

Small scale variability of Water Vapor in the atmosphere

Xavier Calbet, AEMET (xcalbeta@aemet.es)

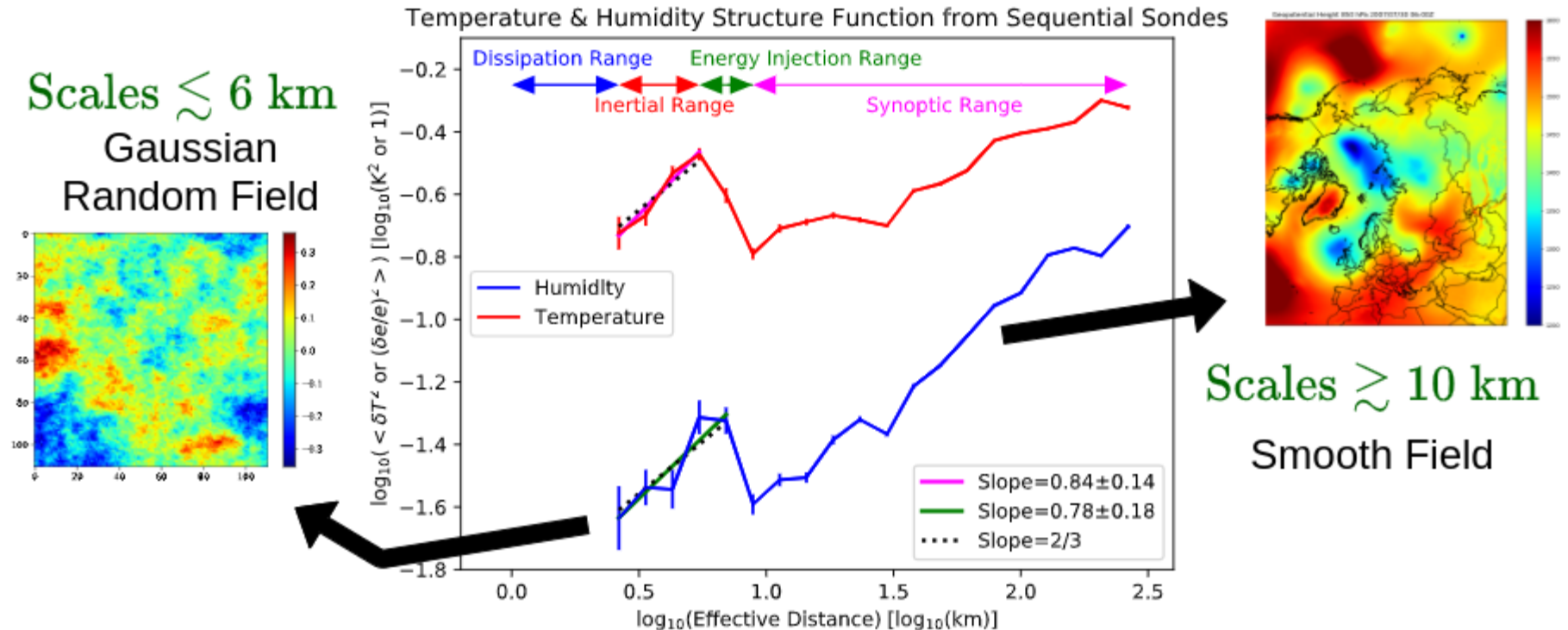
C. Carbajal-Henken, B. Sun, T. Reale, S. DeSouza-Machado

13 December 2022

WVEW

Conclusion: Variability of Water Vapour

Two different scales

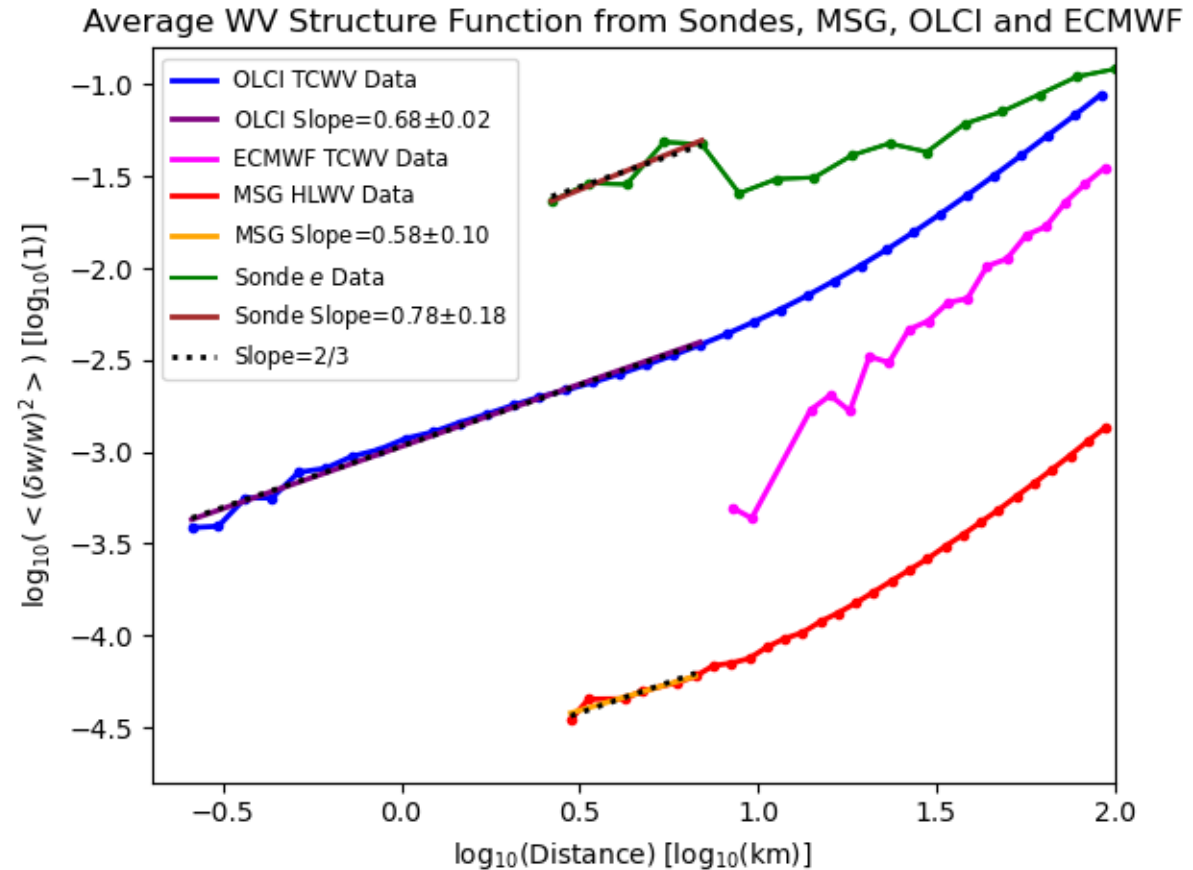


Calbet et al. 2022, AMT

<https://amt.copernicus.org/articles/15/7105/2022/>

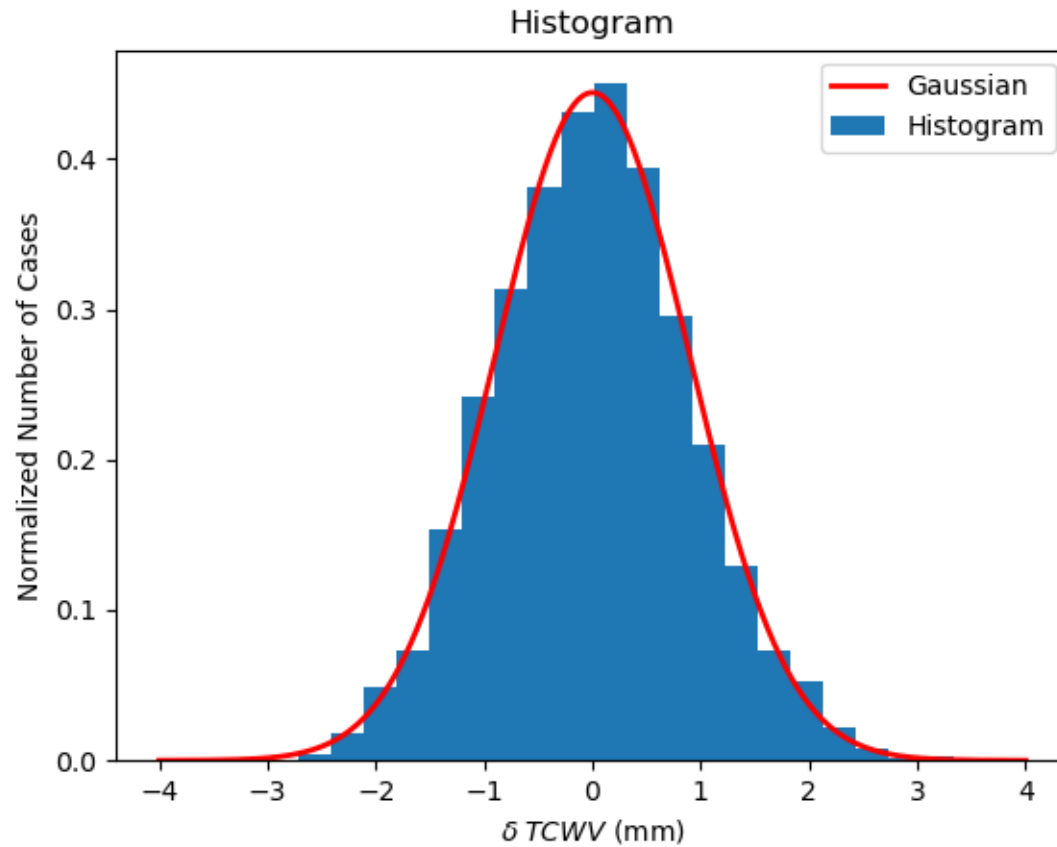
Structure Function of WV from Sondes, MSG and OLCI

Structure function confirmed!!



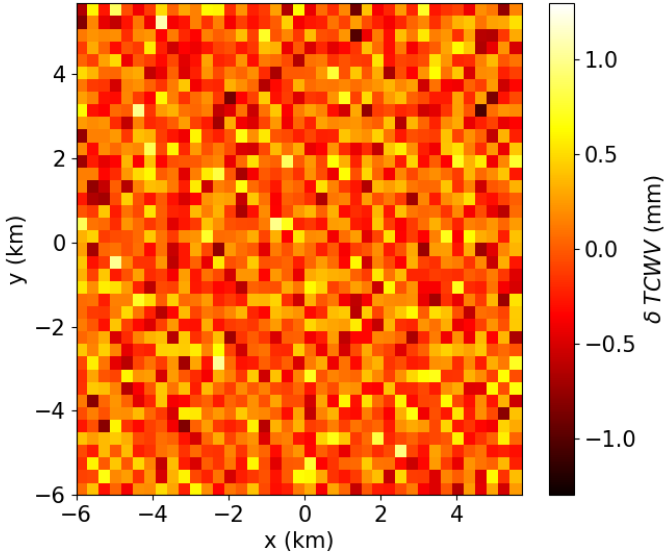
Histogram of $\delta TCWV$ from OLCI

Gaussian histogram confirmed!!

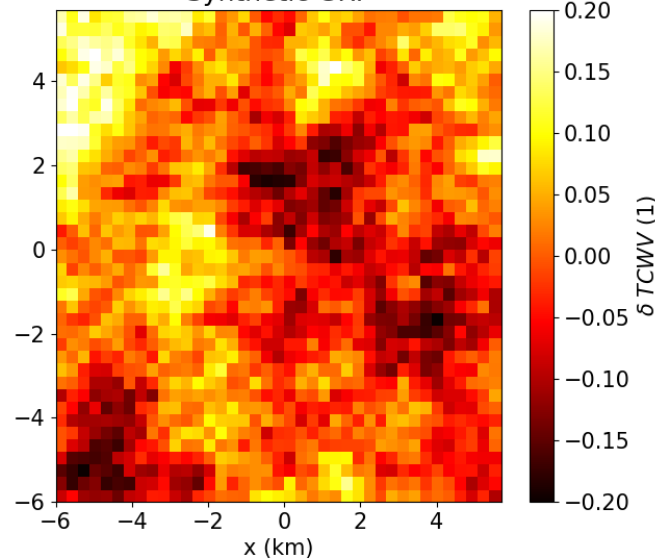


Histogram of $\delta TCWV$ from OLCI

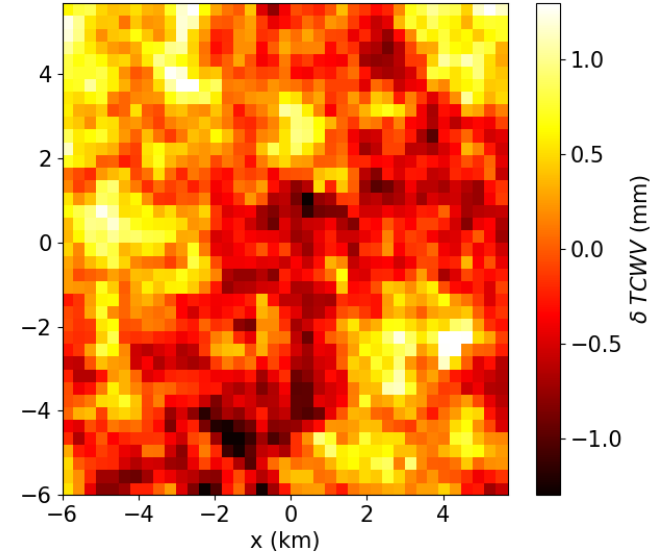
Spatially Independent Synthetic GRF



Synthetic GRF



Direct OLCI Measurement



Product OLCI TCWV
“noise”

Synthetic GRF
with 2/3 law spatial
correlation

OLCI $\delta TCWV$
measurement

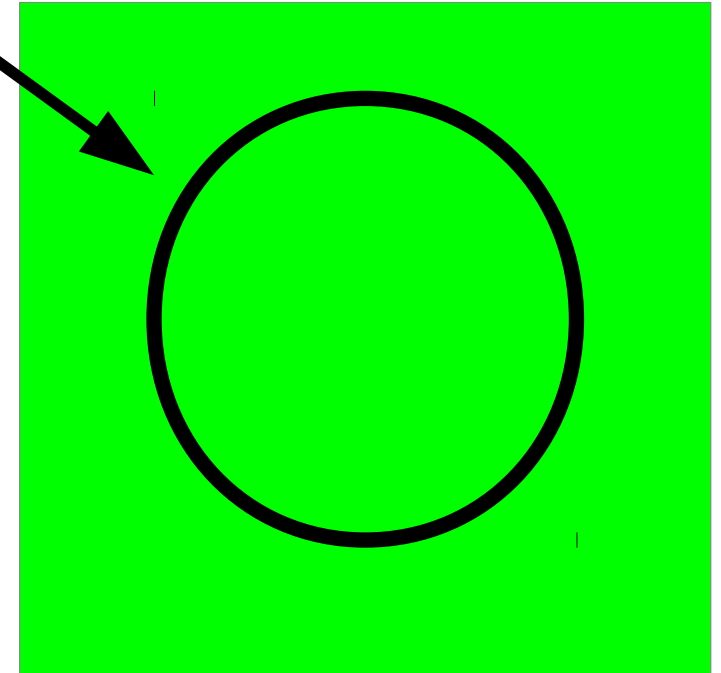
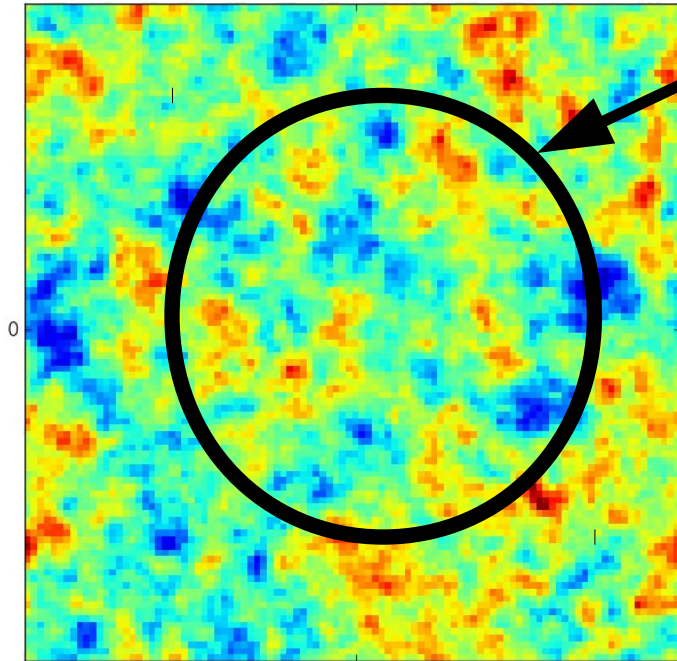
Gaussian Random Field confirmed!!

Variability of Water Vapour at small scales

Reality: Scales < 6 km
Gaussian Random Field

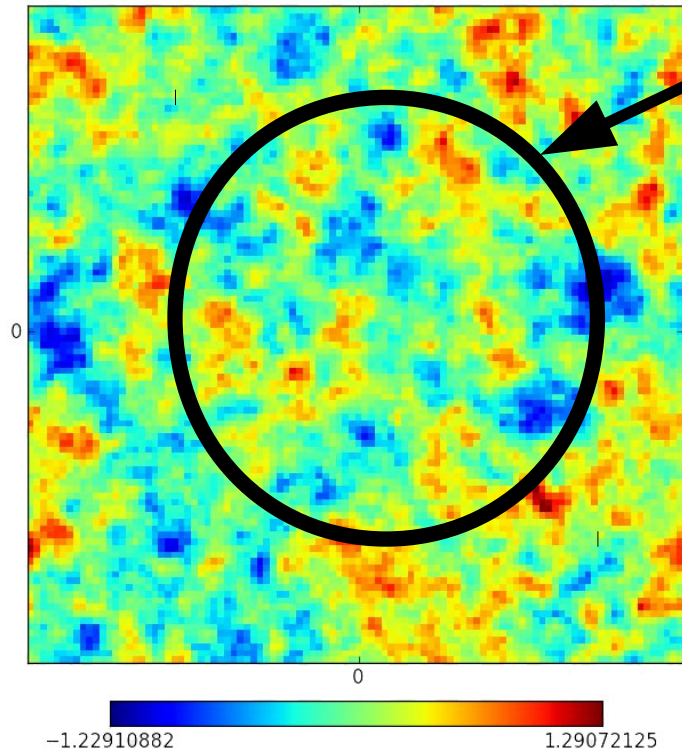
Currently assumed:
Homogeneous Field

FOV



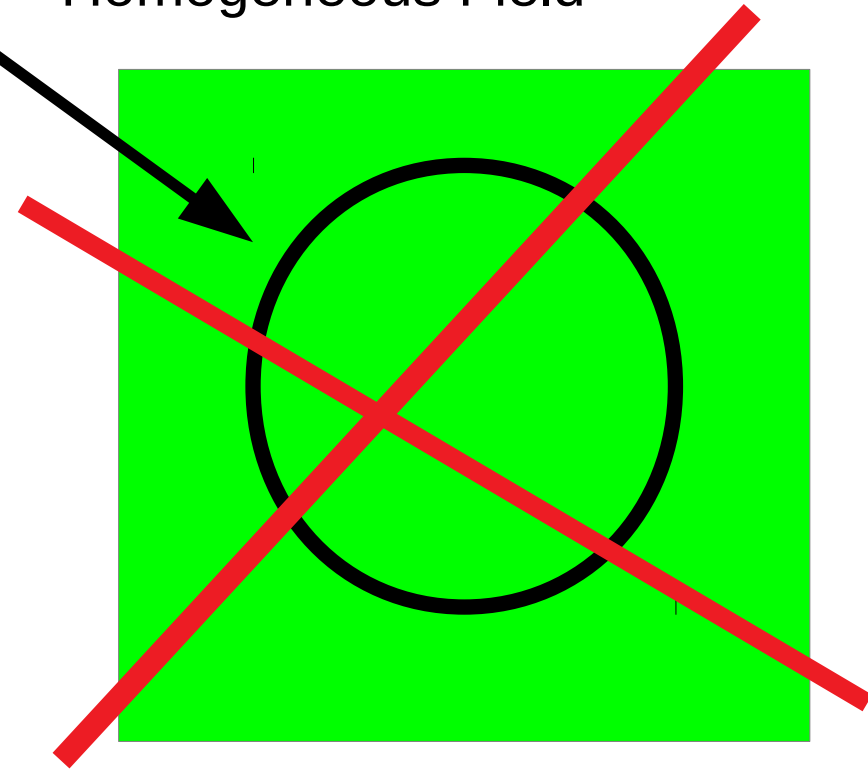
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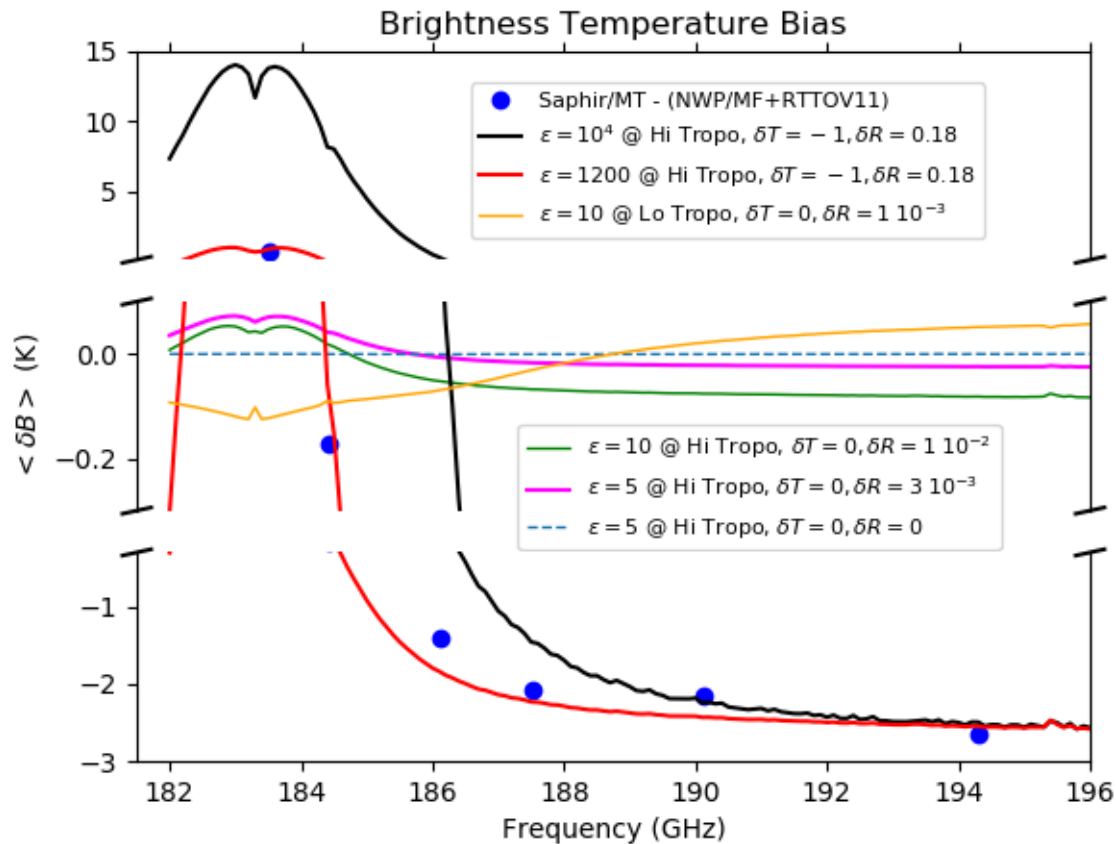


Consequences

- This WV variability within the FOV may cause a **bias** in WV **RTM** simulations (retrievals)
- WV is stochastic at small scales → **Difficult to “fuse”** data from different scale measurements (i.e. Satellites, NWP, Surface Stations, Lidar's, etc)
- Nowcasting is inherently **stochastic**

WV variability → RTM biases

WV variability within MW FOVs can cause significant biases in RTMs



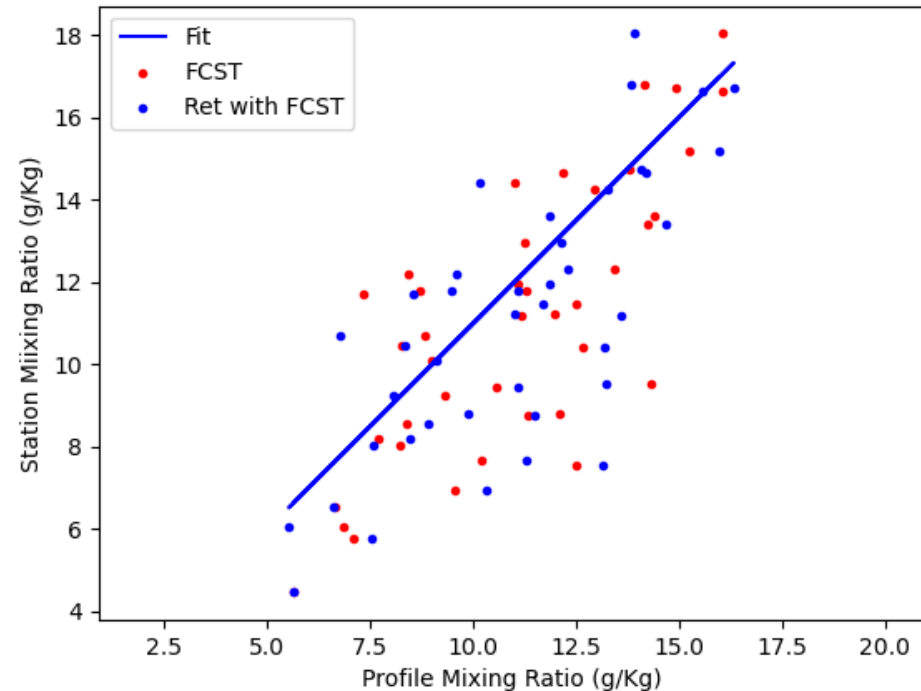
Calbet et al. 2018, AMT

WV variability → Data Fusion

Forecasts and Sat Retrievals versus Surface Stations →

- +: There is a correlation!!
- -: The dispersion is quite high :=(

More on this from [Zsofia Kocsis](#)!



WV variability → Nowcasting

More work needs to be done to be useful for Nowcasting → specially in data fusion

More on this from [Zsofia Kocsis](#)!