The basic relation

$$\frac{d}{dt}\left(d\underline{L}\right) = \boldsymbol{D} \cdot d\underline{L}, \tag{1}$$

with $d\underline{L}$ the distance $(dx, dy) = (x_B - x_A, y_B - y_A)$ of two infinitesimal separated points A and B, and **D** the 'deformation matrix'

$$\boldsymbol{D} = \begin{pmatrix} \frac{\partial u}{\partial x} & \frac{\partial u}{\partial y} \\ \frac{\partial v}{\partial x} & \frac{\partial v}{\partial y} \end{pmatrix}, \tag{2}$$

describes the continuous deformation of $d\underline{L}$ by the velocity vector $\underline{u} = (u, v)$ at that position. Equation (1) originates directly from $d\underline{x} = \underline{u} \cdot dt$ and may be found in most treatises about hydrodynamics, e.g. Lamb (1879).

Lamb, S. H.: Hydrodynamics. University Press, Cambridge, 1879.

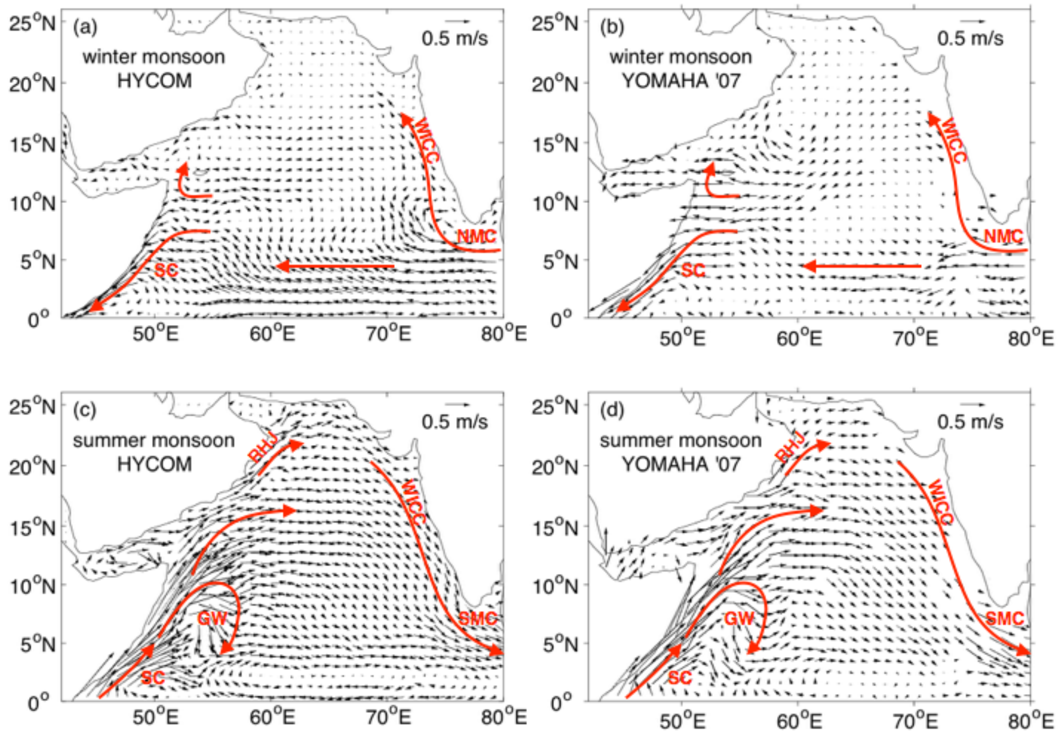

Figure S1: Mean surface velocity obtained from HYCOM (a, c) and YoMaHa'07 (b, d). Current branches indicated after Schott et al. (2009) are the Somali Current (SC), Northeast and Southeast Madagascar Current (NMC and SMC), Ras al Hadd Jet (RHJ), West Indian Coast Current (WICC) and Great Whirl (GW) for the winter monsoon (a, b) from November to February and the summer monsoon (c, d) from June to September.

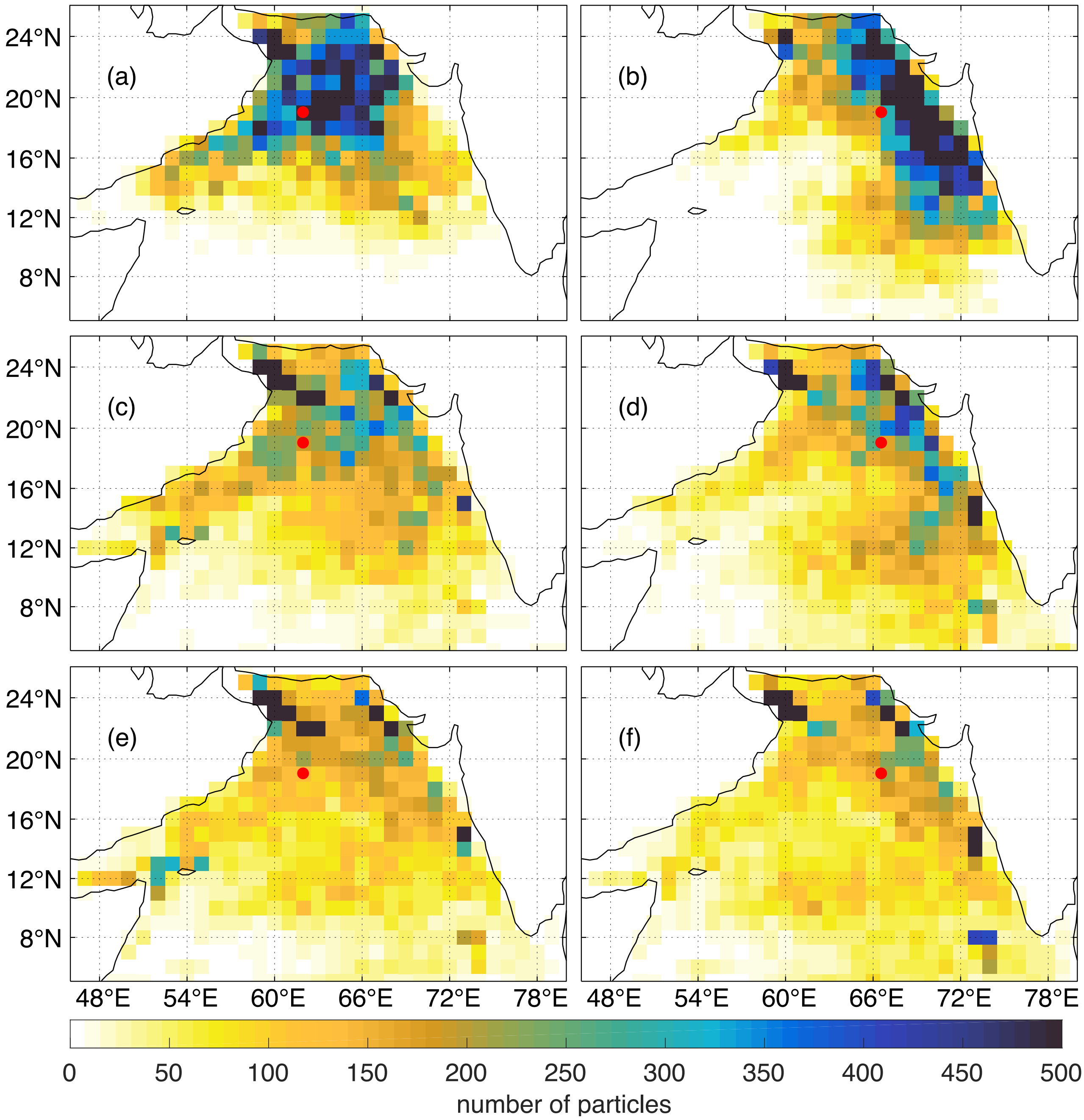

Figure S2: Lagrangian particle distribution after 4 (a, b), 8 (c, d) and 12 (e, f) years simulation for the WR (left) and the ER (right). Eastern (ER) and western (WR) release locations are marked in red.

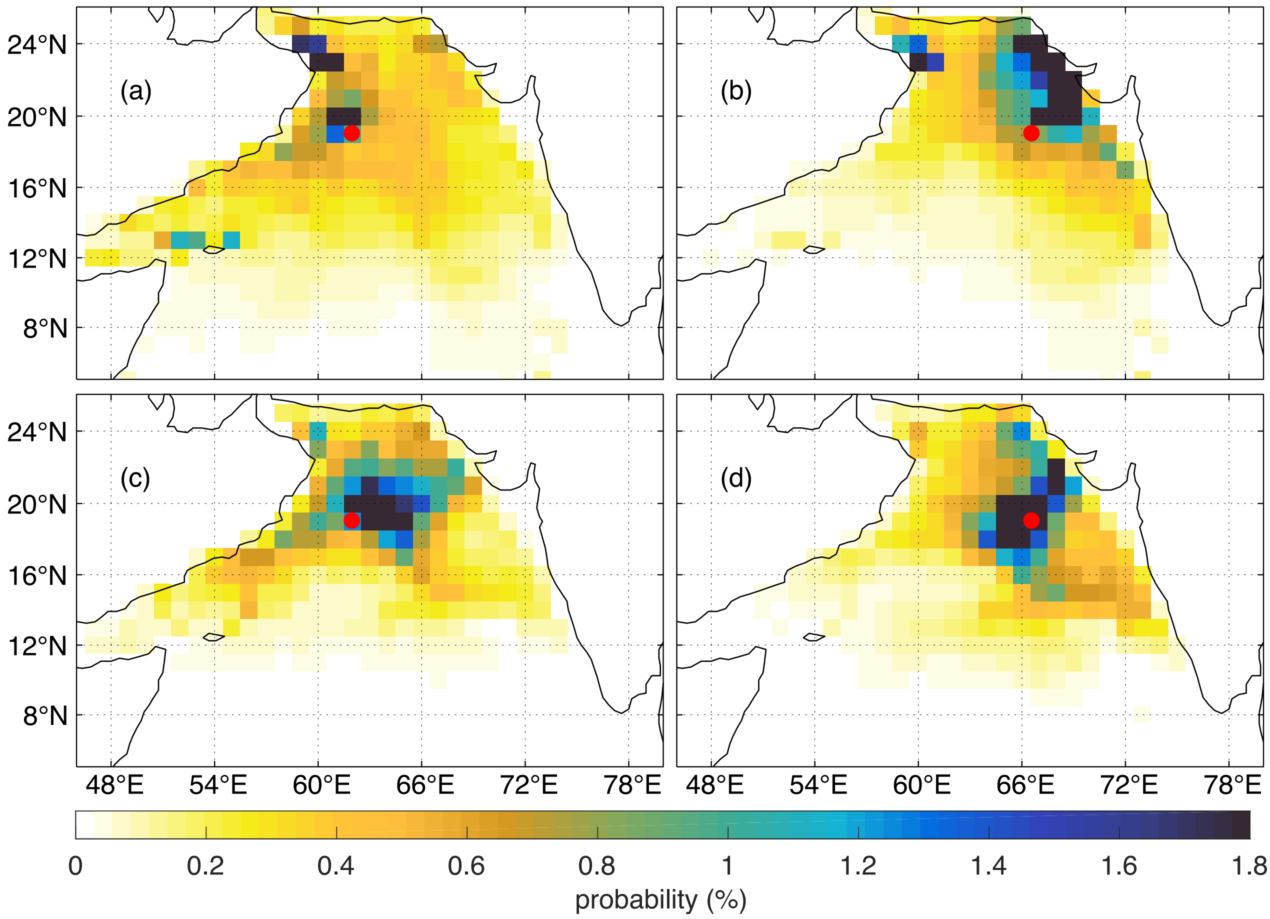

Figure S3: Same as Fig. 6 but for the density layers of σ=26.4 kg/m³ (a, b) and σ=27.4 kg/m³ (c, d).

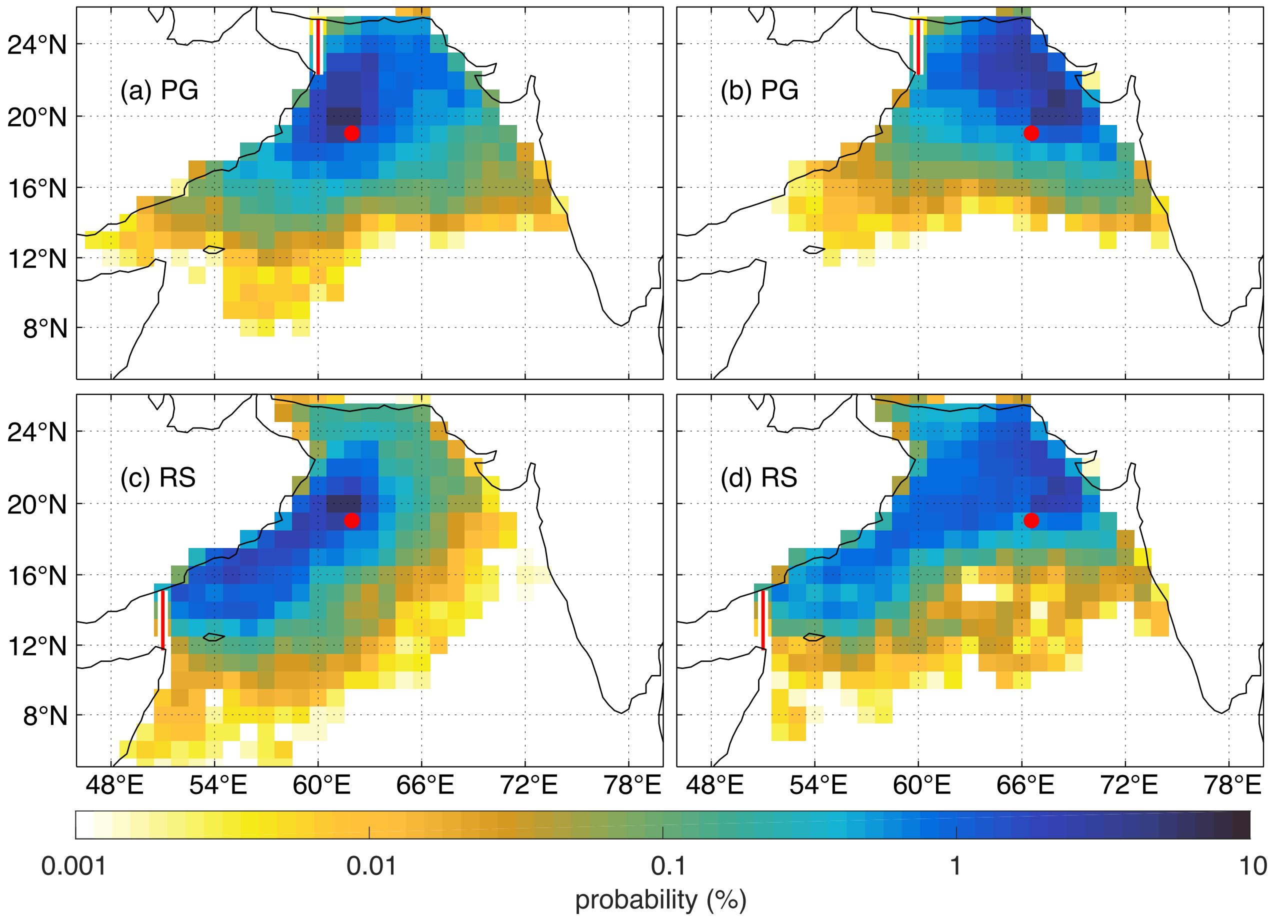

Figure S4: Same as Fig. 7 but for the density layer of σ=26.4 kg/m³.

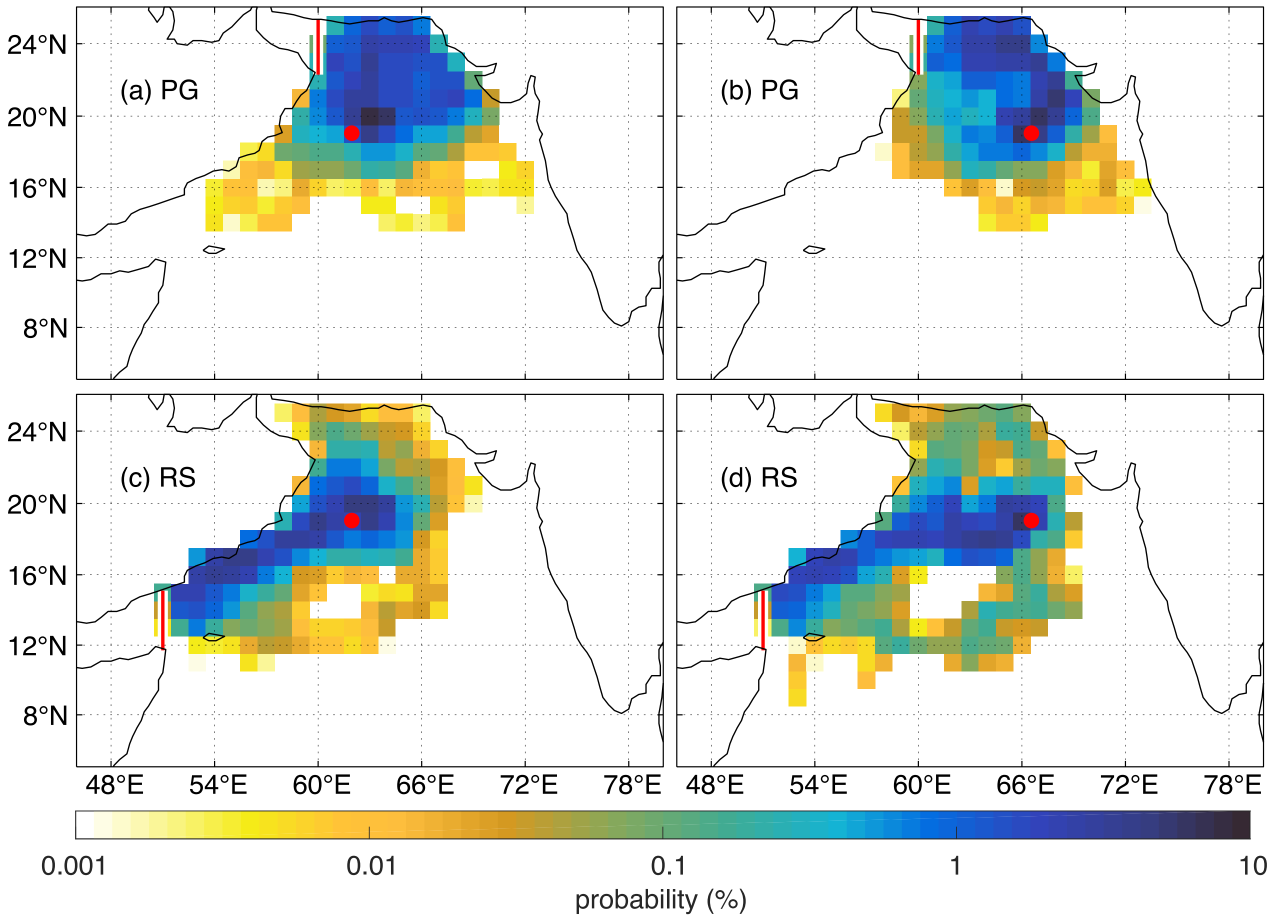

Figure S5: Same as Fig. 7 but for the density layer of σ=27.4 kg/m^3.

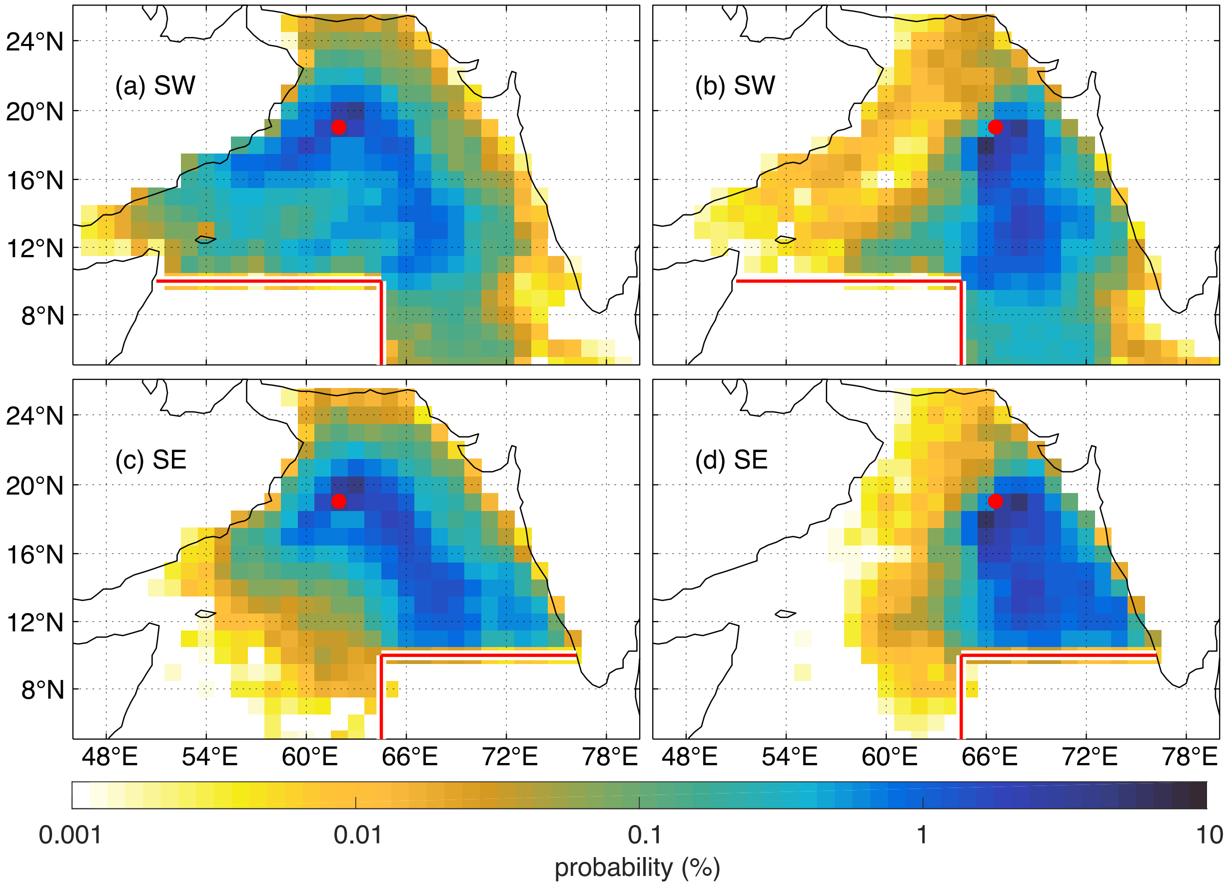

Figure S6: Lagrangian particle position probability maps show the most pronounced pathways of fluid particles along the isopycnal σ=27 kg m^{-3} for the backward trajectory analysis, entering the Arabian Sea from the south west (a, b) and the south east (c, d) streaming into the eastern (right) and western (left) basin. Eastern (ER) and western (WR) release locations in the OMZ are marked in red, as well as the sections, that need to be crossed, to define the source regions.