0.1 evspsblpot: potential evapotranspiration

This variable accounts for theoretical maximum evaporation that is possible to occur. It is computed following the common method included in the GCMs. One of the first proposed method was provided by Manabe (1969). Different iterations later propose improvements in this initial methodology in order to overcome its deficiencies, see for example Barella-Ortiz et al. (2013) for an intercomparison among different methodologies.

In the module, two methodologies are provided and selected via the namelist parameter `potevap_diag`

- bulk method: this method corresponds to the initial one proposed in Manabe (1969). It basically consists in a difference between a supposed saturated air at the surface temperature and the humidity of the atmosphere as it is depicted in equation 1 `[potevap_diag = 1]`

$$
\begin{aligned}
&* \, qc: \; surface \; drag \; coefficient \\
&qc = C_D \sqrt{U10^2 + V10^2} \\
&evspsblpot_{bulk} = \rho(1) qc \left[ws(ts) - QVAPOR(1) \right]
\end{aligned} \tag{1}
$$

  where $ws(ts)$: saturated air at ts ($kgkg^{-1}$), qc: surface drag coefficient (ms^{-1}), TSK: surface temperature (K), $ws(ts)$: saturated air by surface temperature ($kgkg-1$) based on August-Roche-Magnus approximation, $press$: air pressure (Pa), $U10, V10$: 10 m wind components (ms^{-1}), $QVAPOR$: 3D water vapour mxing ratio ($kgkg^{-1}$), C_D: drag coefficient ($-$, only available from MM5-similarity and MYNN surface layer schemes, otherwise is zero).

- Milly92 method: this method makes a correction into the bulk diagnostic in which other atmospheric-related phenomena are taken into account and summarized in a correction parameter (Milly, 1992). It is explained in equation 2 and its implementation is similar to the one present in ORCHIDEE model (Organising Carbon and Hydrology In Dynamic Ecosystems, `http://orchidee.ipsl.fr/`, de Rosnay et al. (2002). The implementation is retrieved from the module `src_sechiba/enerbil.f90`. `[potevap_diag = 2]`

$$
\begin{aligned}
&* \, beta: \; Moisture \; availability \; function \; (similar \; in \; ORCHIDEE) \\
&\beta = \frac{sfcevap}{evspsblpot_{bulk}} \\
&* \, \partial_T ws(T): \; Derivative \; of \; Saturated \; air \; by \; T(1) \\
&\quad Using \; numerical \; 1st \; order \; approximation \\
&\qquad \partial_T ws(T) = \frac{ws[T(1) + 0.5] - ws[T(1) - 0.5]}{2 \times 0.5} \\
&* \, \xi: \; Milly's \; correction \\
&\xi = \frac{L\rho(1) qc \partial_T ws(T)(1 - \beta)}{4EMISSCtBoltzmanT(1)^3 + \rho(1)Cpqc + L\rho(1)qc\partial_T ws(T)\beta} \\
&evspsblpot_{Milly92} = evspsblpot_{bulk} \frac{1}{1 + \xi}
\end{aligned} \tag{2}
$$

  where β: Moisture availability function, $sfcevap = QFX$ surface evaporation ($kgm^{-2}s^{-1}$) from QFX: surface moisture flux ($kgm^{-2}s^{-1}$), L: latent heat of vaporization, $EMISS$: emissivity (1), $CtBoltzman$: constant of Stefan-Boltzman, Cp: specific heat of air, $\partial_T ws(T)$: derivative of saturated air at temperature of first atmospheric layer ($kgkg^{-1}$)

The choice between methodologies is driven in namelist with parameter labeled `potevap_diag` in `cordex` section, with default value 2. See in figure 1 an example of the differences between both implementations

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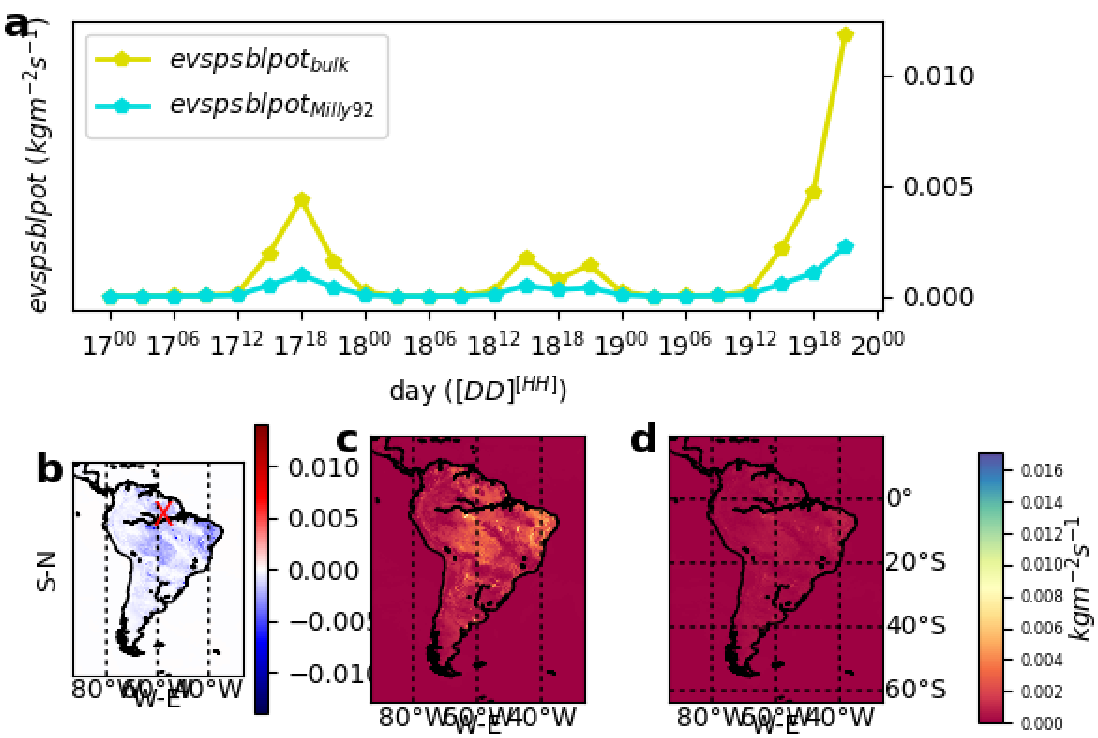

Figure 1: Evolution (a) of potential evapotranspiration by bulk (yellow) and Milly92 (blue) methods at S 4° 58′ 55.524”, 62° 4′ 37.92” W (red cross in b), on 2015-11-18 15 UTC differences (b, $evspblpot_{Milly92} - evspblpot_{bulk}$) between both methods, and values using Milly method (c) and bulk (d)

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