

Review of egusphere-2025-5761, Müller et al., The lapse rate.....

GENERAL

It is pleasing to see this unique study of strat-trop exchange in connection with monsoonal circulations. The work is of a high standard, original and is clearly suitable for publication in *Atmos Chem Phys*. In the COMMENTARY below I make some points that may be helpful. In particular, the references are long on recent work and somewhat short on original contributions.

COMMENTARY

lines 35 et seq: This section misses out some earlier references that deal with research quality observations, and which say some relevant things about the tropical tropopause [1,2,3,4,5]. In particular, the average θ_w at the sea surface in the tropics is 355 K, significantly lower than the potential temperature of the tropical tropopause, however that is defined. Transport from the midlatitude stratosphere and local descent must contribute [3]. Reference [5] below has some highly relevant discussion, also applicable in large parts of the subsequent text. The original point about the role of the monsoon was made in [6], amplified in [7]. They should be referenced.

lines 45-50: It would be helpful to the reader if the location of the StratoClim campaign was supplied.

line 69: In 1972 the NASA WB57F flew around a Cb top and anvil penetrating the tropopause near Amarillo, Texas. It saw higher concentrations of water vapour downwind than upwind of the penetrating top and anvil. It is reported in the CIAP report, published by the US Dept of Transportation in 1974.

lines 73-79: These are all model based arguments. Observational ones, considerably better founded, are in [5] and [8], in which the TTL (not then called that) was pointed out.

line 118: Saturation over ice is a crude approximation, see discussion in [5].

lines 133-140: Isotopic studies are very useful in principle. One process that needs discussion is the very fast exchange rates at aqueous particle surfaces. For example, an O atom in a water molecule that enters a particle may not be attached to the same H (and D) atoms when it leaves. Particles are not at equilibrium; Henry's Law does not apply.

lines 163-166: Such trajectories are Lagrangian sampling of an Eulerian system, so are not truly following a given unmixed air mass.

lines 200-207: See the discussion in [9].as referenced in [5].

lines 272-281: Interesting. In general, for the whole paper, I find it surprising that there is no mention of the subtropical jet stream and its migration north during boreal summer. See [10].

lines 283-288: Note that an early stratosphere-troposphere GCM predicted the role of monsoonal circulation in air entry to the stratosphere [12].

lines 318 & 332: "Control" is a slippery concept, given the nonconvergent variance of airborne observations [11].

lines 334-338: See Figure 14 in [3].

[1] *Q J R Meteorol Soc*, **122**, 929-944 (1996)

[2] *Q J R Meteorol Soc*, **124**, 1559-1578 (1998)

[3] *J Geophys Res*, **108(D23)**, 4734 (2003)

[4] *J Geophys Res*, **109**, D05310 (2004)

[5] *J Geophys Res*, **111**, D13304 (2006)

[6] *J Geophys Res*, **102**, 13213-13234 (1997)

[7] *Q J R Meteorol Soc*, **125**, 1079-1106 (1999)

[8] *Q J R Meteorol Soc*, **123**, 1-69 (1997)

[9] *J Geophys Res*, **98**, 8639-8664 (1993)

[10] *Q J R Meteorol Soc*, **106**, 227-253 (1980)

[11] *Entropy*, **27(7)**, 740 (2025)

[12] *Q J R Meteorol Soc*, **110**, 321-356; 357-392 (1984)