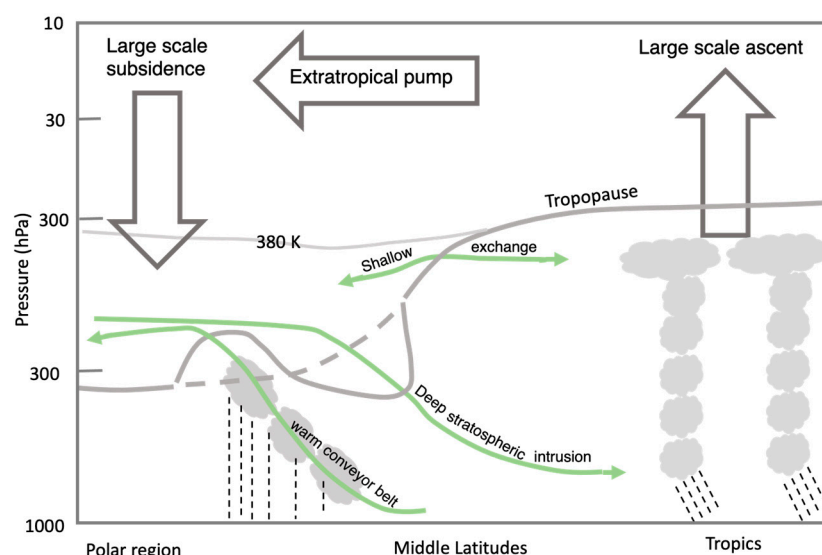
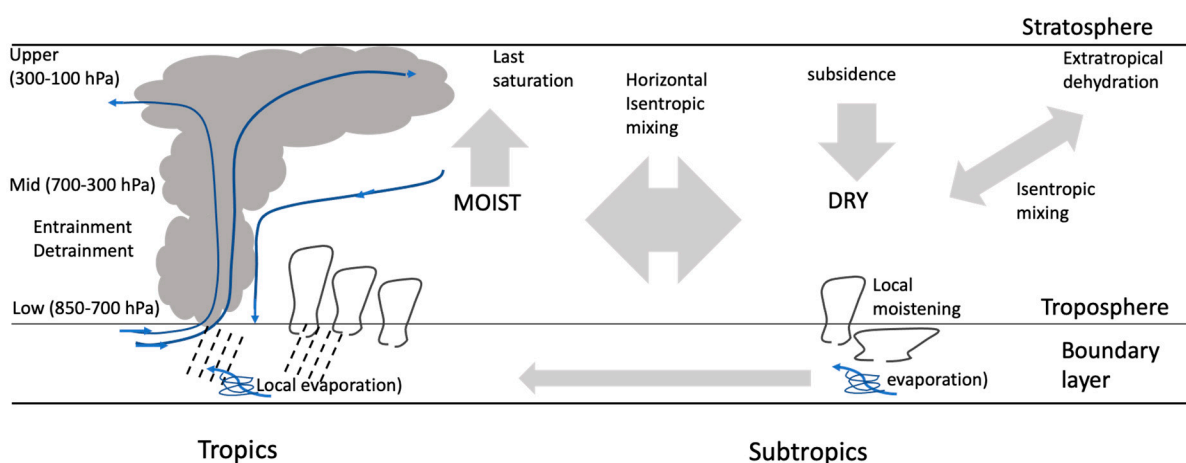


# Ice Core $^{17}\text{O}$ Reveals Past Changes in Surface Air Temperatures and Stratosphere to Troposphere Mass Exchange

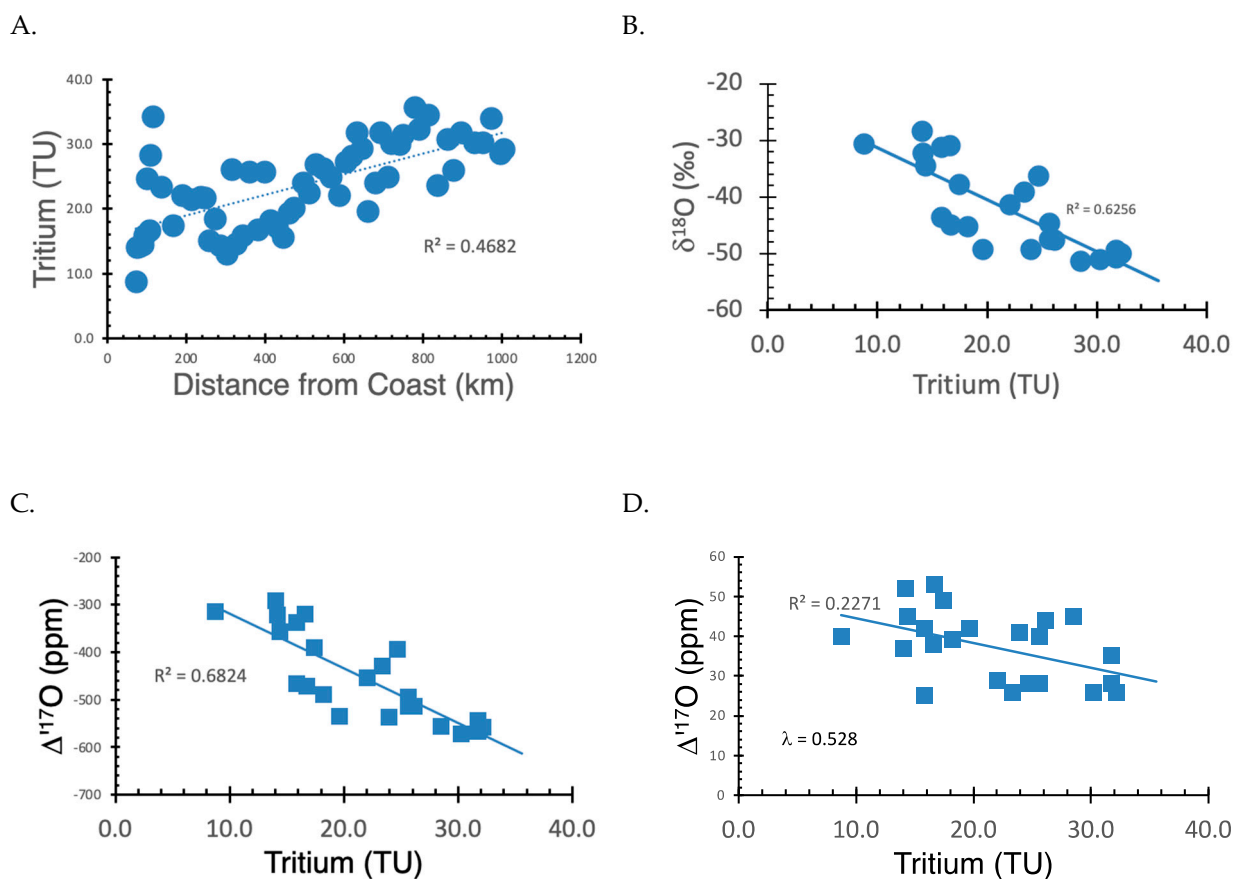
Pradeep K. Aggarwal, Frederick J. Longstaffe and Franklin W. Schwartz



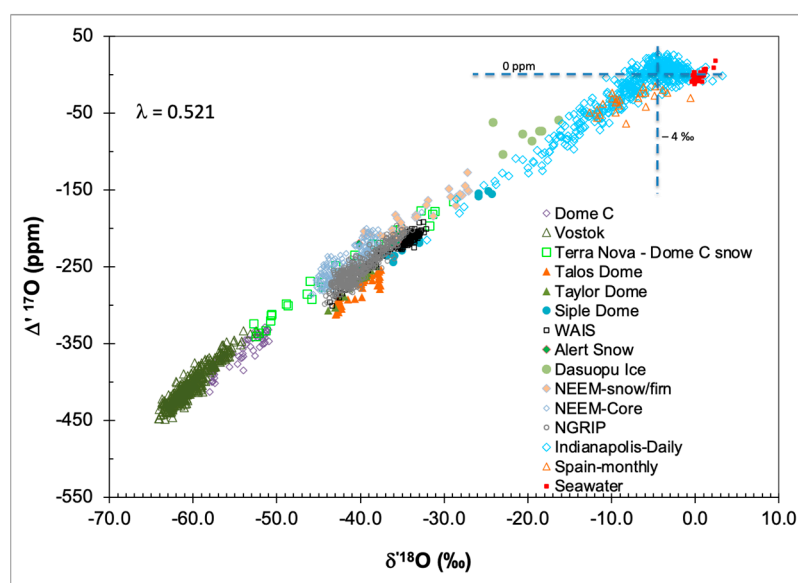
**Figure S1.** Schematic representation of the Brewer-Dobson Circulation with upwelling in the tropics, poleward transport by the “extratropical pump”, and downwelling in the high latitudes. Re-drawn after Holton et al. [42] and Stohl et al. [71].

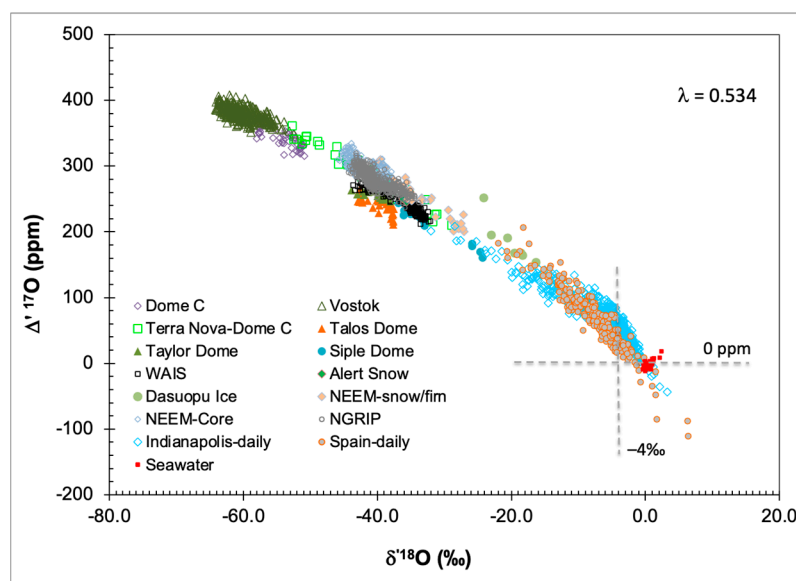


**Figure S2.** Schematic representation of moisture transport in the troposphere (re-drawn after Stohl et al. [71]). Water vapor from surface evaporation in the tropics and subtropics is transported upwards in convective clouds. Moisture from detrainment of cloud condensate and saturated air mass is transported to other regions by large scale circulation.

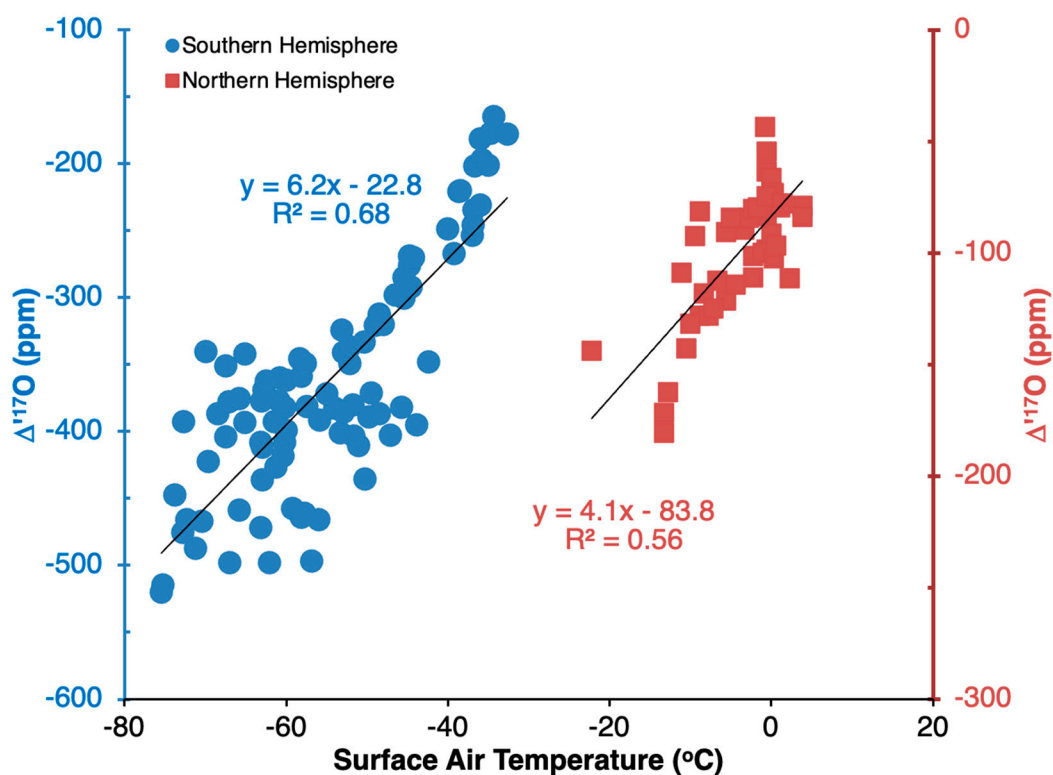


**Figure S3.** Tritium and oxygen isotopes in Antarctic surface snow from Terra Nova Bay to Dome C. Tritium and distance data are from [64–65] and  $\delta^{18}\text{O}$  is from [68]. A. Tritium with distance from the coast. B.  $\delta^{18}\text{O}$  versus tritium. Correlation of  $\delta^{18}\text{O}$  with tritium suggests that some of the decreasing  $\delta^{18}\text{O}$  may be attributed to an increasing contribution of upper tropospheric moisture containing stratospheric input. C.  $\Delta^{17}\text{O}$  versus tritium with  $\lambda = 0.516$ . D.  $\Delta^{17}\text{O}$  versus tritium with  $\lambda = 0.528$ .

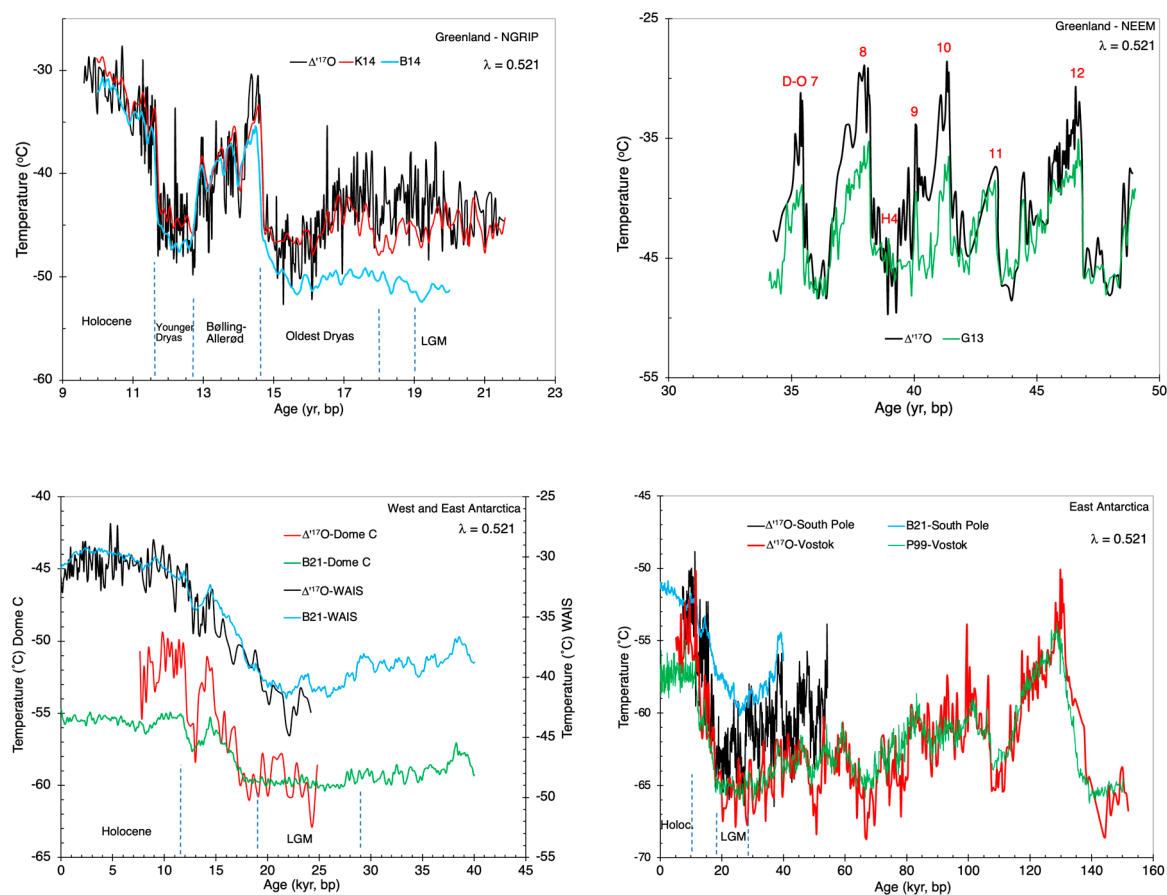




**Figure S4.** The effect of the value of MDF coefficient on  $\Delta^{17}\text{O}$ . For MDF coefficient values less than 0.521, the  $\Delta^{17}\text{O}$  and  $\delta^{18}\text{O}$  are positively correlated and the magnitude of  $\Delta^{17}\text{O}$  has negative values (less than zero) owing to MDF coefficient value being less than the effective  $\delta^{17}\text{O}/\delta^{18}\text{O}$  ratio in stratospheric input. For values of 0.534 or higher, the correlation becomes negative and  $\Delta^{17}\text{O}$  values mostly are greater than zero. For intermediate values of MDF, the correlation and  $\Delta^{17}\text{O}$  values are variable as shown in Figure 1 in the text.



**Figure S5.** Calibration of the  $\Delta^{17}\text{O}$  paleothermometer using an MDF coefficient of 0.521. Compare with Figure 3 in text.



**Figure S6.** Reconstructed surface air temperatures for multiple ice cores using a value of 0.521 for the MDF coefficient.