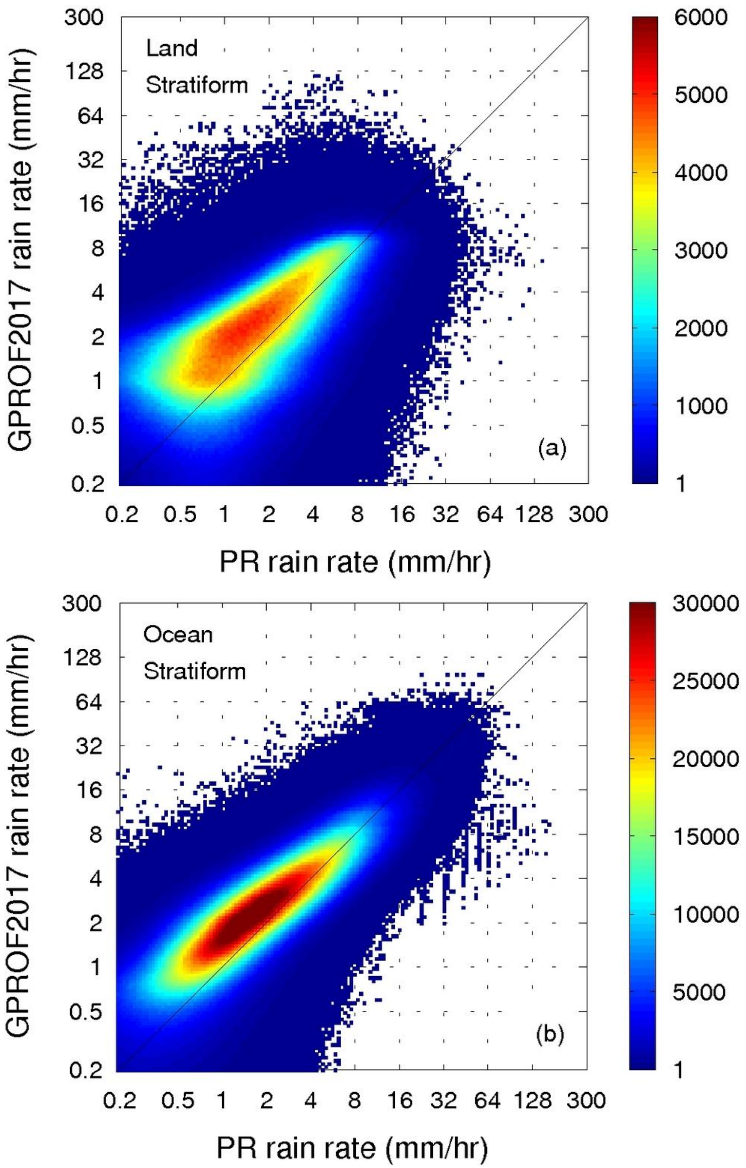
# Raindrop Signature from Microwave Radiometer Over Deserts

Yalei You[1], Joseph Munchak[2], Ralph Ferraro[3], Karen Mohr[2],
Christa Peters-Lidard[2] , Catherine Prigent[4] , Sarah Ringerud[1,2], Scott Rudlosky[3],
Heshun Wang[1],  Hamidreza Norouzi[5], and Satya Prakash[6]

[1]CISESS/ESSIC, UMD, [2]NASA GSFC, [3]NOAA/NESDIS/STAR
[4]Sorbonne Universite, France, [5]New York City College of Technology
[6]Indian Institute of Science

# Why raindrop emission matters




- Statistic metrics (correlate, root-mean-square-error, and bias) are better over ocean than over land.
- Primary signature: raindrop-emission over ocean vs. ice particle scattering over land
- Many other validation studies have also confirmed that the estimated rain rates over ocean are more accurate than those over land

You et al., 2020, JHM

**Objectives:**

- Identify the raindrop emission signal over deserts
- Explain why the emission signal exists

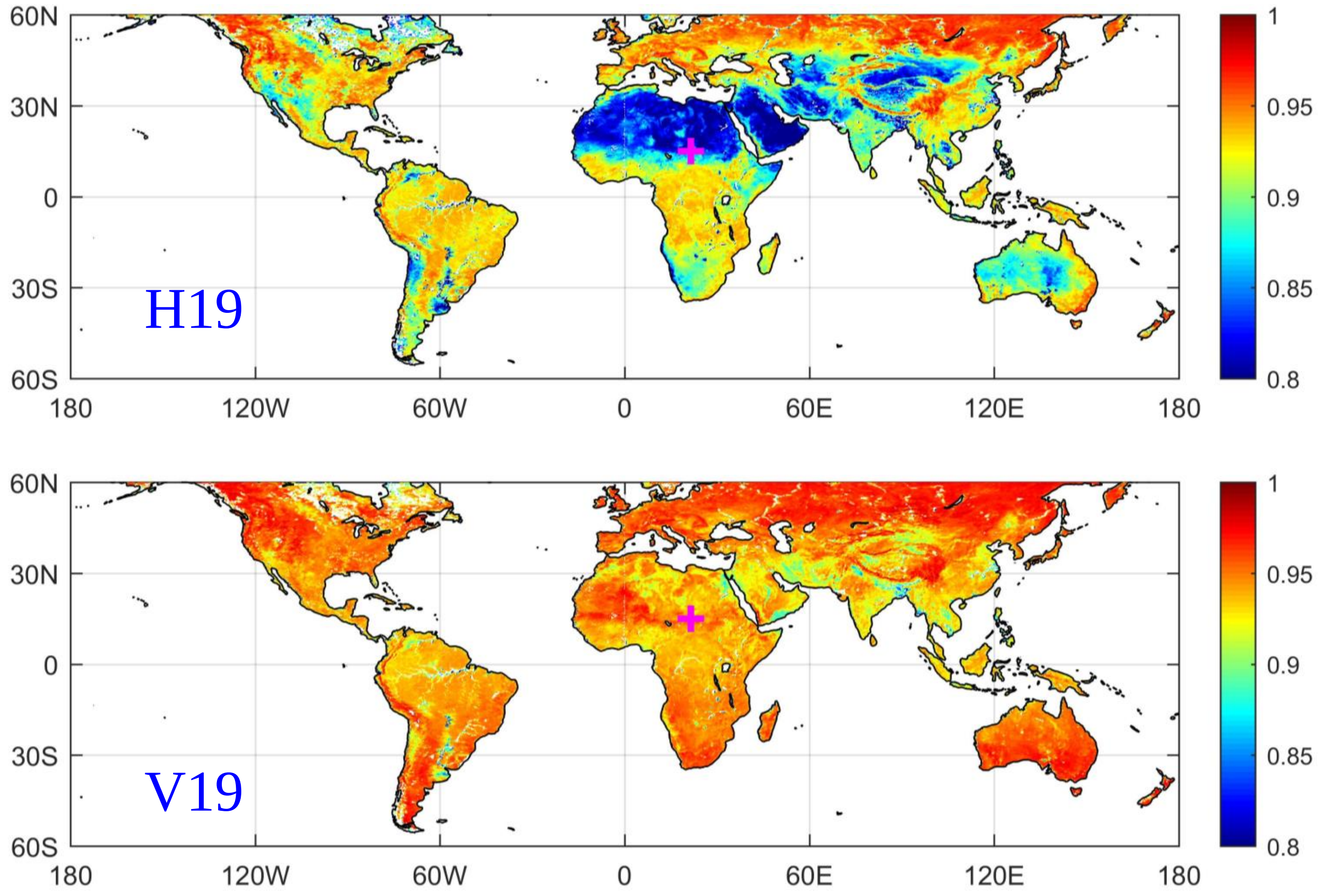
**Datasets:**

- AMSRE and CloudSat (2006-2011, sun-synchronous)
- GMI and KuPR (2014-2019)

**Approach**

- Analyze the TB time series

# Emissivity at H19 and V19 (July, 2008)

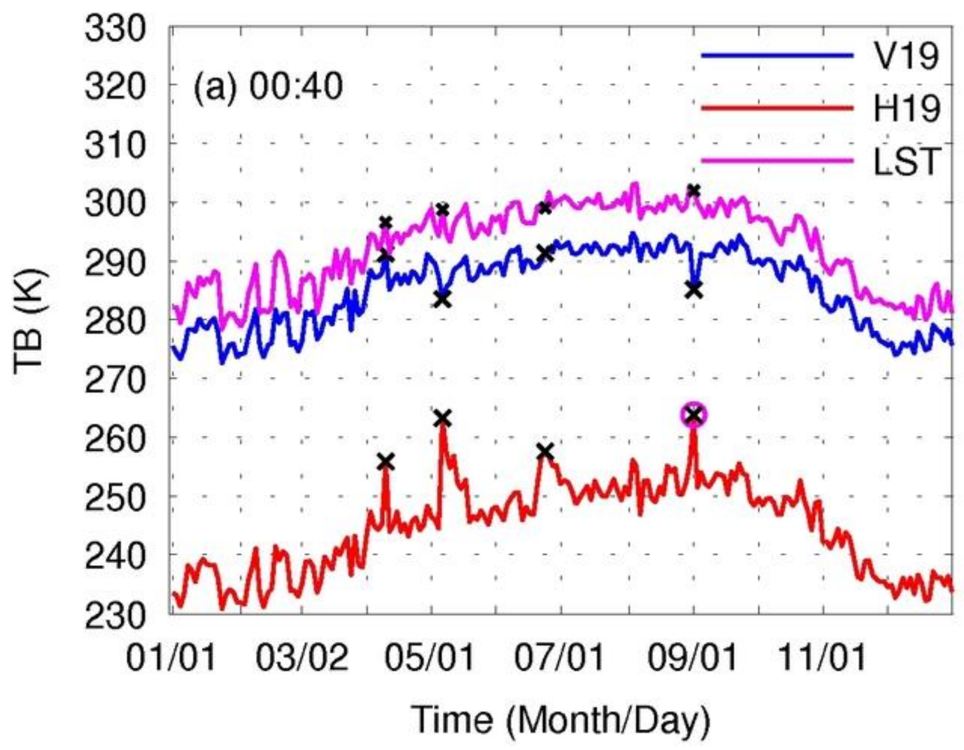



- Emissivity at H19 is about 0.8 over large areas of some world deserts
  - **Sahara Desert**
  - **Arabian Peninsula**
  - **Taklamakan Desert**

- We will show a TB time series over the grid box (21.5E-21.75E, 14.5N-14.75N) (purple cross)

**Credit: Hamid and Satya**

# TB time series over the grid box (21.5E, 14.5N)




- H19 TB increases of about 10, 18, 8, and 14 K on 10 April 2009, 7 May 2009, 24 June 2009, and 1 September 2009 (indicated by four black crosses), relative to the same overpass on the preceding day at the same time.

- Purple circle indicates that CPR observed surface rainfall with reflectivity of −4.1 dBZ on 1 September. There are no coincident CPR observations for the other three events.

- **three possible reasons why H19 TB can increase by this magnitude:**
  - Land surface temperature (LST) increase
  - Surface emissivity increase
  - **Liquid water emission**

You et al., 2020, GRL

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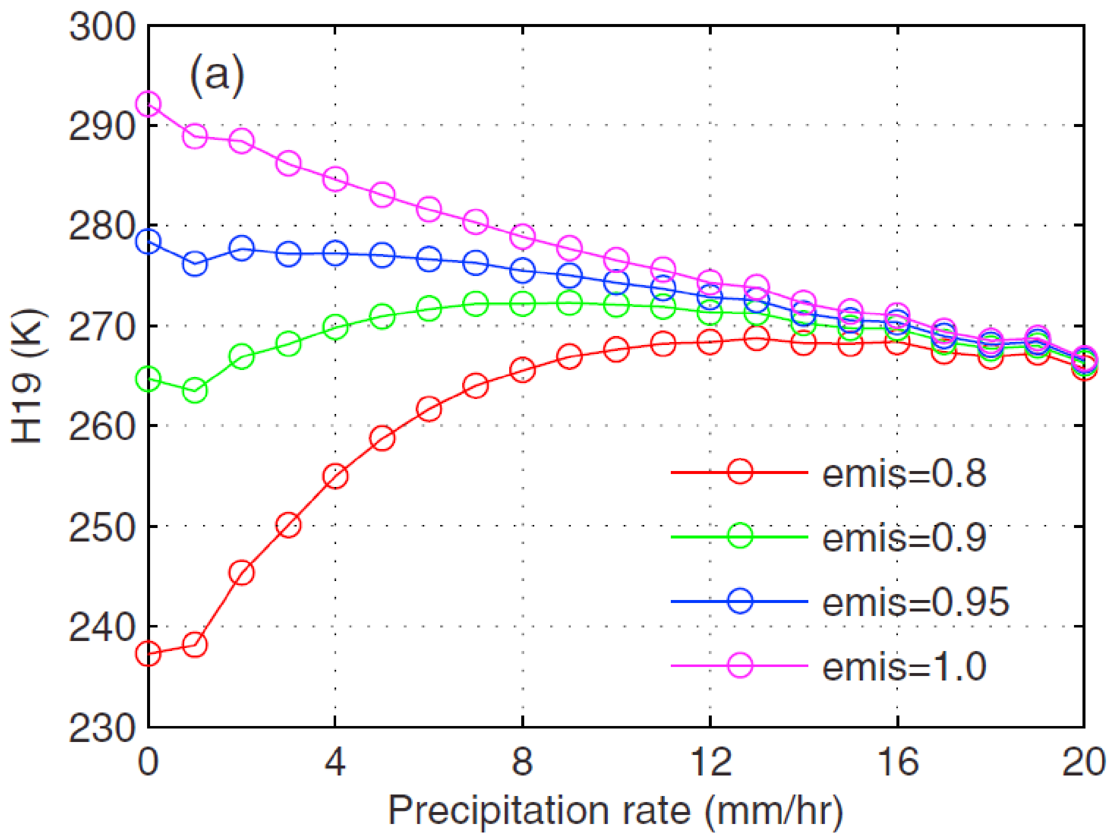


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**You et al., 2018, JGR**

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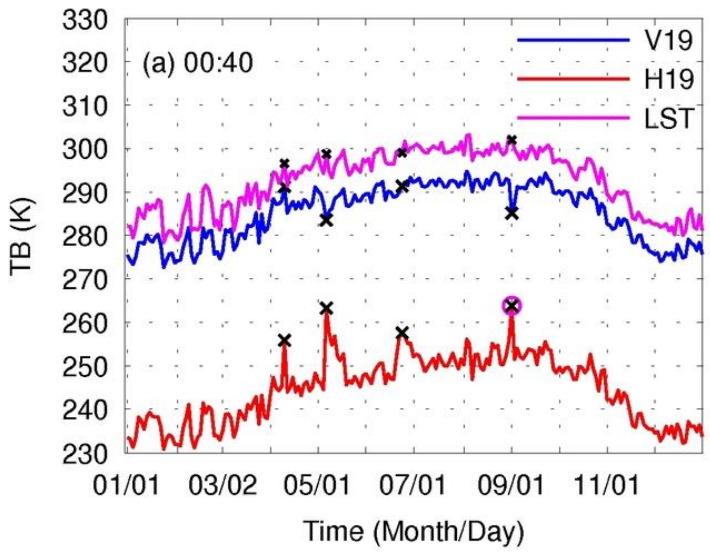
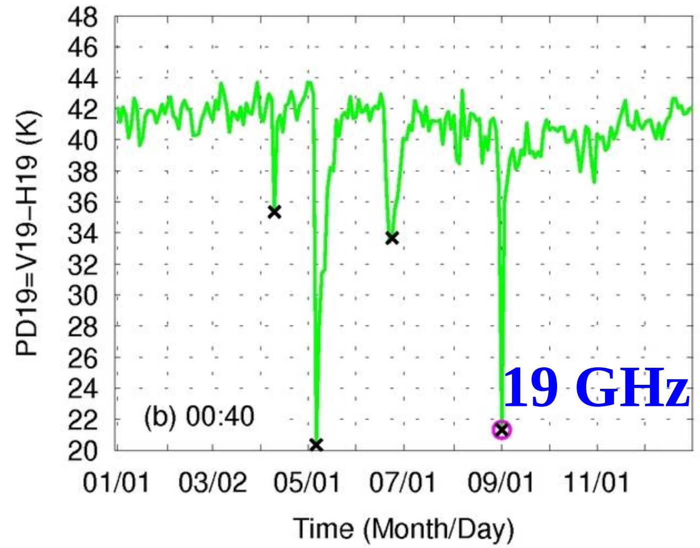
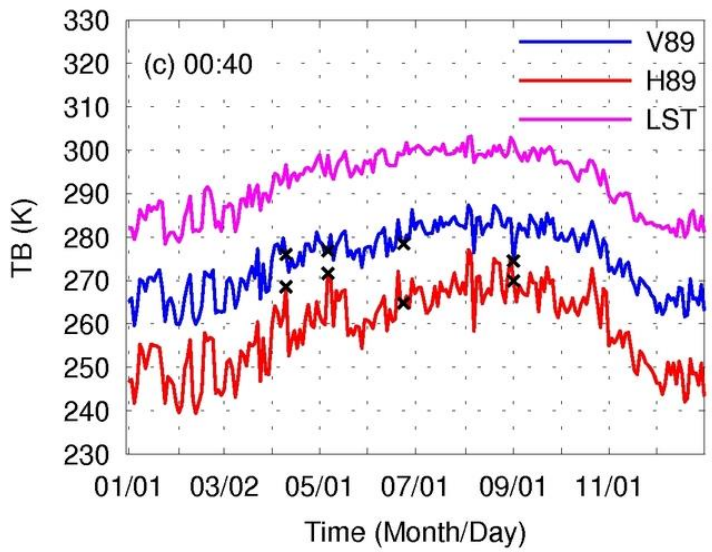
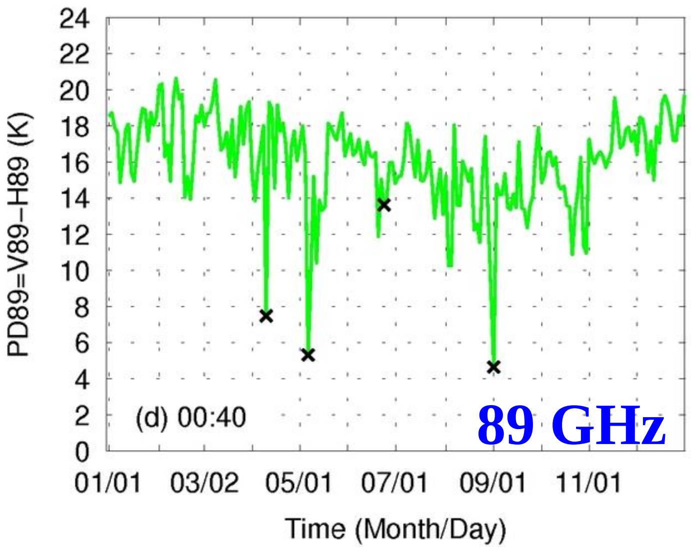


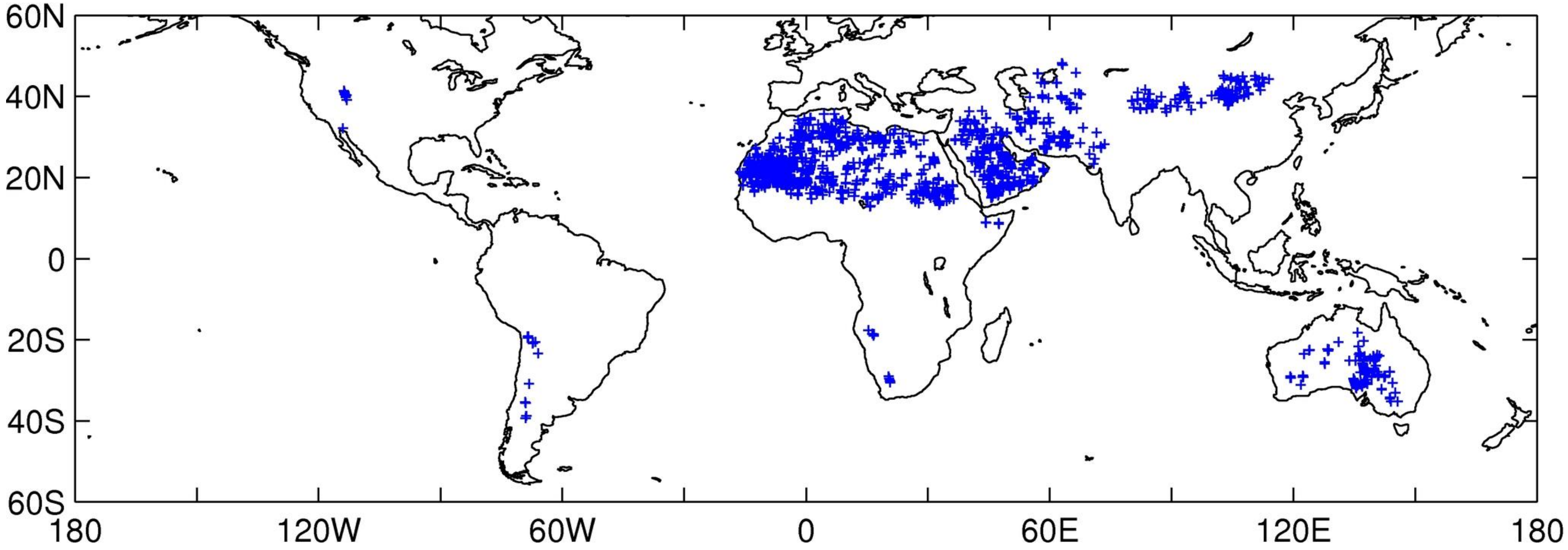

Scattering signal at 89 GHz is NOT as strong as the emission signature at 19 GHz




You et al., 2020, GRL

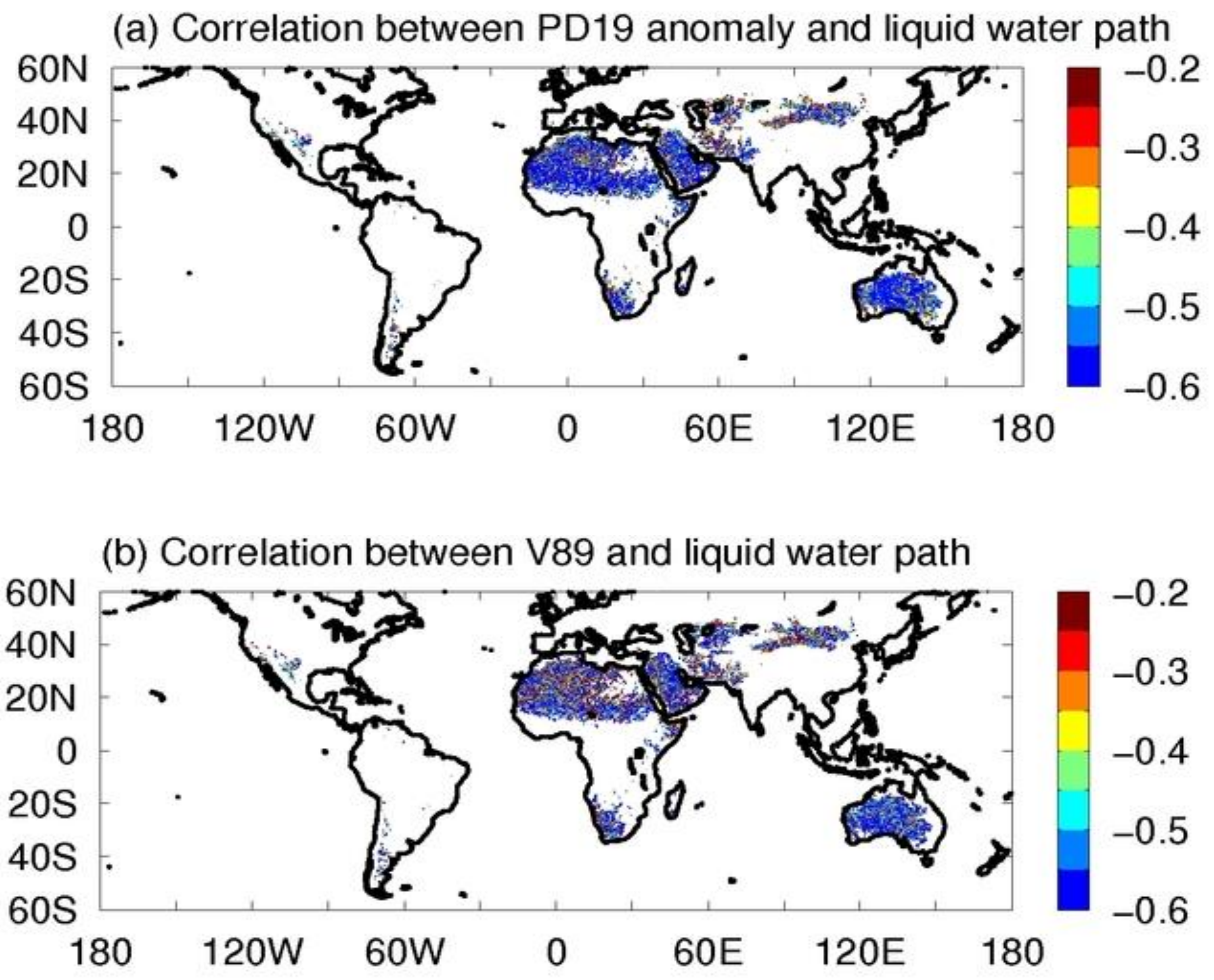
# Where the raindrop emission signal exists



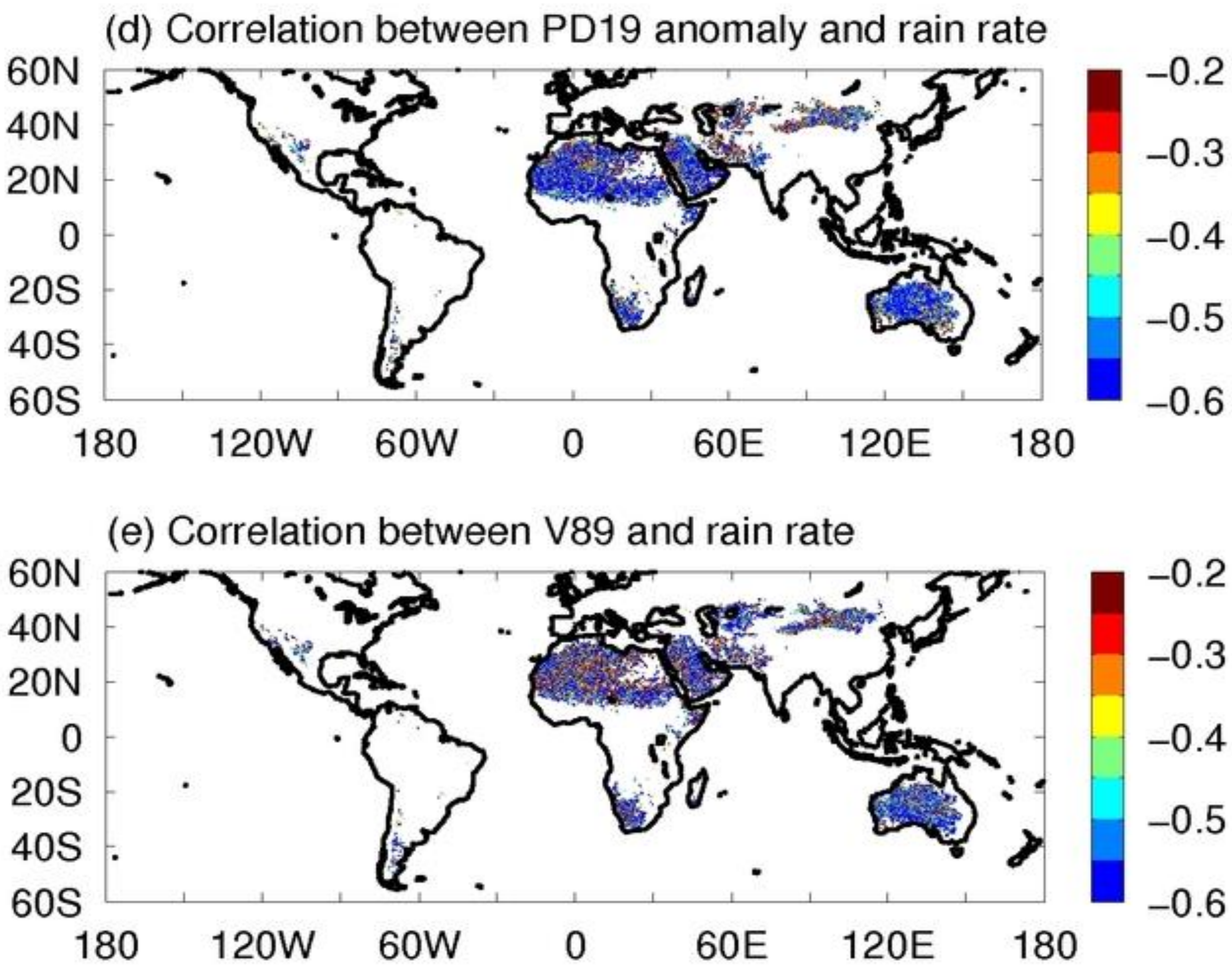

- For each raining observation (CPR reflectivity > −15 dBZ), we compute the difference between PD19 and the monthly mean PD19 at that location

- **The locations of all PD19 decreases of at least 10 K show strong coincidence with large desert regions**

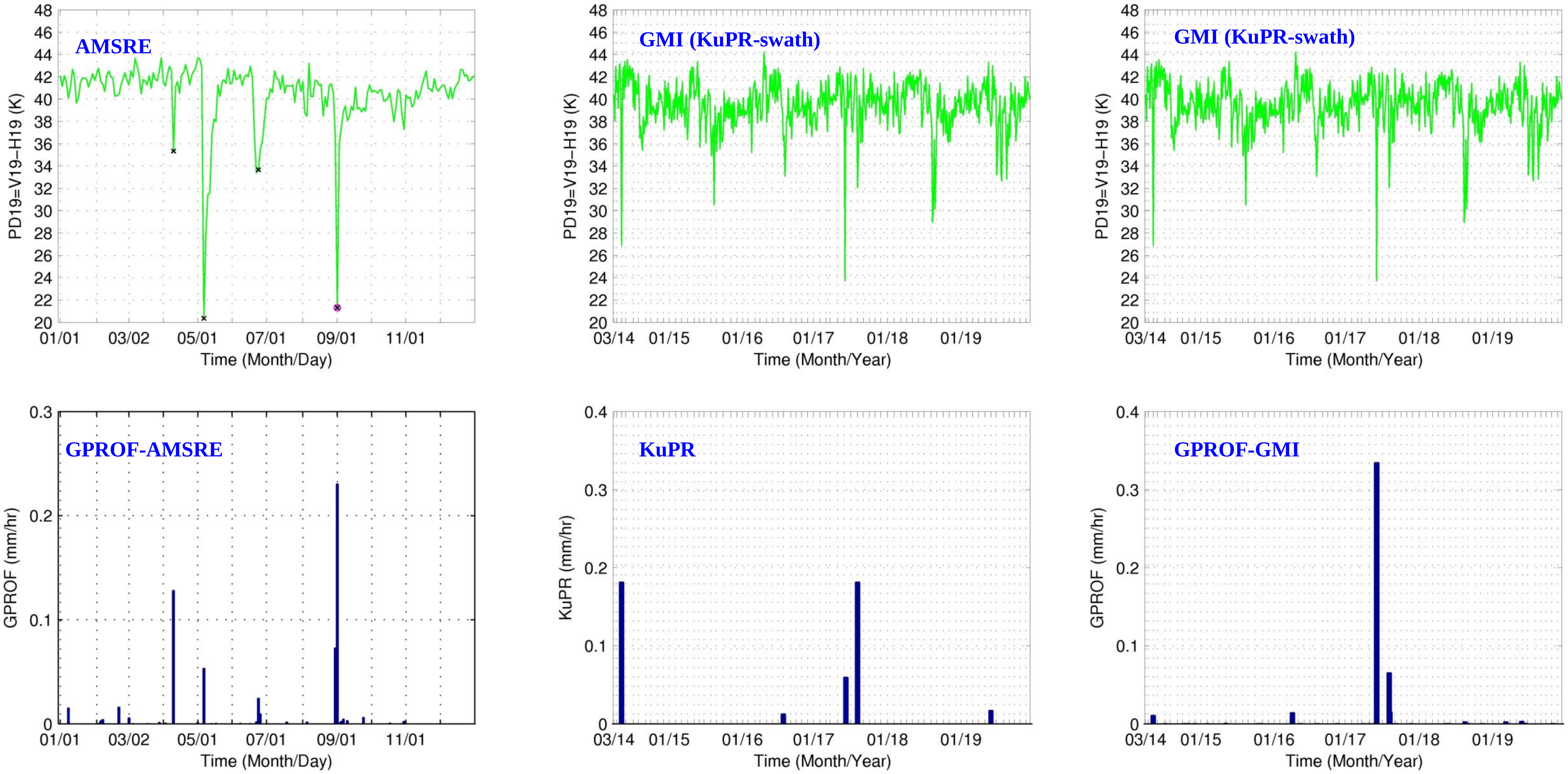
## Better correlation with LWP from PD19 than from V89



## Better correlation with surface rain rate from PD19 than from V89



# GPROF retrieval results over the grid box (21.5E, 14.5N)



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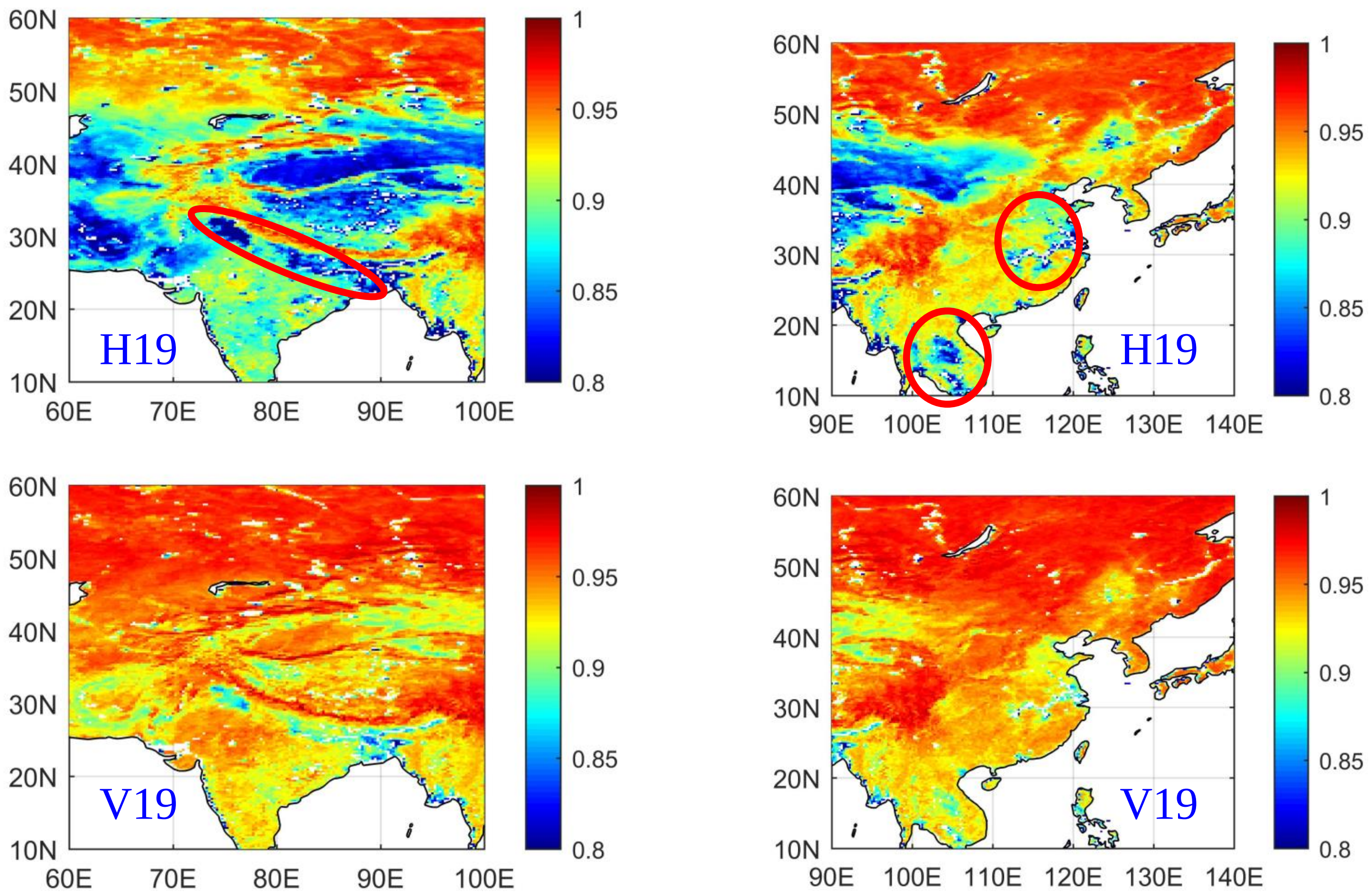
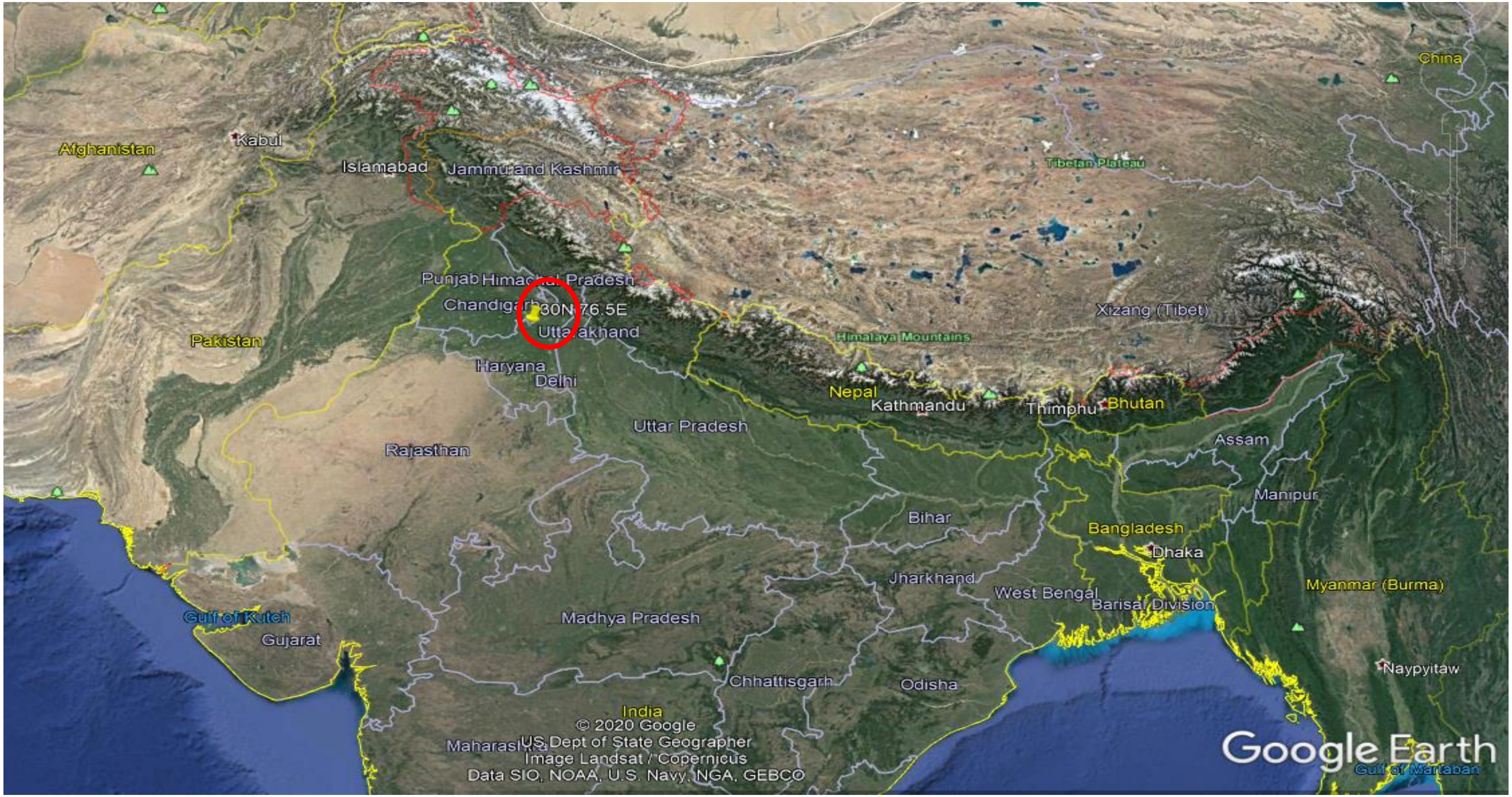


# TB time series over the grid box (76.5E, 30N)



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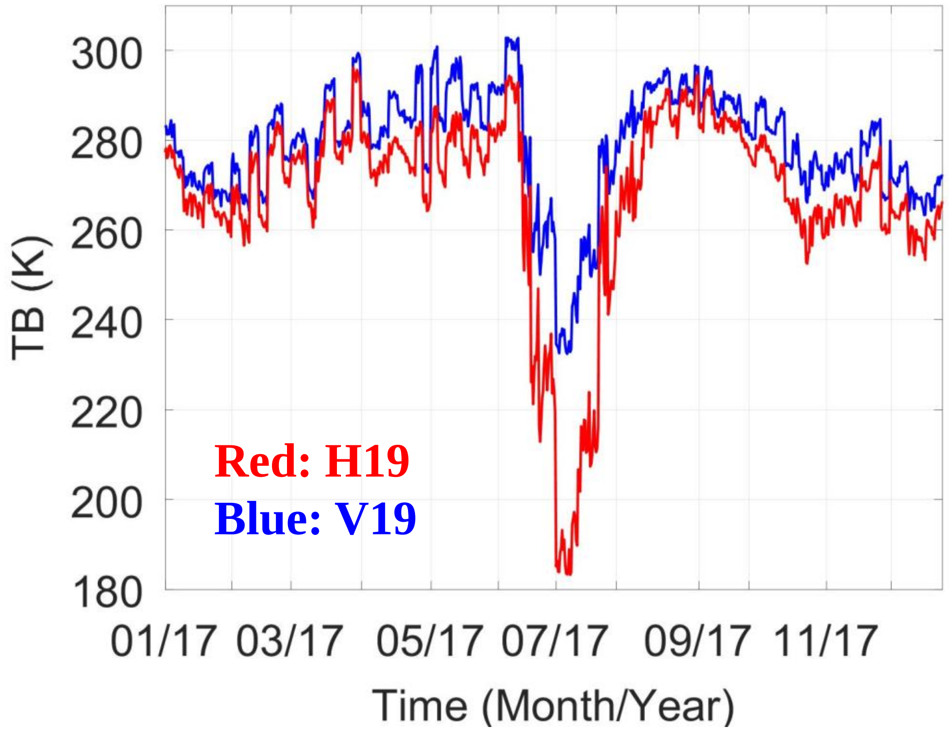


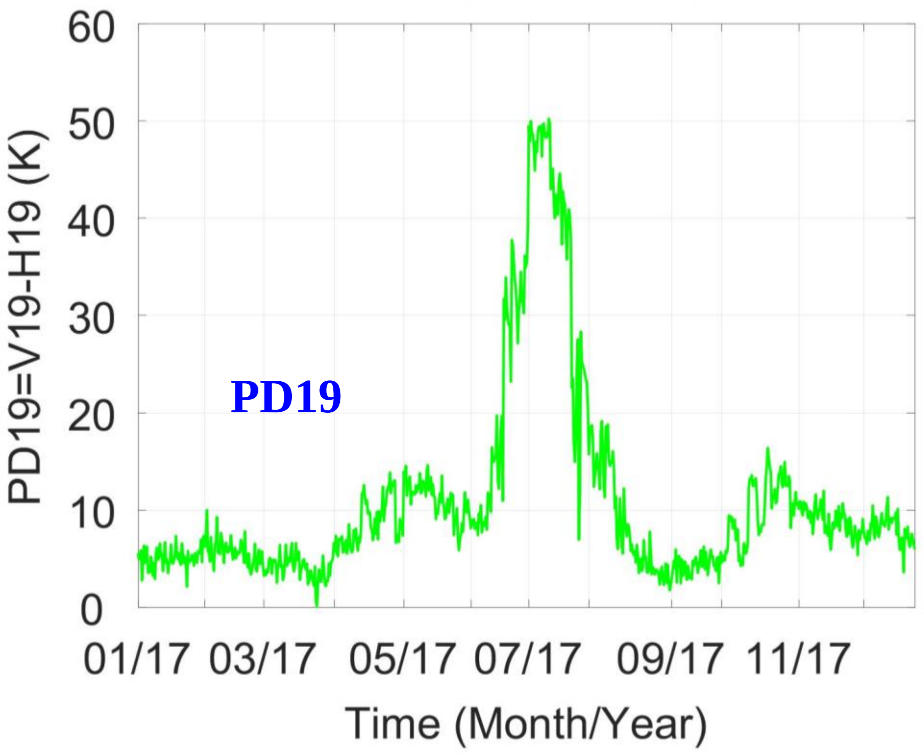

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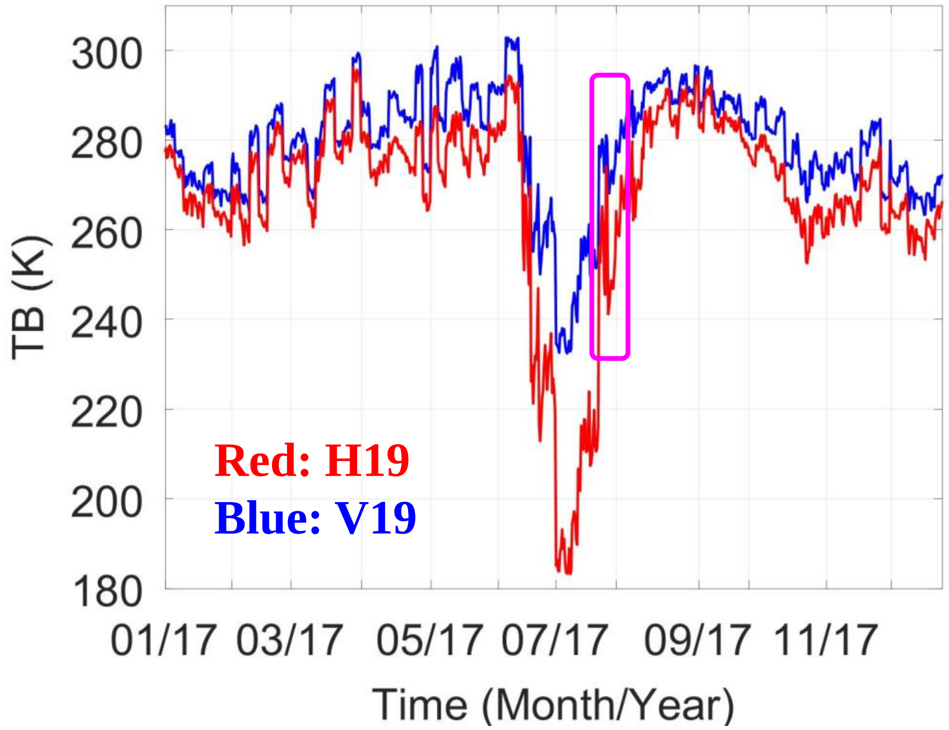


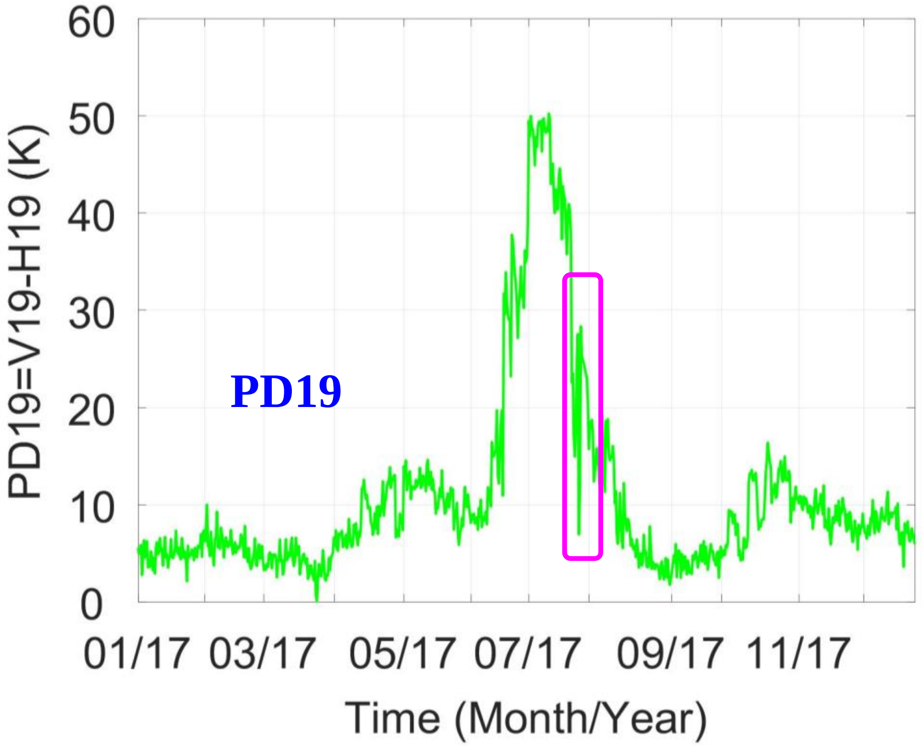

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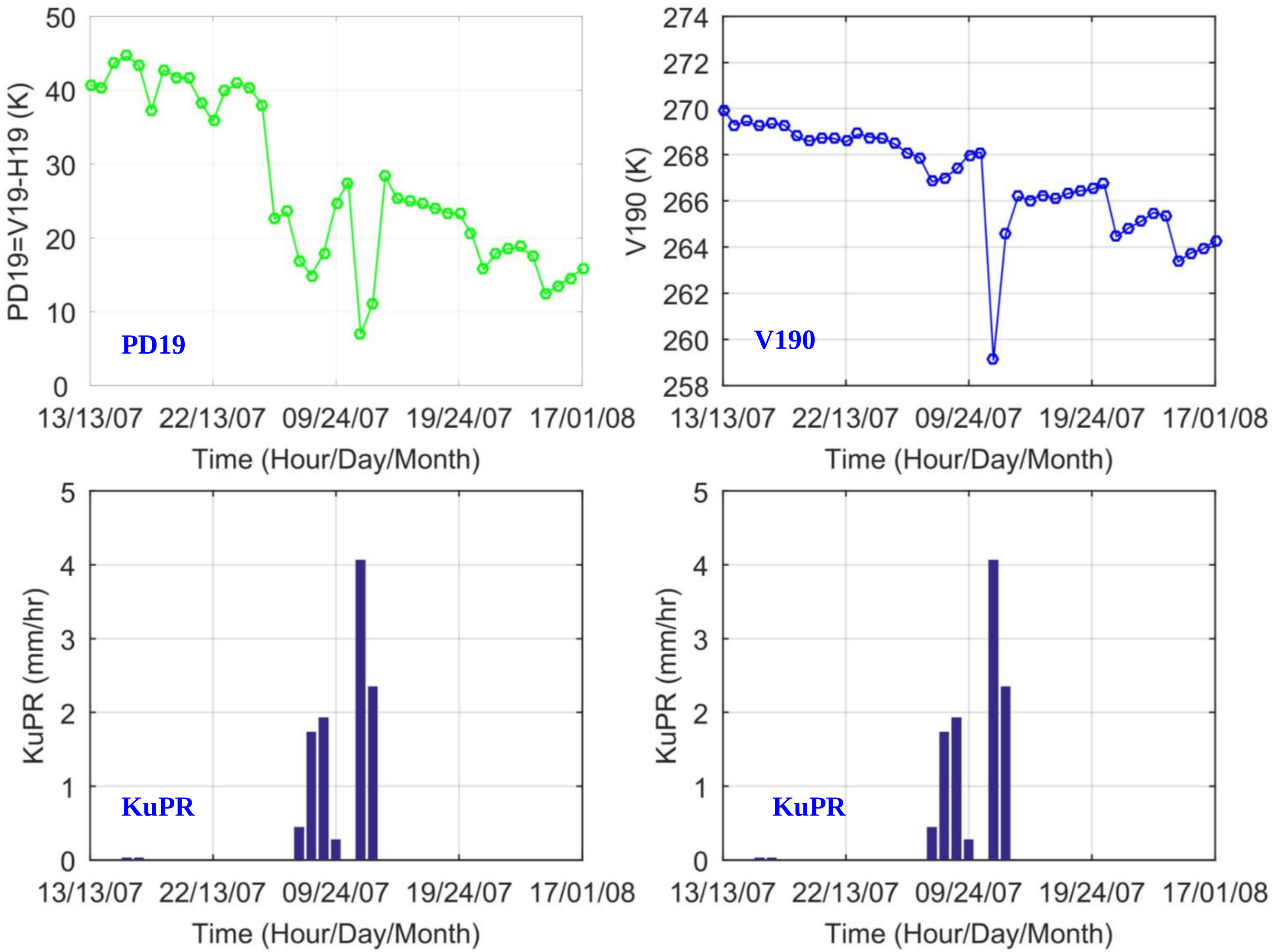

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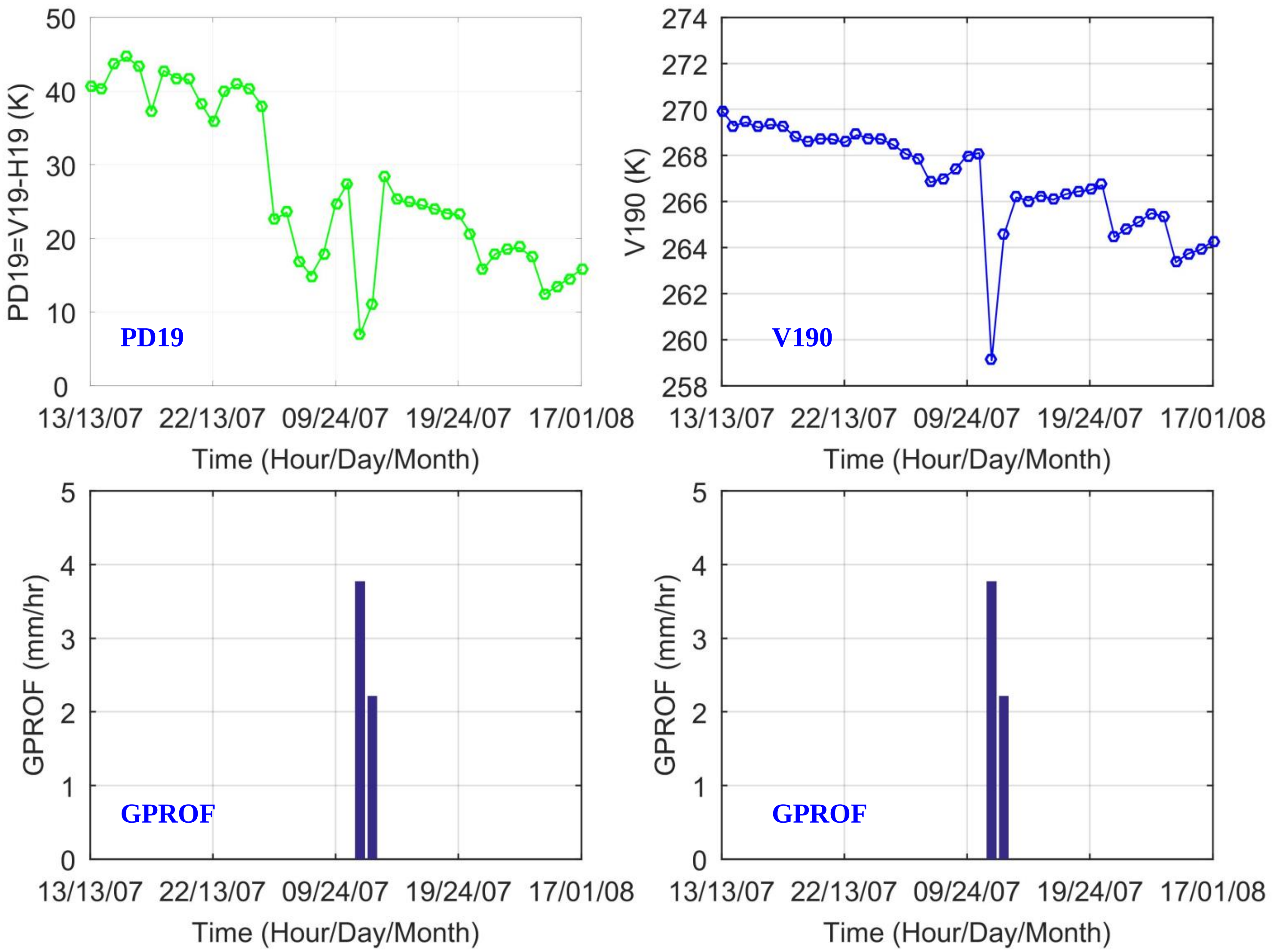

## Summary:

- **Raindrop emission signature exists over deserts (and other low-land-surface-emissivity areas)**
- **PD19 time series can capture the raindrop emission signature**

**You, Y., Munchak, S. J., Ferraro, R., Mohr, K., Peters-Lidard, C., Prigent, C., et al. (2020). Raindrop signature from microwave radiometer over deserts. *Geophysical Research Letters*, 47, e2020GL088656. https://doi.org/10.1029/2020GL088656**

# Comments/Questions