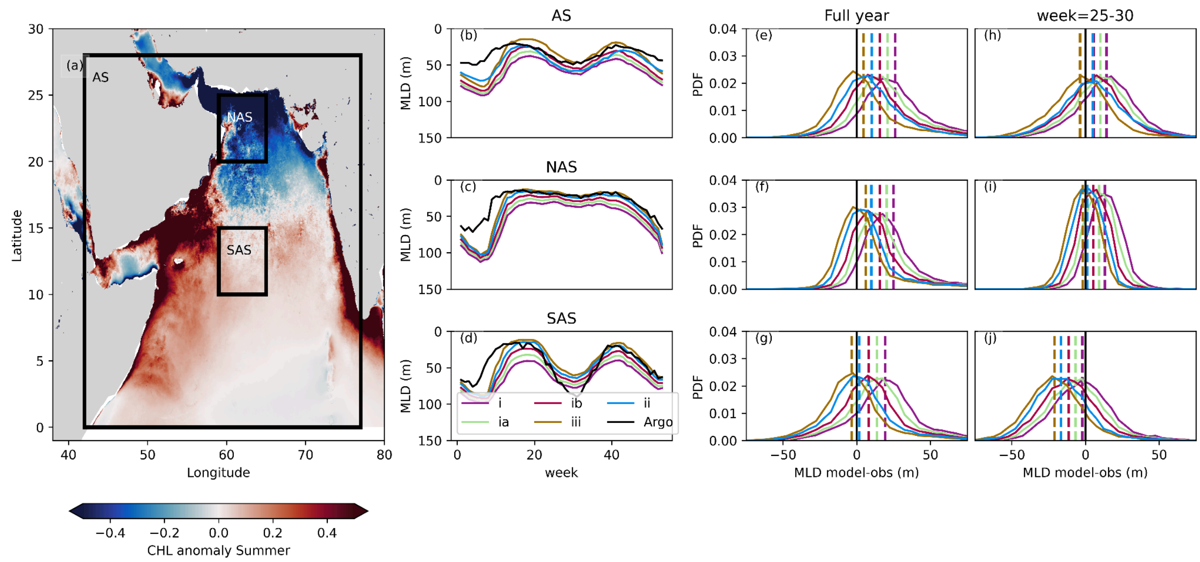

Figure S1. *(a) Chlorophyll concentration summer climatology anomaly. Boxes mark the Arabian Sea, the Northern Arabian Sea and the Southern Arabian Sea regions used in panels (b-m). (b-m) Sensitivity of the modelled MLD by the GOTM 1D model to Water types. MLD annual time-series for Argo (black) and MLD output by GOTM using 5 different water types between (i, ia, ib, ii, iii) for the whole AS (b), NAS (f), and SAS (g). (h-i-j) Full-year bias distribution for each of the water types compared to the observations per region. (k-l-m) It is the same as (h-i-j) but for only data in weeks 25-30 (summer onset). Water type ii is best at representing shallow MLD. In the SAS during summer less turbid waters (type i) are best at reproducing the MLD.*

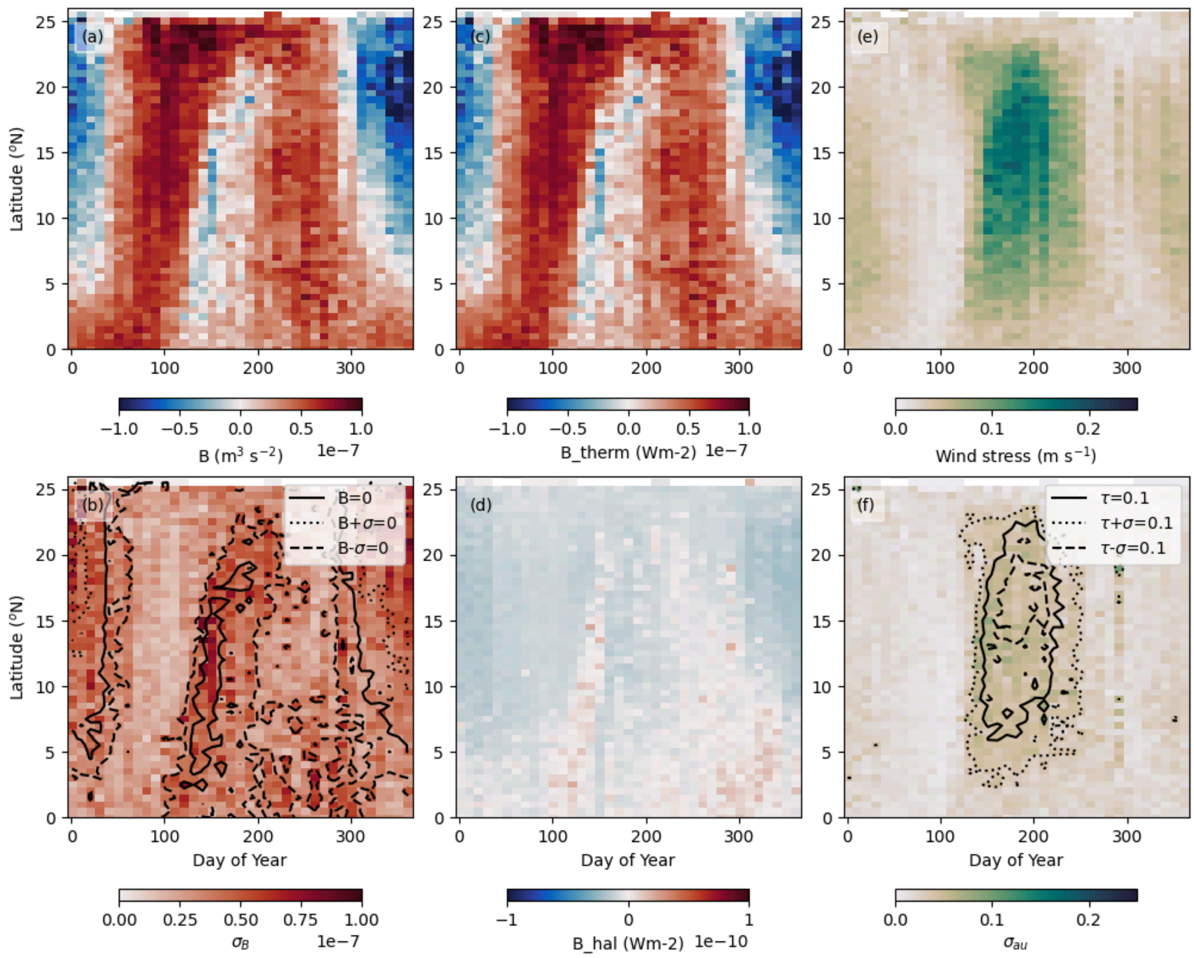

Figure S2*. Latitudinal hövmollers of (a) buoyancy flux, B; (b) standard deviation of the buoyancy flux; (c) thermal and (d) haline component of the buoyancy flux; (e) wind stress and (f) standard deviation of wind stress. In (b) contours of B=0 (solid) and B=0 for ±1std (dotted and dashed). In (f) contours of 0.1 wind stress (solid) and 0.1±1std (dotted and dashed).*

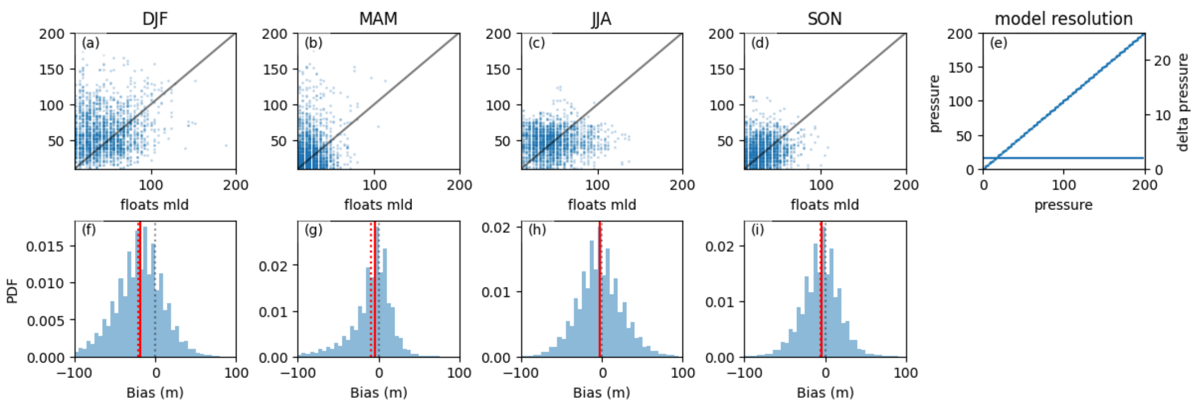

Figure S3. *Mixed layer depth comparison between observation and 1D GOTM. a-d) Scatter of the observed MLD vs. the 1D modeled MLD per season. e) Scatter of the 1D model vertical resolution (regular grid of 2m (delta pressure) in the upper 200m). f-i) Histograms of the difference between the observed MLD and the 1D modeled MLD. The mean and median of the difference per season are respectively: DJF: -21±30 m, -19 m; MAM -9 ±26 m , -5 m; JJA -3±28 m ,-3 m; and SON -6 ±25 m , -5 m.*

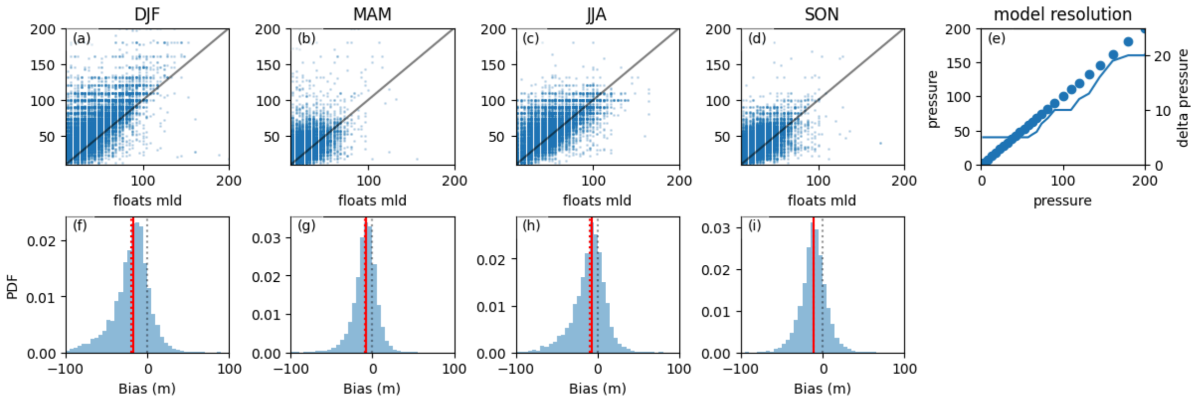

Figure S4. *Mixed layer depth comparison between observation and 3D MOM4p1-TOPAZ a-d) Scatter of the observed MLD vs. the 3D modeled MLD per season. e) Scatter of the 3D model vertical resolution. Grid size is represented by delta pressure variable. f-i) Histograms of the difference between the observed MLD and the 3D modeled MLD. The mean and median of the difference per season are respectively: DJF: -20±24 m, -17 m; MAM: -9 ±16 m , -8 m; JJA: -10±20 m ,-8 m; and SON: -11 ±17 m, -11 m.*

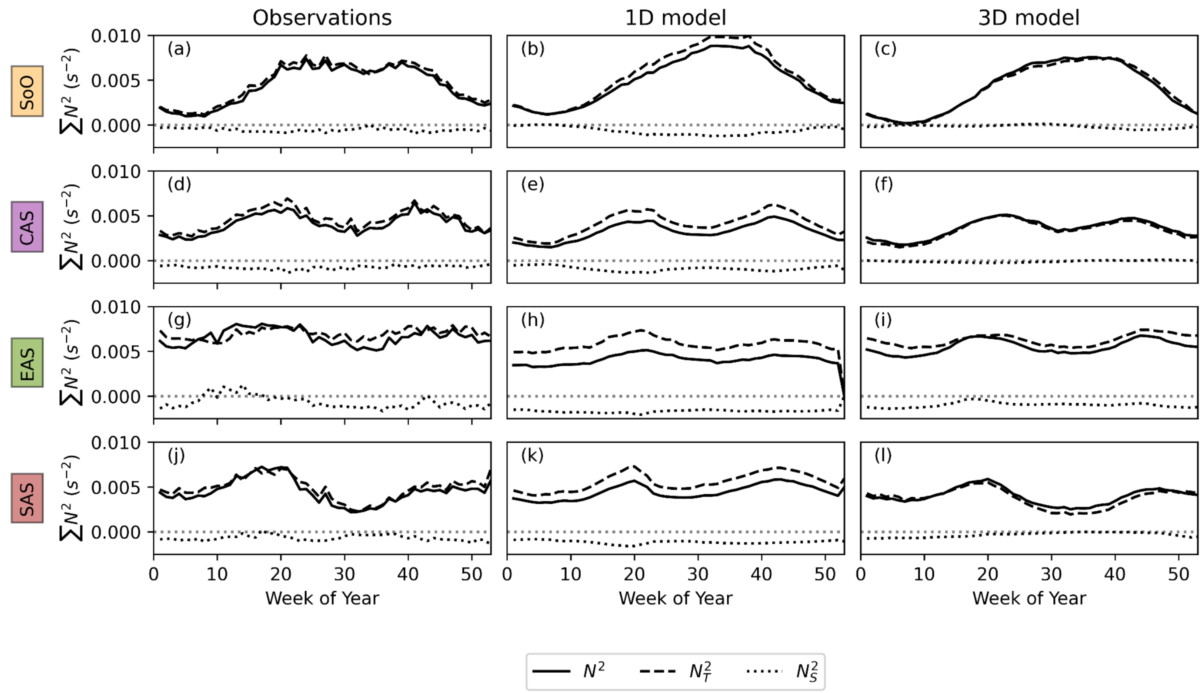

Figure S5. Vertical integration of the weekly climatology of** N^2 **and its haline, and thermal components for observations, 1D, and 3D models. *The vertical integral of stratification (N^2 - solid), the thermal component of the stratification (N^2_T - dashed), and the haline component of the stratification (N^2_S - dotted) for the observations (first column), 1D model (second column) and 3D model (third column). Each row corresponds to the locations of the different case studies in Figure 8.*