

## Relevance of $d$ excess in climate and water sciences

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The "deuterium excess" defined as  $d = \delta D - 8\delta^{18}O$  is an offshoot of the Global Meteoric Water Line (GMWL) defined as  $\delta D = 8 \delta^{18}O + 10$ .<sup>1,2</sup> Deuterium excess is "set" by the prevailing humidity at the source from where precipitation producing vapor is derived and does not change barring post precipitation processes, primarily evaporation. Mixing with additional vapor source with different  $d$  excess can also affect the  $d$  excess in precipitation<sup>3</sup>. Additionally,  $d$  excess may have paleoclimate implications if suitable paleo waters can be obtained<sup>4</sup>. In effect  $d$  excess is valuable geophysical tool that enables coupling of meteorology and surface water generation. There are also implications in hydrology<sup>5,6</sup>. However, in order to meaningfully use the  $d$  excess parameter in various applications, the processes that control  $d$  excess especially in local precipitation, need to be fully understood and evaluated. This is particularly the case when multiple sources of moisture are involved. A case study from a site in South West Michigan, USA exemplifies this. Precipitation in this region is influenced by air masses originating in the Gulf of Mexico, Canadian Arctic, The Pacific and the Atlantic. In particular, the region is influenced by the Great Lakes, another source of water vapor.  $d$  excess associated with each of these moisture sources needs to be considered while using this parameter in climate and hydrologic applications.

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