# Influence of winter storms and Santa Ana winds on the isotopic composition of near-surface atmospheric moisture in San Diego, USA


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Acknowledgement



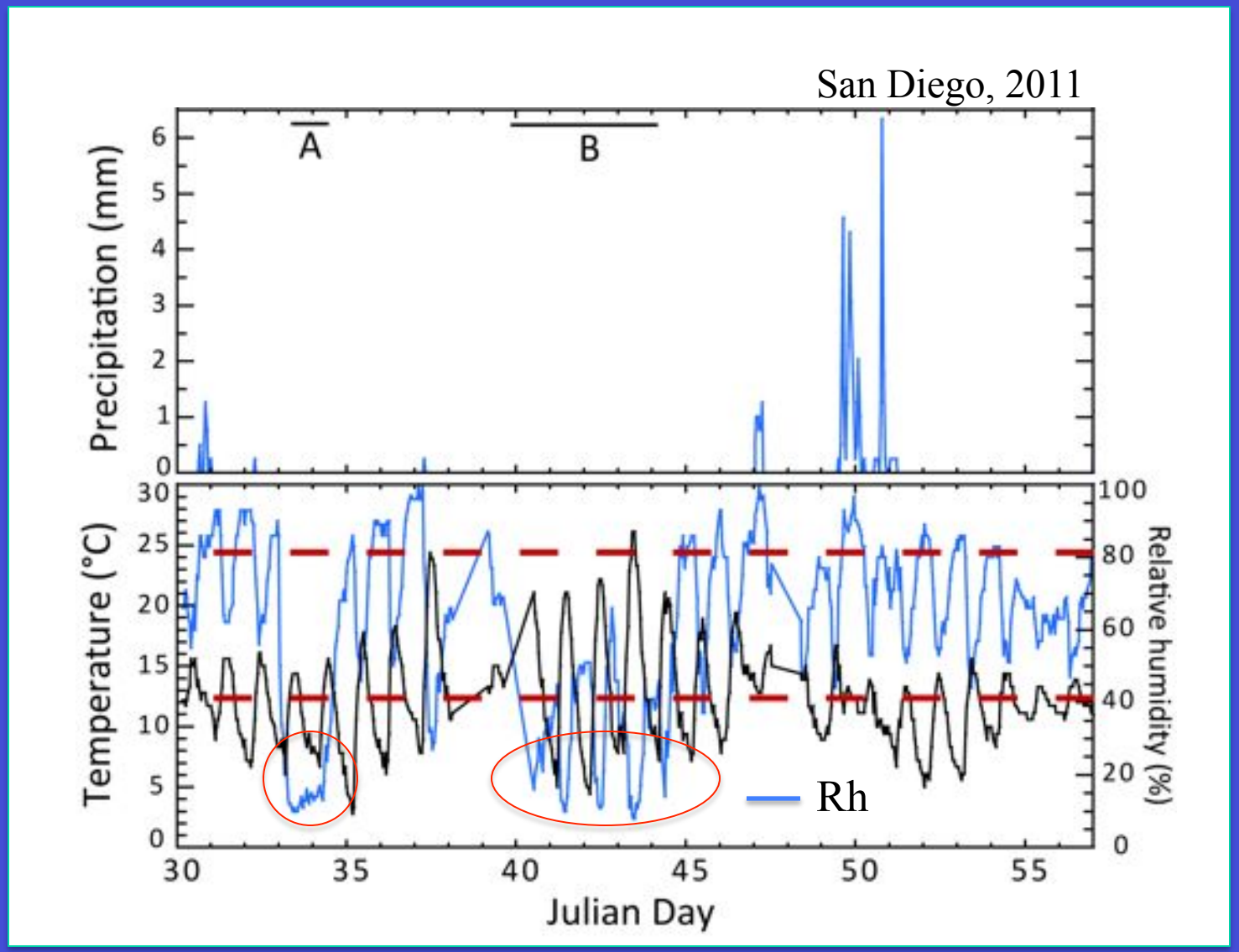

## Which processes are the primary controls of the isotopic composition of atmospheric water vapor in San Diego?

Sampling location: San Diego State University campus

Sampling period: February 2011

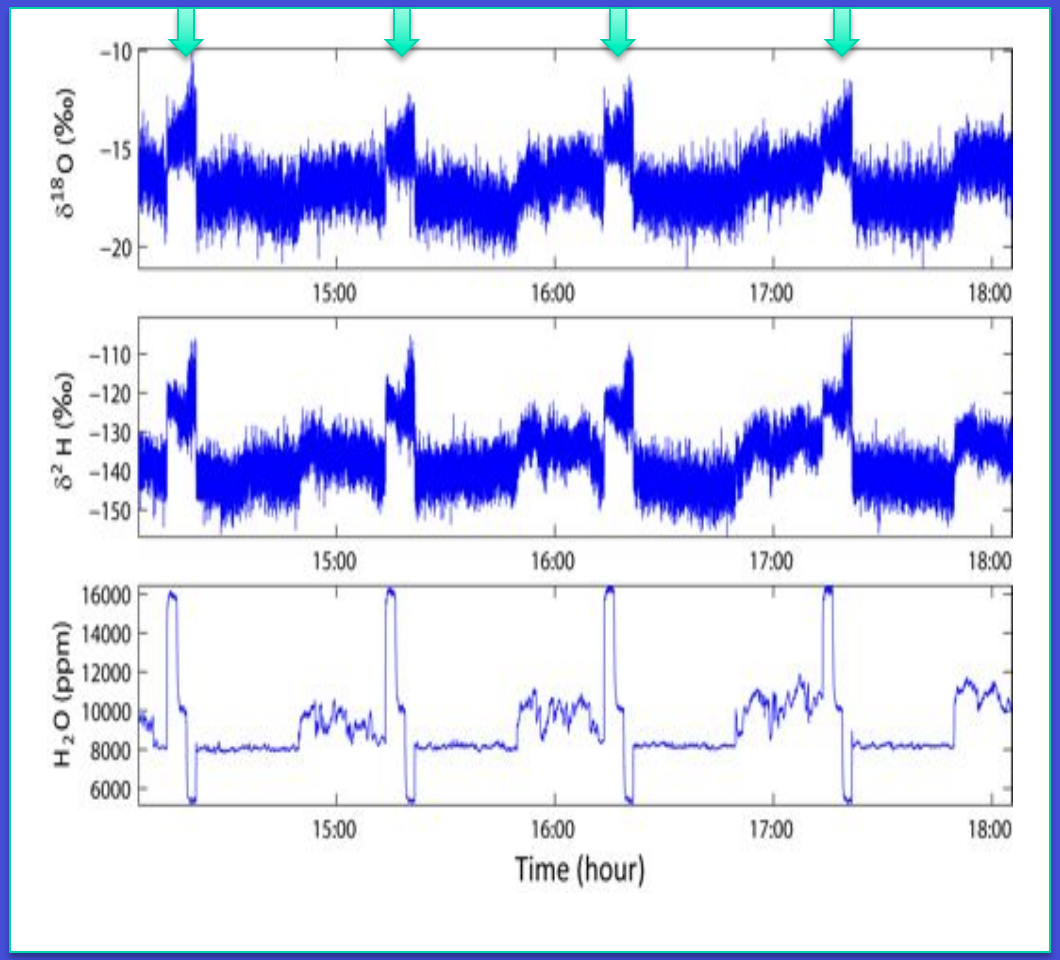
Data: hourly averages of near-surface water vapor mixing ratios and their isotopic composition

# Vapor isotope ratios were measured in locally extreme weather conditions (Santa Ana and winter rainstorms)



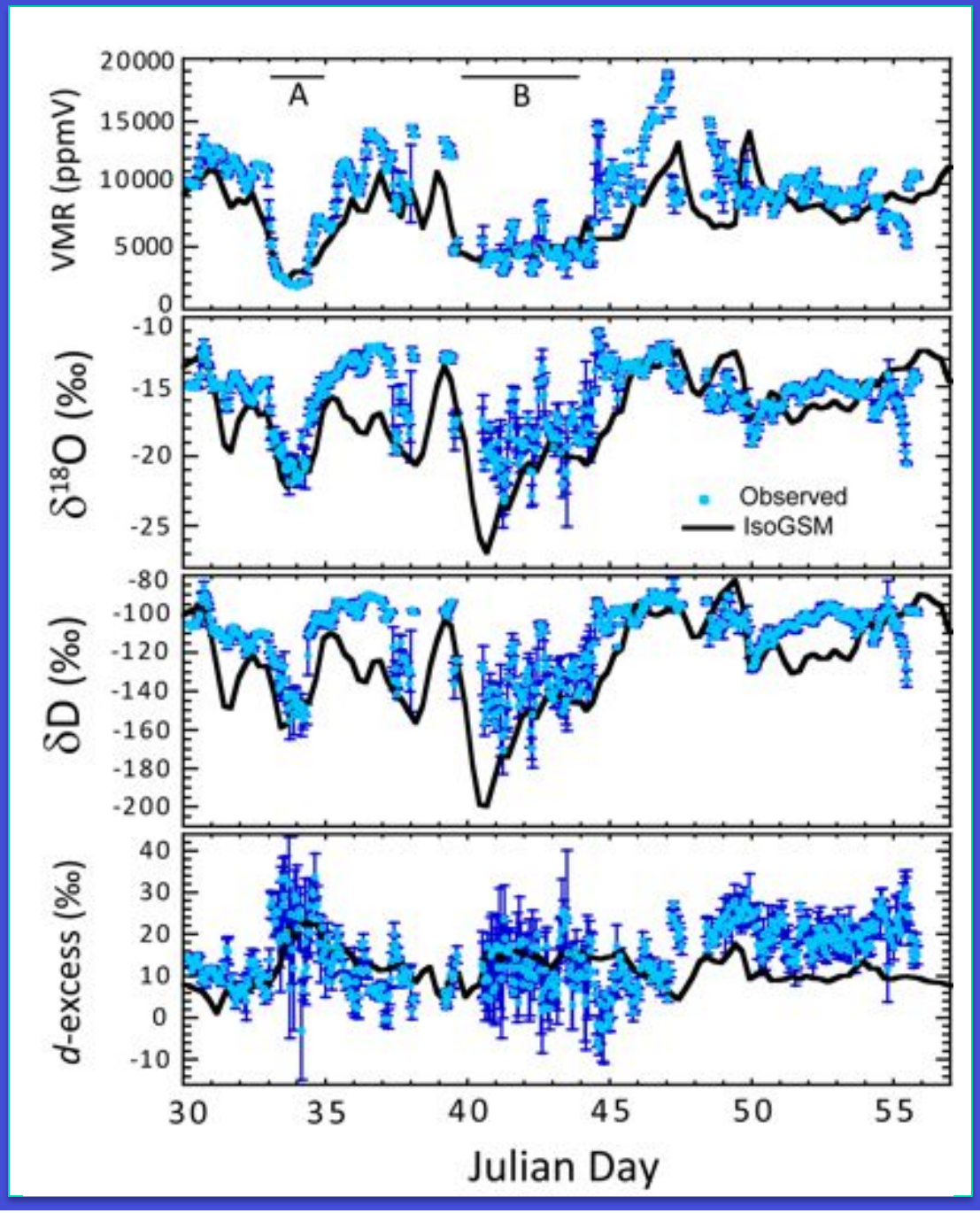
Hourly calibration is performed to ensure high data quality

Accuracy: ±0.5 ‰ for δD and ±0.1 ‰ for $\delta^{18}O$




A LGR analyzer and a water standard source unit allows for in-situ, hourly water vapor isotope measurements

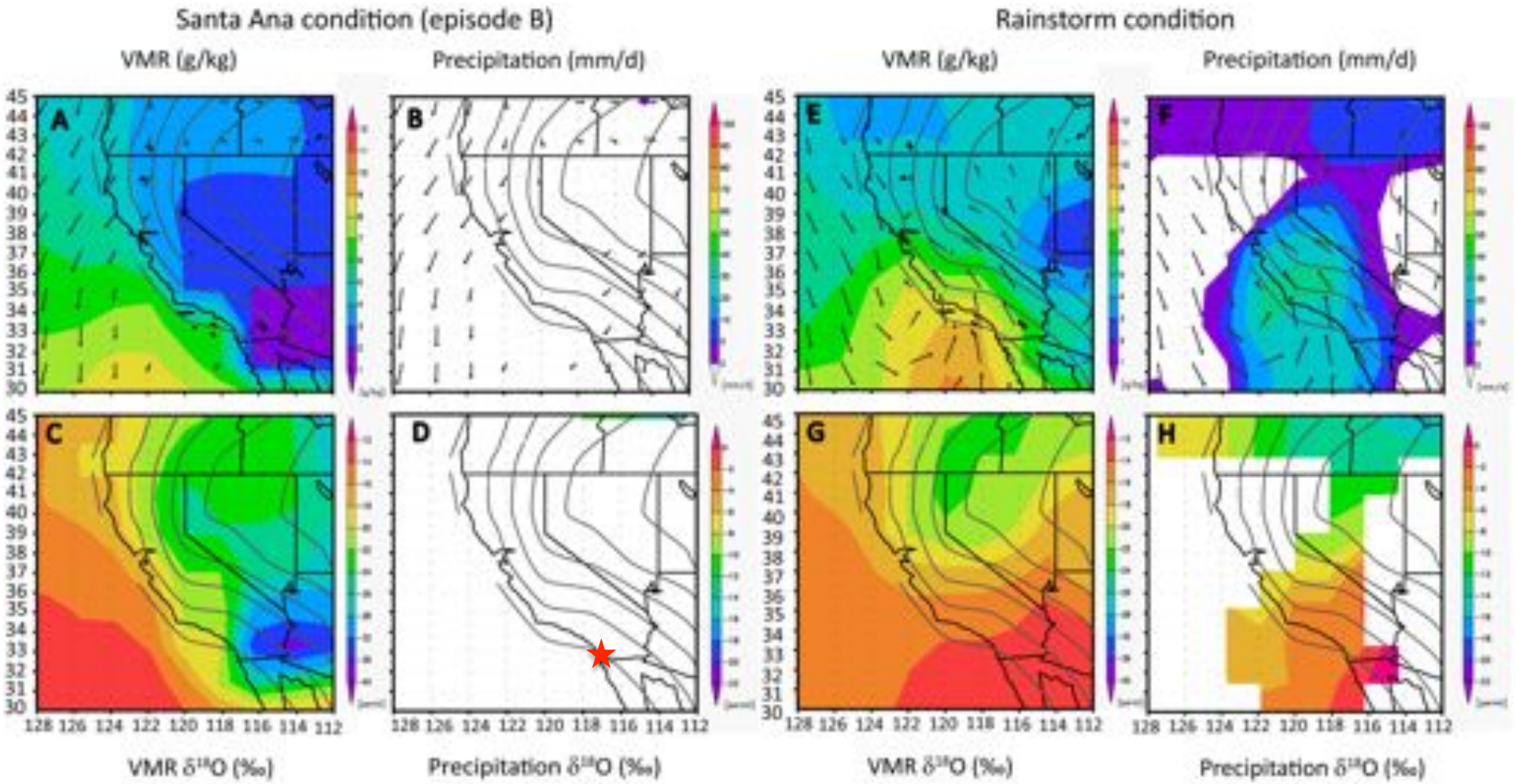
Rambo et al. (2011) J. Atm. Ocean Tech 28: 1448-1457




Synoptic weather cycles depict large day-to-day variability in the mixing ratio and isotopic composition of near-surface atmospheric moisture.

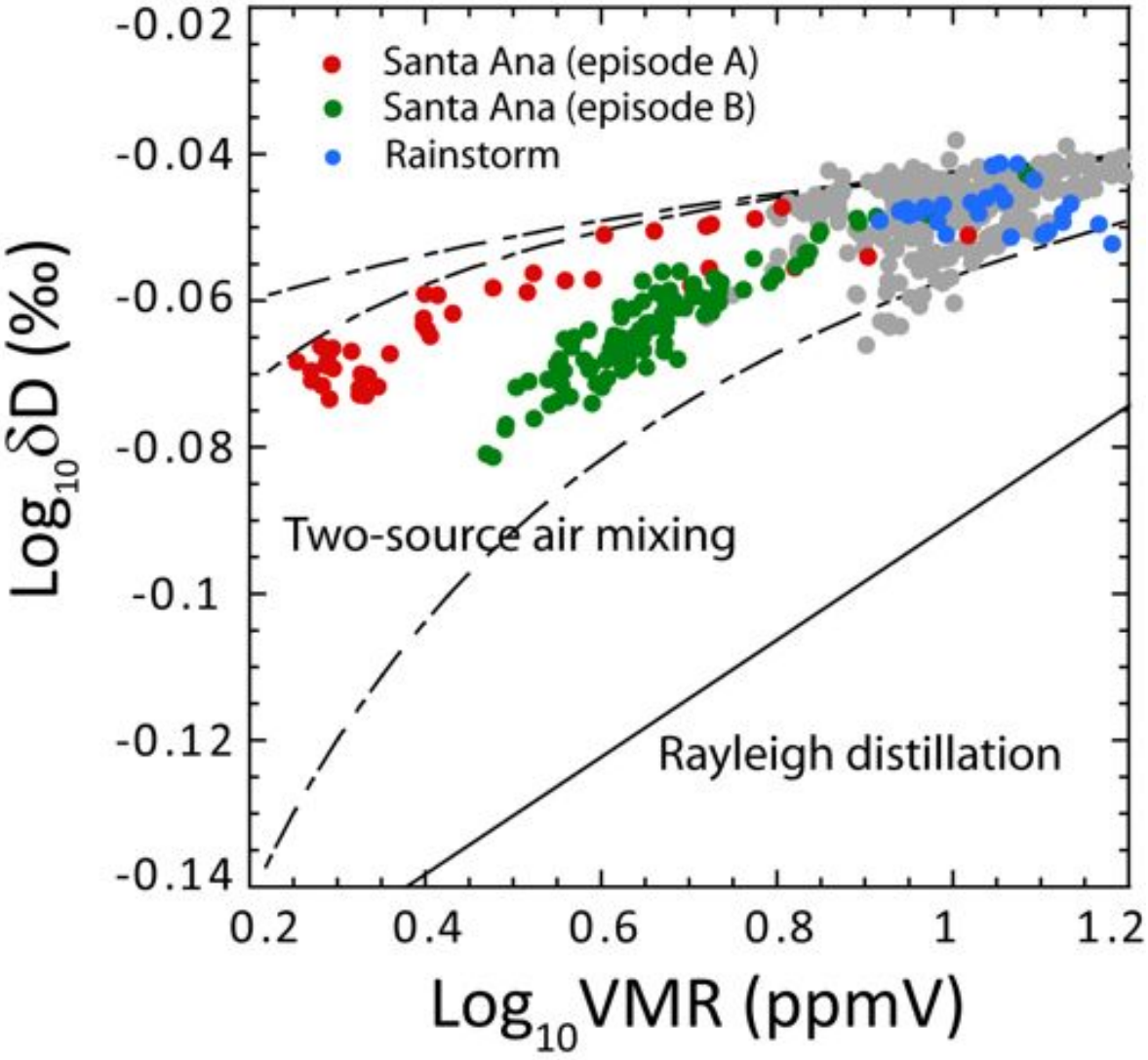
Remarkably low mixing ratio and isotope ratios were observed during Santa Ana conditions.

# Examples of IsoGSM simulation for two extreme weather events



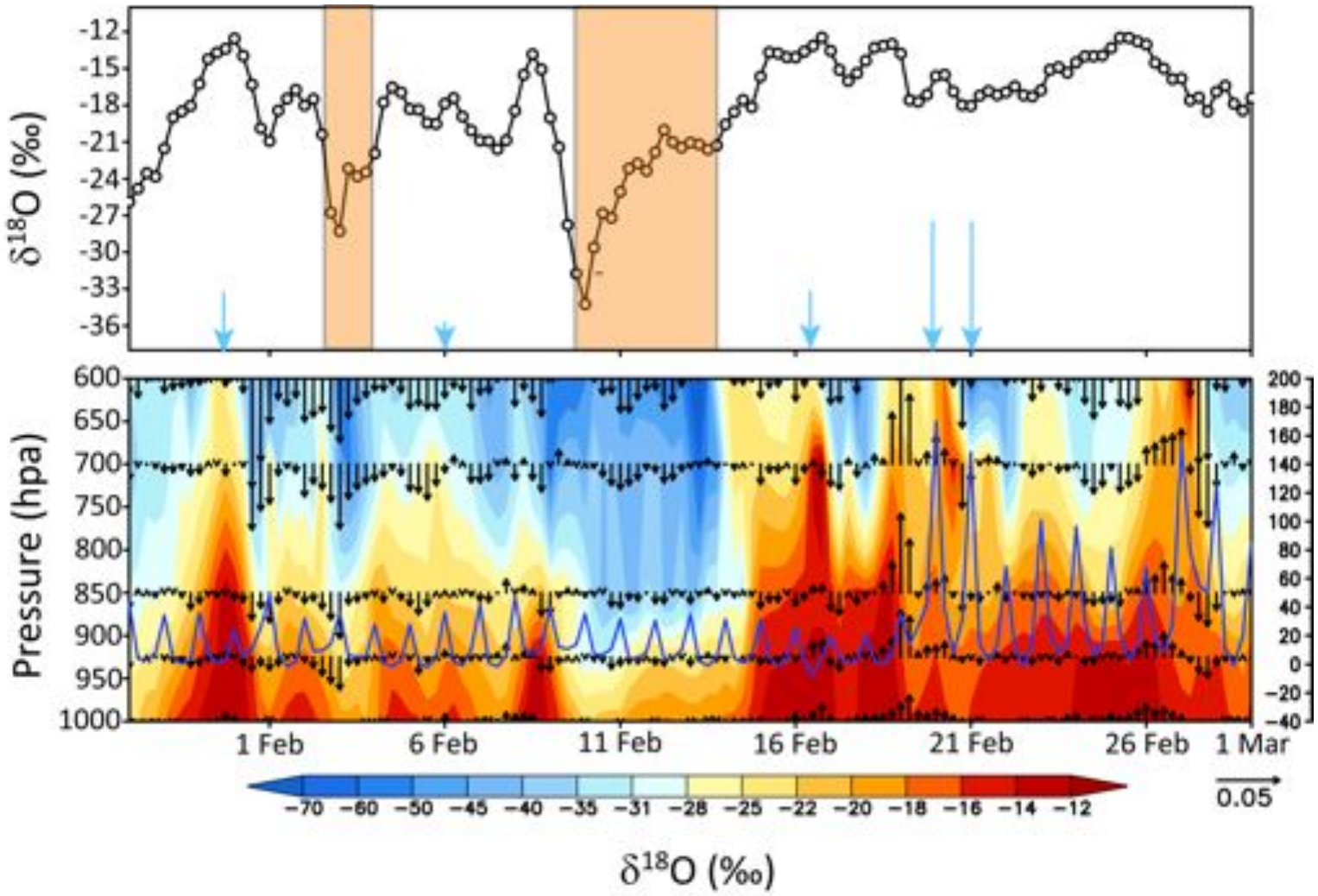

Farlin, Lai & Yoshimura (2013) WRR 49:3685-3696

# Paired δ-q analysis suggests atmospheric mixing is the dominant process during Santa Ana conditions



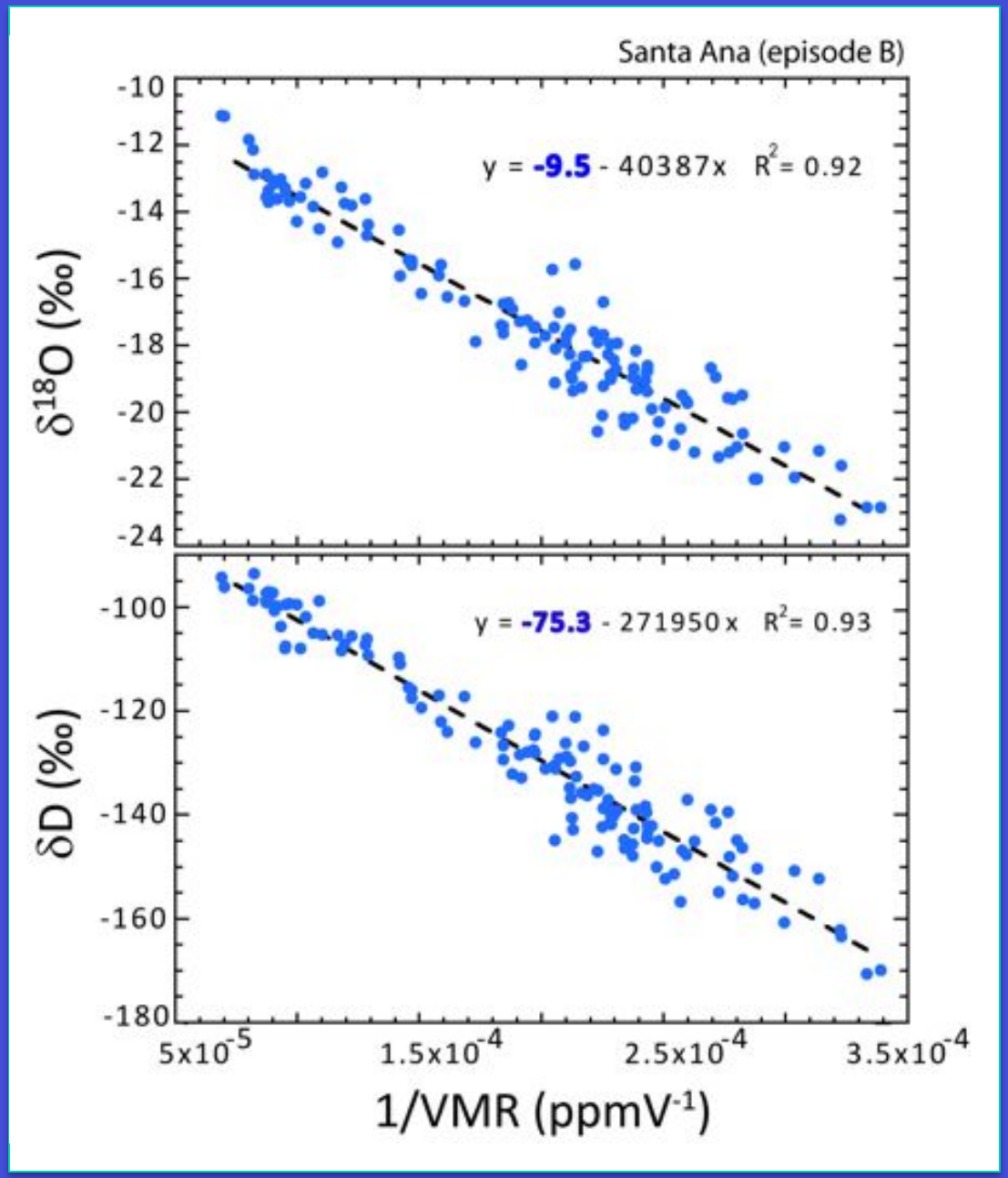

Farlin, Lai & Yoshimura (2013) WRR 49:3685-3696

During Santa Ana winds, strong subsidence transports air of low humidity and low $\delta^{18}O$ from the free troposphere, which then mixes with the relatively moist air in the ABL.




Farlin, Lai & Yoshimura (2013) WRR 49:3685-3696

# Santa Ana conditions are great examples of mixing events.



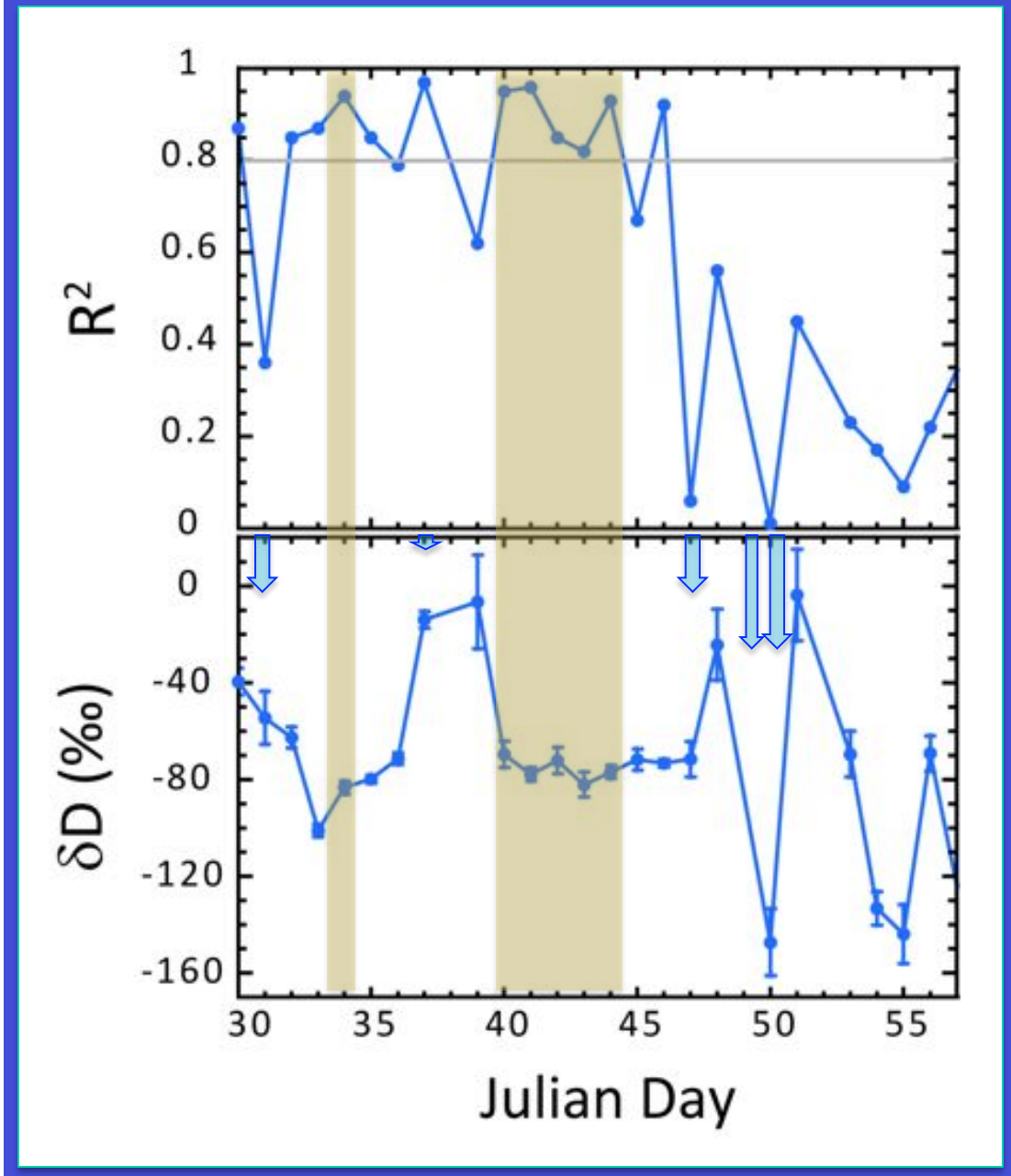

Using a two-source mixing model, the isotope ratios of the source moisture were estimated:

$\delta D$ = -75.3 ‰

$\delta^{18}O$ = -9.5 ‰

*d-excess* = 0.7 ‰

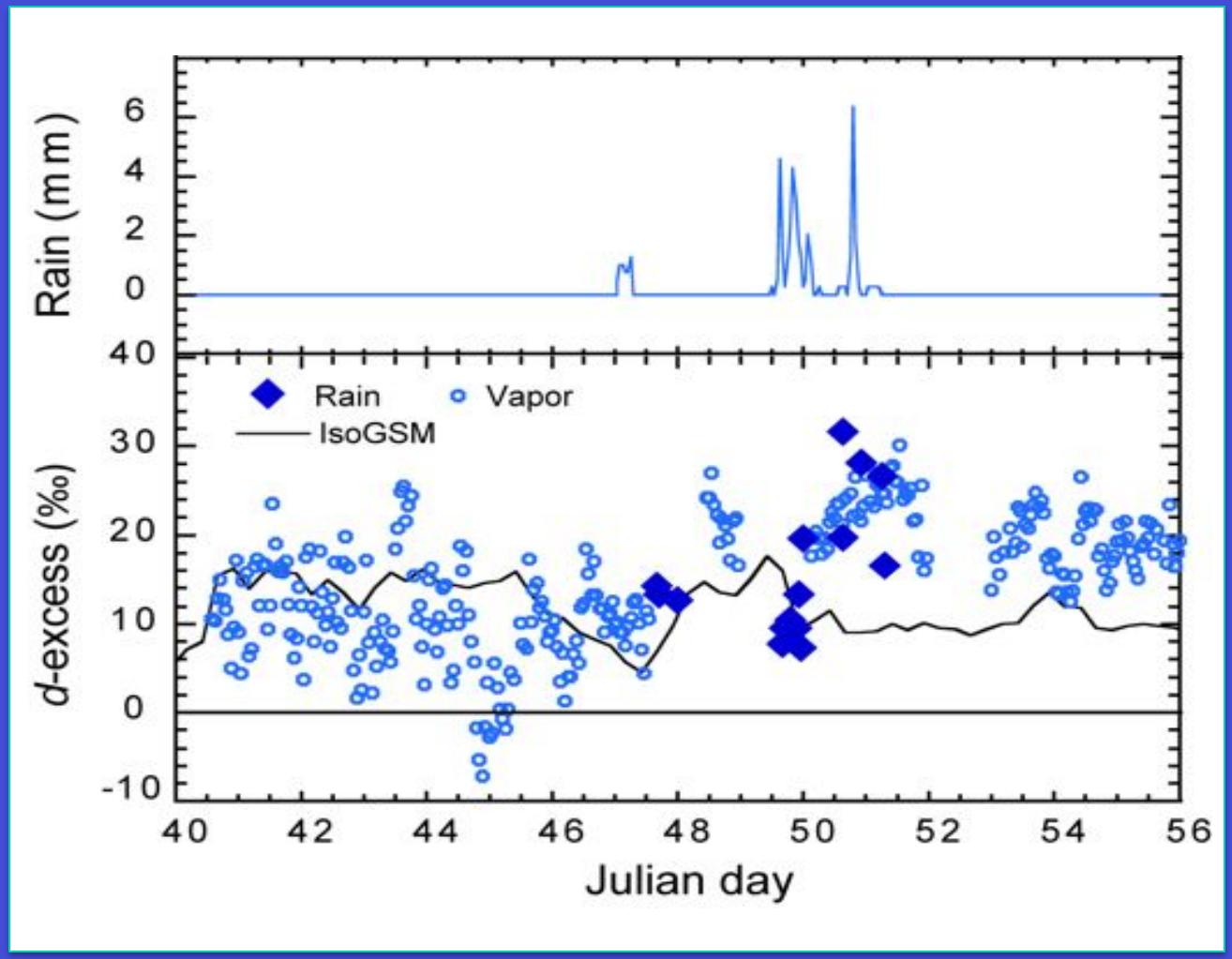
These values are close to a source of marine vapor in equilibrium with the ocean water at SST ≈ 23°C (tropical origin)




When the influence of other processes (such as condensation during rainfalls) on the isotope ratios increases, the mixing approach breaks down (low $R^2$ values).

Farlin, Lai & Yoshimura (2013) WRR 49:3685-3696

A shift in the *d-excess* value occurred, and remained elevated many days following intense rainfalls starting on DOY 50




Farlin, Lai & Yoshimura (2013) WRR 49:3685-3696