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Supporting Information for

Interpreting precession driven δ^{18}O variability in the South Asian Monsoon region

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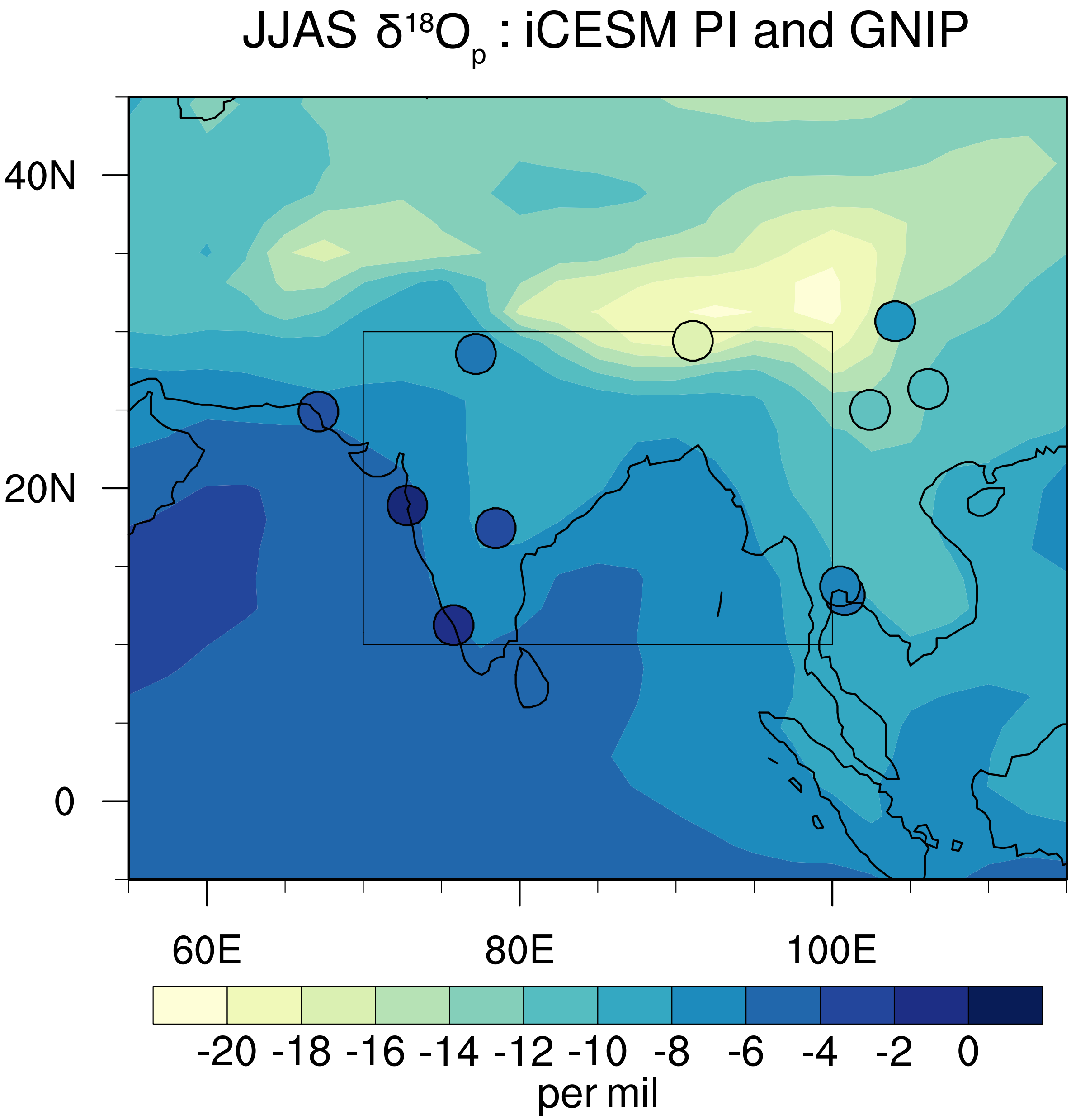

Figure S1. Comparison between summer $\delta^{18}O$ of precipitation from iCESM with $\delta^{18}O$ of precipitation from the Global Networks of Isotopes in Precipitation (GNIP) observation stations. Contours are JJAS $\delta^{18}O$ of precipitation averaged from the final 50 years of a preindustrial iCESM simulation. GNIP data are JJAS $\delta^{18}O$ of precipitation averages from stations within 5° of the SASM region. Only stations with at least 3 years of summer data are plotted. GNIP data come from a compilation by the Stable Water Isotope Intercomparison Group (SWING2;

http://www.giss.nasa.gov/staff/gschmidt/SWING2.html). In general, observed and simulated JJAS $\delta^{18}O$ of precipitation spatial patterns agree. The model appears to have a small depletion bias. However, the comparison is limited by the few, and often short duration, observational records.

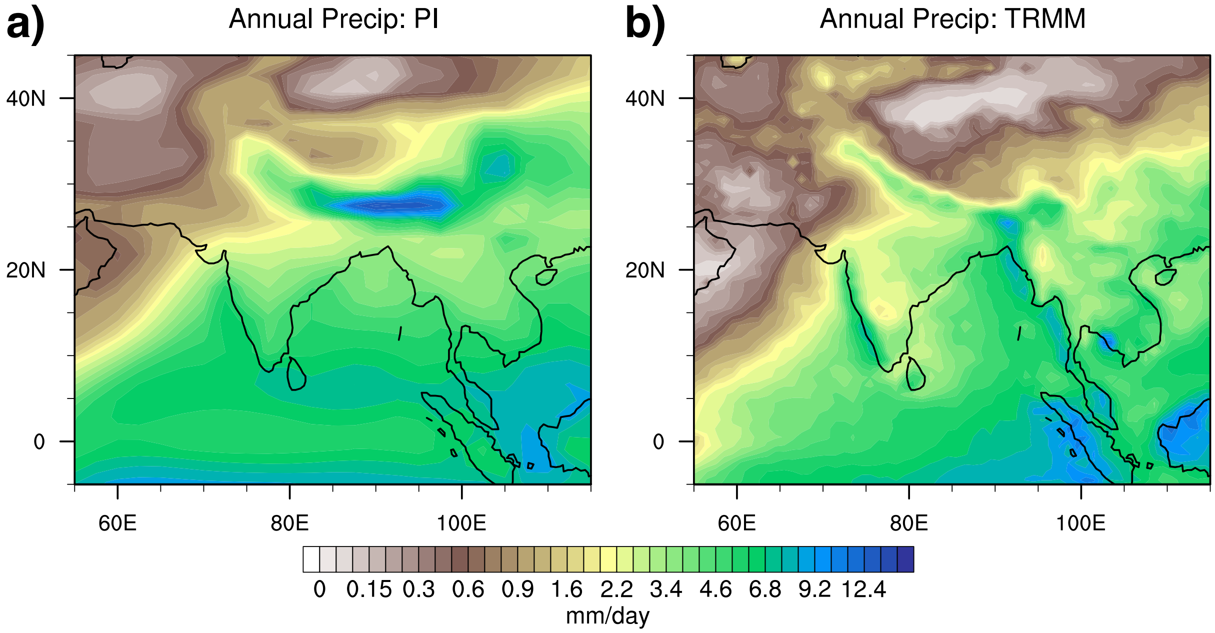

Figure S2. Comparison of iCESM simulated precipitation with satellite observations. **a)** Annual average precipitation rate from the final 50 years of a preindustrial iCESM simulation. **b)** Annual average precipitation rate from the Tropical Rainfall Measuring Mission (TRMM) between 1998-2009 (Huffman et al., 2007). The model does a good job capturing the precipitation amounts estimated by the TRMM satellite. However, there is too much precipitation around 30°N, 95°E in the simulation. This discrepancy with the satellite observations might be artificially amplified due to an underestimation of precipitation by TRMM during high intensity events (Iguchi et al., 2009).

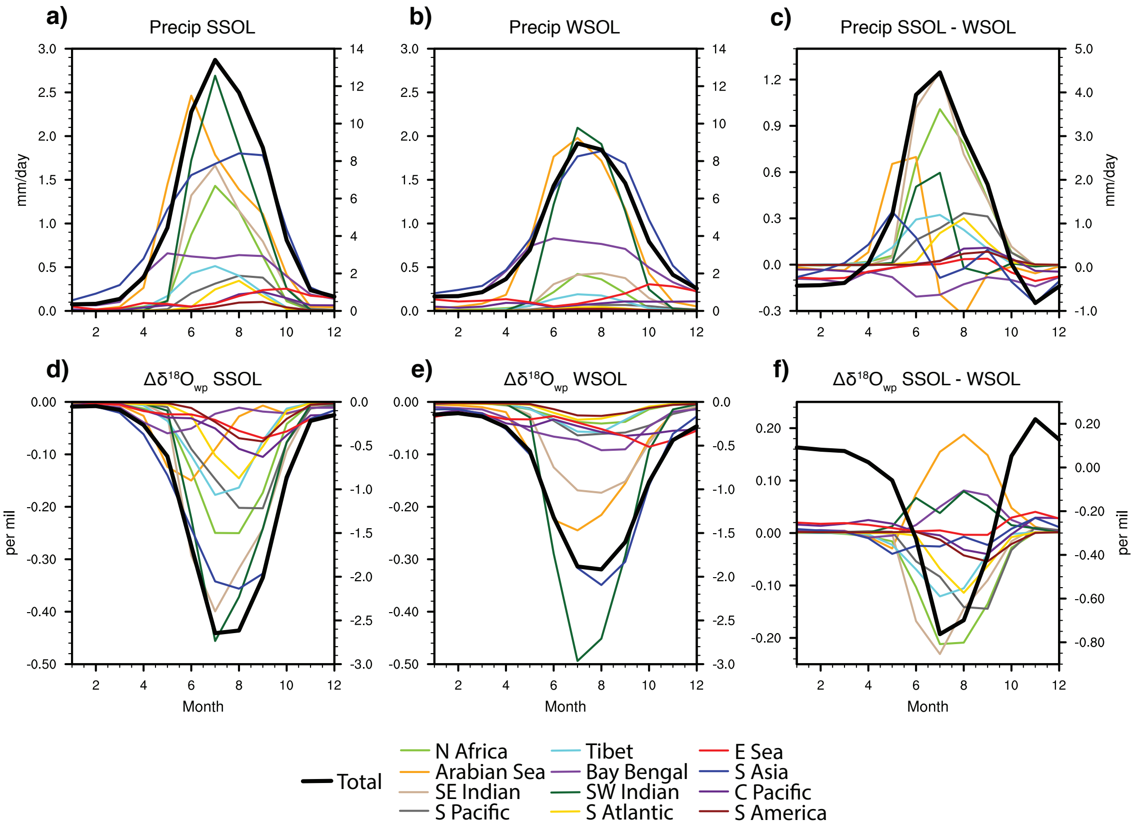

Figure S3. Source water contributions to SASM precipitation and δ^{18}O. SASM precipitation with perihelion at the Northern Hemisphere **a)** summer solstice (SSOL), **b)** winter solstice (WSOL), and **c)** their difference (SSOL – WSOL). SASM $\delta^{18}O_{wp}$ of precipitation with perihelion at the Northern Hemisphere **d)** summer solstice (SSOL), **e)** winter solstice (WSOL), and **f)** their difference (SSOL – WSOL). To aid comparison between quantities on different scales, the left y-axis corresponds with individual water sources and the right y-axis corresponds to total signal (thick black line).

References

Huffman, G.J., Bolvin, D.T., Nelkin, E.J., Wolff, D.B., Adler, R.F., Gu, G., Hong, Y., Bowman, K.P. & Stocker, E.F. (2007). The TRMM multisatellite precipitation analysis (TMPA):

Quasi-global, multiyear, combined-sensor precipitation estimates at fine scales. *Journal of hydrometeorology*, *8*(1), 38-55. https://doi.org/10.1175/JHM560.1

Iguchi, T., Kozu, T., Kwiatkowski, J., Meneghini, R., Awaka, J., & Okamoto, K. I. (2009). Uncertainties in the rain profiling algorithm for the TRMM precipitation radar. *Journal of the Meteorological Society of Japan. Ser. II*, *87*, 1-30. https://doi.org/10.2151/jmsj.87A.1