PRECIPITATION CLASSIFICATION AND QUANTITATIVE MAPPING USING GROUND-BASED RADAR DATA, INTENDED FOR DROUGHT MONITORING IN CYPRUS

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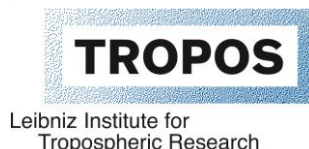[2]Cyprus University of Technology, Cyprus,
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Outline

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Introduction

- **Drought** is reported as a **rainfall deficit with regard to its long-term mean** that affects a large area for a certain time period

- Contrary to other natural disasters, drought has a **variety of unique features**

- Drought is a **multidimensional phenomenon** that **starts imperceptibly, advances slowly** and **cumulatively,** and its **consequences show up gradually**

- Due to the peculiarity of the phenomenon, **weather-based parameters and indices** are **inadequate** for the estimation of the **temporal and spatial drought features**

- Researchers distinguish between **4 major drought types**, i.e. meteorological, agricultural/soil moisture, hydrological and socioeconomic drought

Study area

- **Cyprus** is located in the **Southeast Mediterranean basin** and its climate is described by **mild dry-to-hot summers** and **cool to mild-to-wet winters**.

- The **mean annual precipitation** fluctuates between **400 – 500 mm**, with a **decrease tendency** in the coming years.

- Meanwhile the **mean annual temperature** in the island varies **from 14 ℃ (coastal areas) to 18 ℃ (inland areas)** following the topography.

- **Over 100 water dams and surface reservoirs** are operated on a daily basis.

- **Agricultural activities** in Cyprus include both **annual and permanent crops.** Annual crops are mostly cereals, legumes, industrial crop, forage crops and vegetables. Permanent crops are mainly vineyards, citrus, fruit crops, nuts, olives and locust trees.

- **Droughts occur frequently** in Cyprus and are the source of various **problems to the economy, the environment and the** agricultural production.

Data

- **Two Plan Position Indicator (PPI) stations (Cyprus Department of Meteorology)**

Each station is composed of an X-Band, Doppler, dual-polarization radar that provides continuous information on the estimation of rainfall and hydrometeor classification.
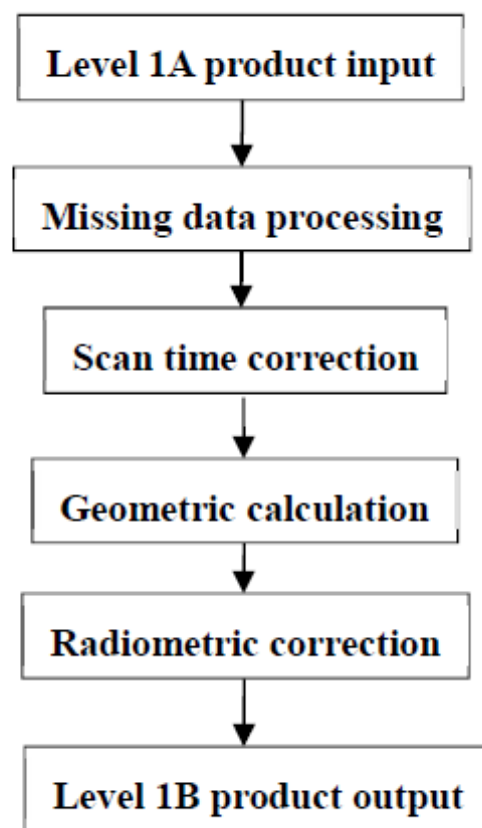
Their spatial resolution is 0.1° and their radius is 150km. The raw information is provided with a frequency of approximately 10 minutes. The radars rotate through 360 degrees and provide surveillance scans for 8 different elevation angles.
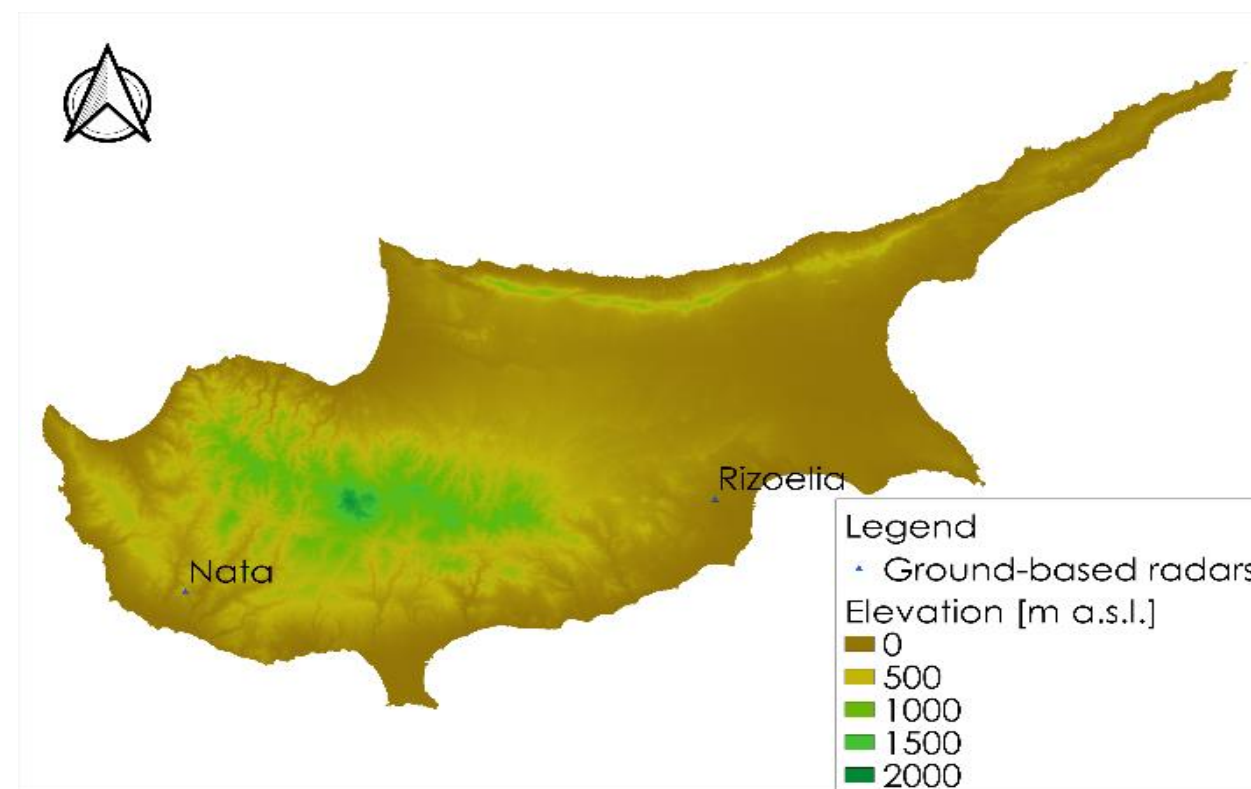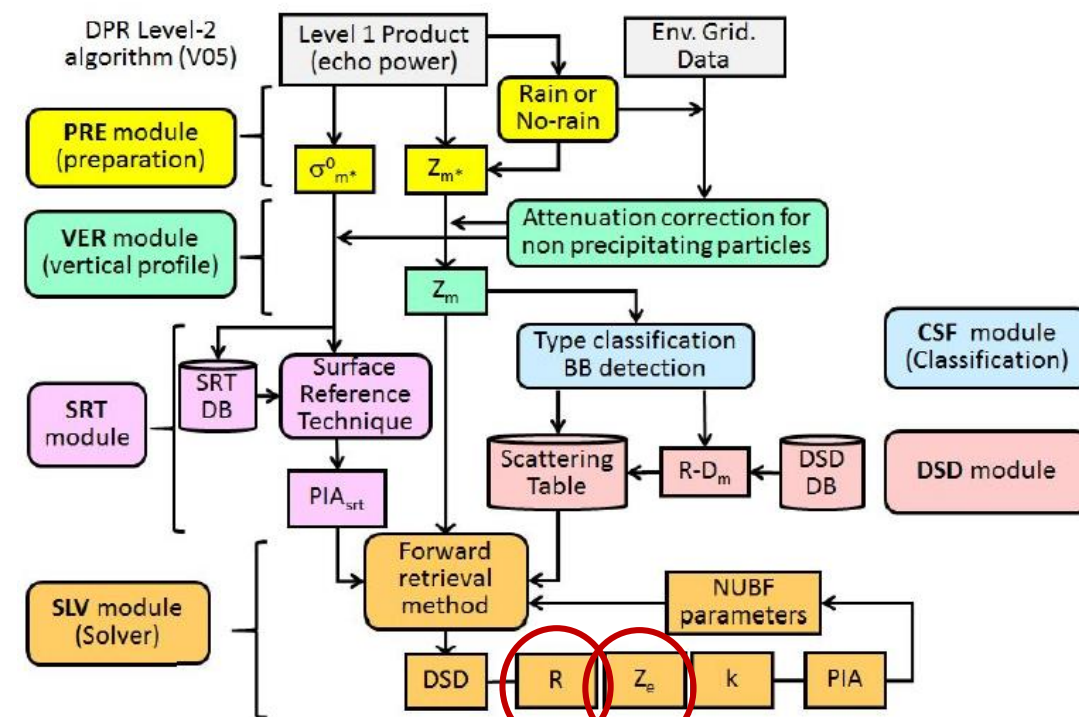
Data

- **GPM DPR Level 2A**

Level 1

Japan Aerospace Exploration Agency (JAXA),
Overview of GPM Products (2017).

Level 2

R is the precipitation rate

Z'_e **is the vertical profile of reflectivity factor Z with attenuation correction**

Iguchi, Toshio, et al. "GPM/DPR level-2 algorithm theoretical basis document." NASA Goddard Space Flight Center (2010).
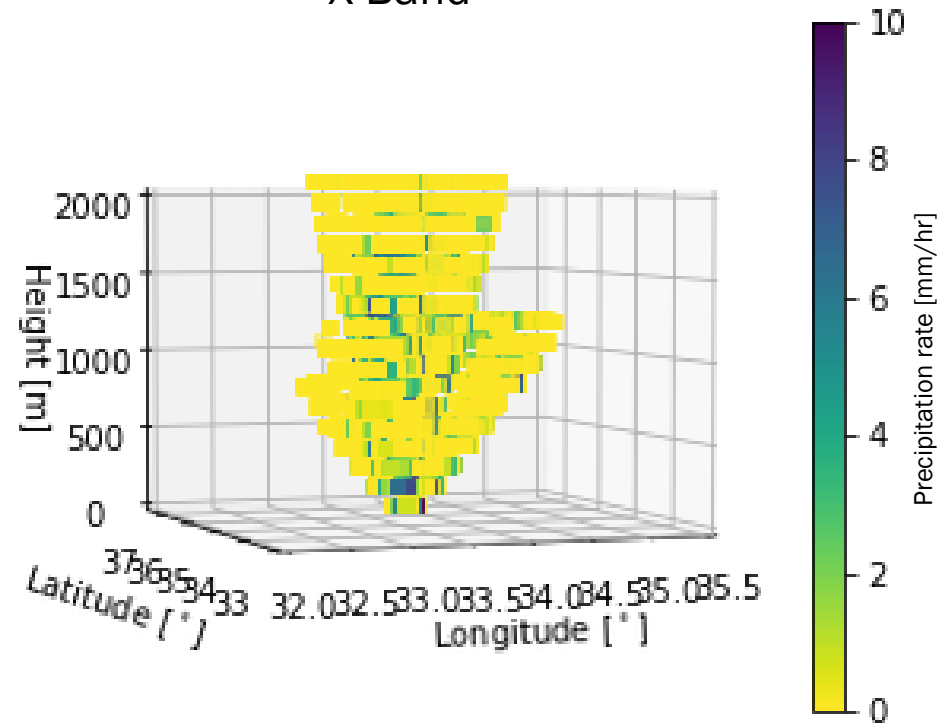
Initial state of the two datasets

GPM

Level 2A DPR
- Vertical profiles of reflectivity factor Z with attenuation correction [dbZ]
- Precipitation rate [mm/hr]

X-Band
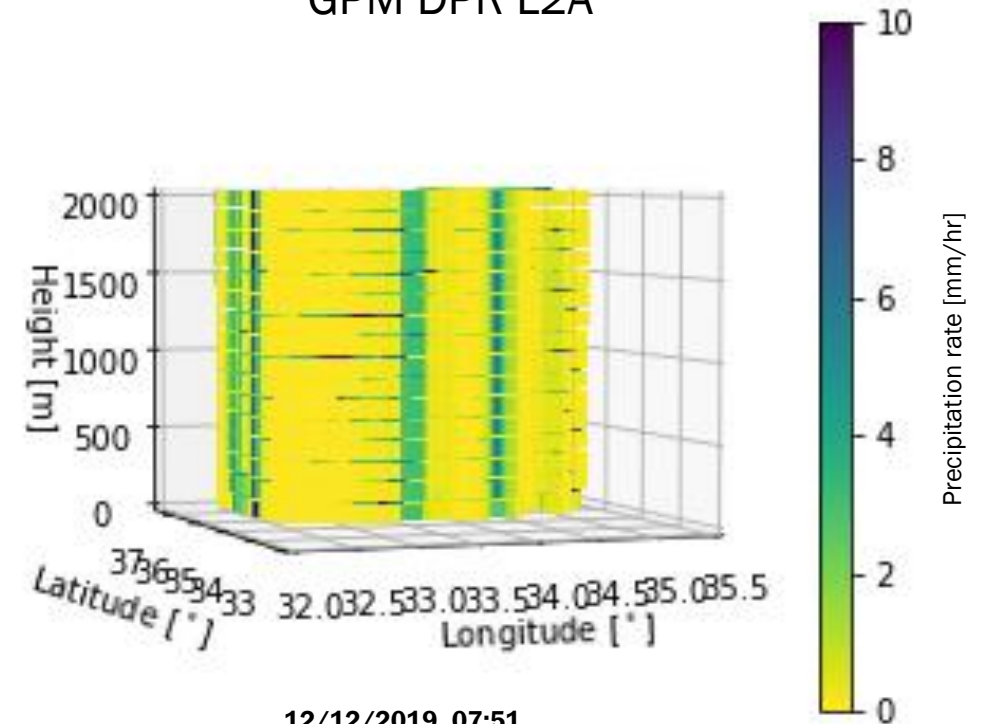
Level 0
- Raw data
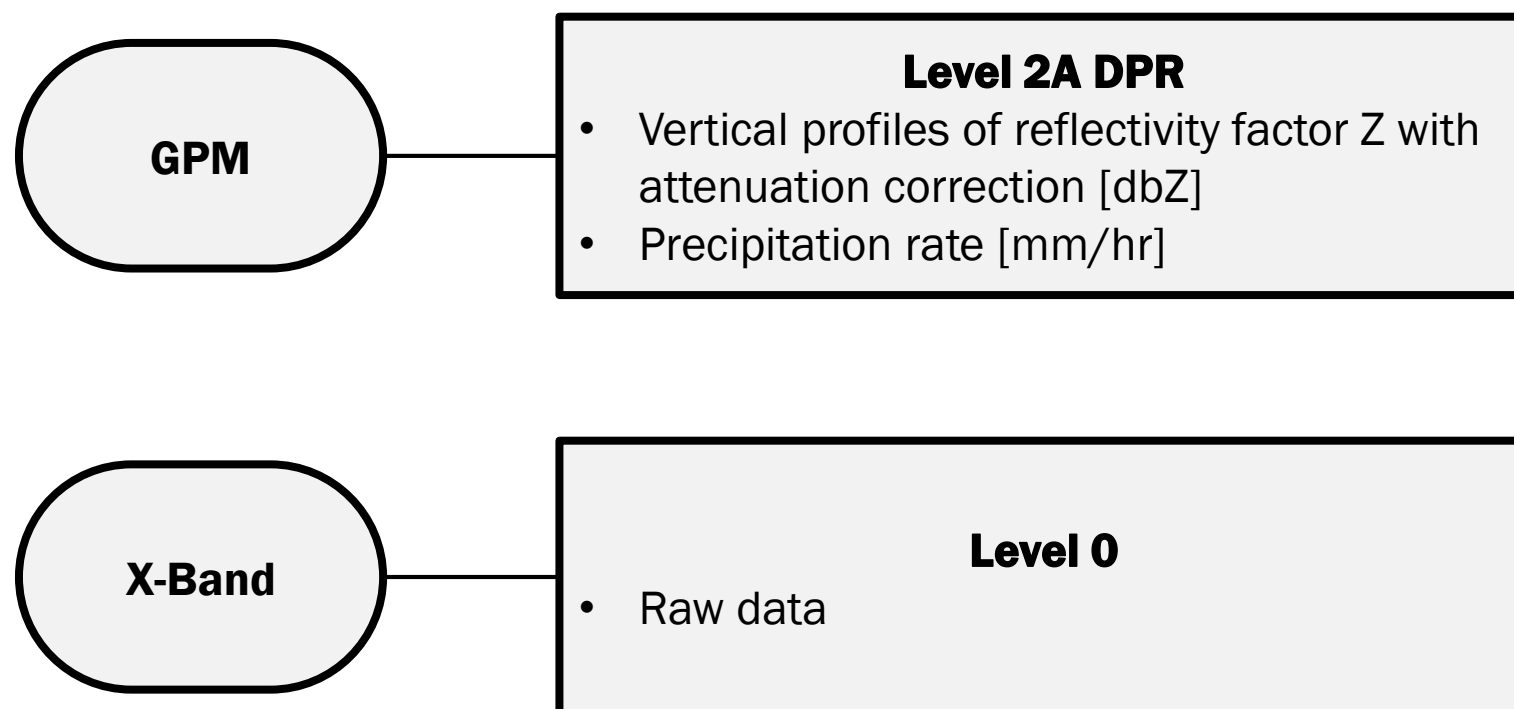
Processing chain
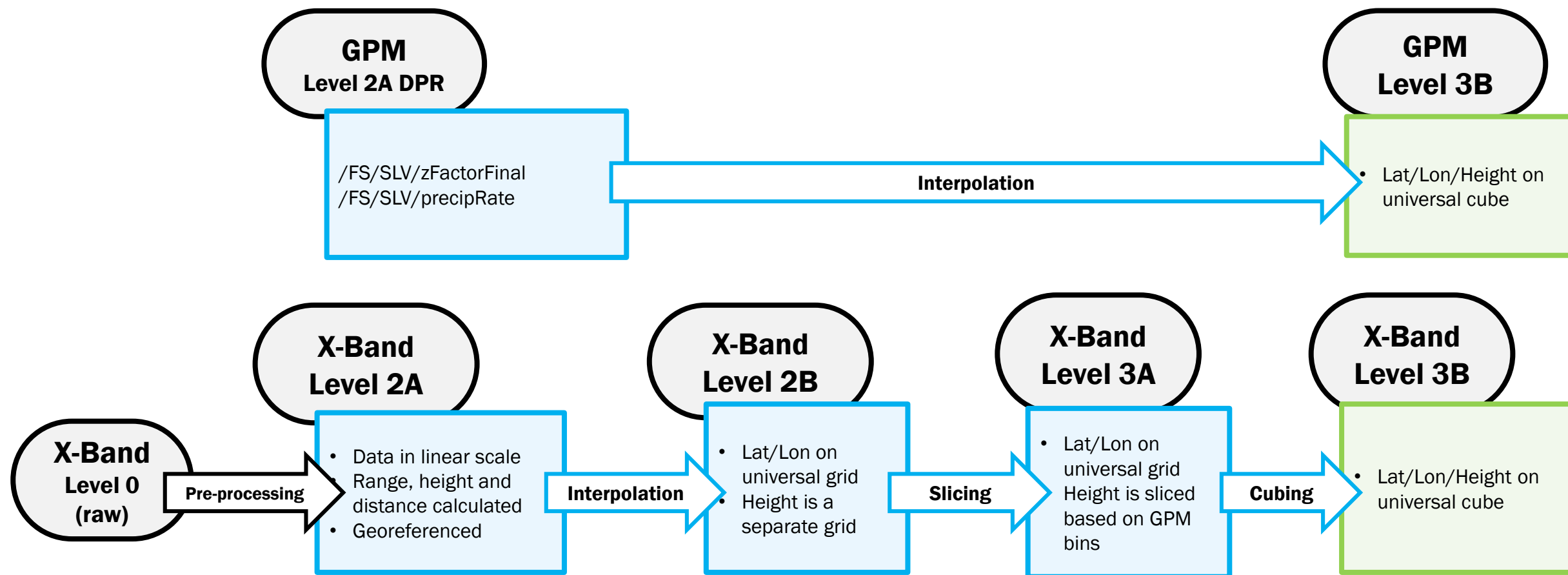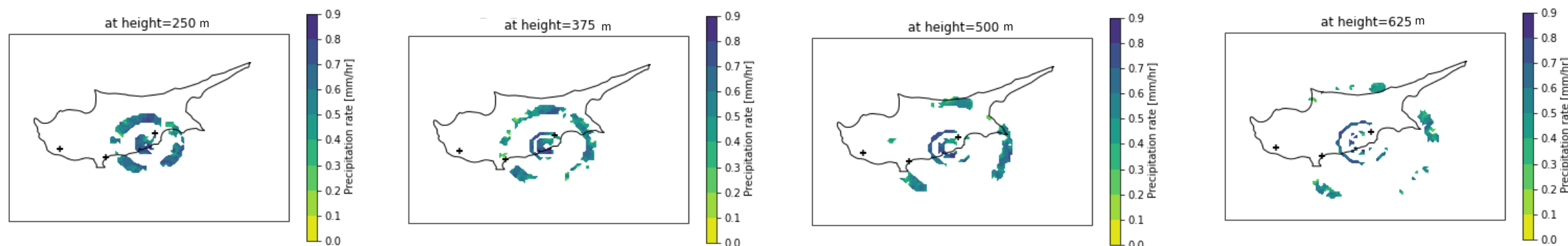
Universal cube

X-Band

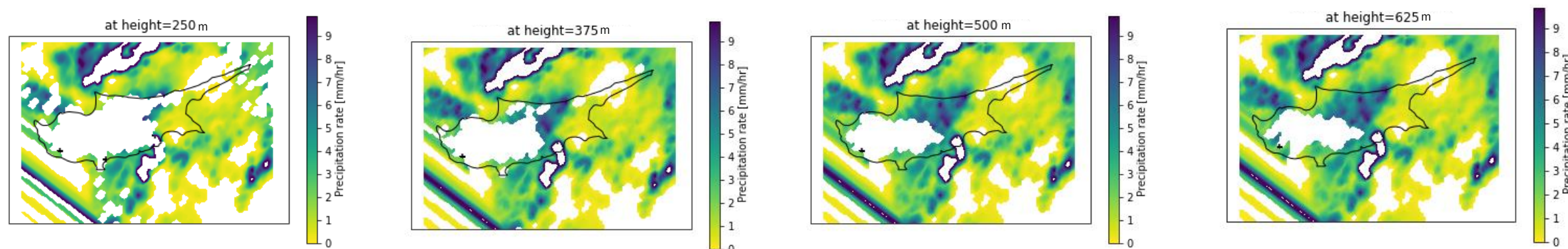12/12/2019, 07:50

GPM DPR L2A

12/12/2019, 07:51

Precipitation rate

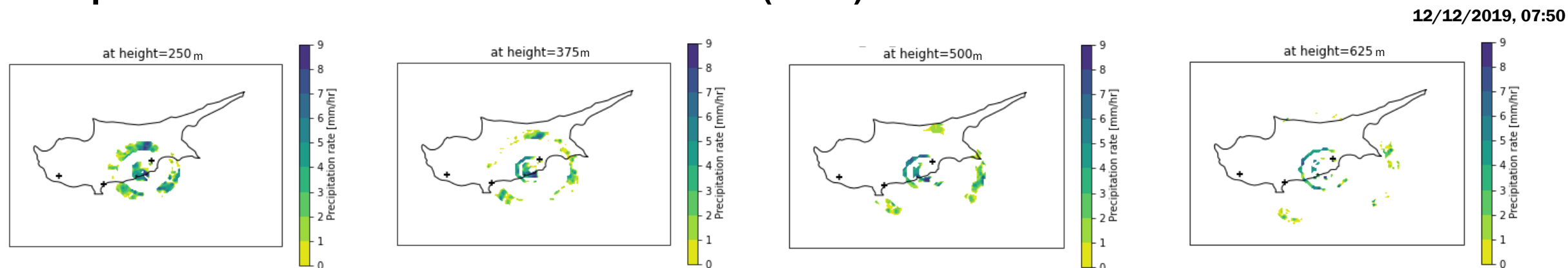**Precipitation rate after Kalogiros et al (2006) standard Z_h-R relation for X-BAND**

Precipitation rate derived from GPM DPR L2A
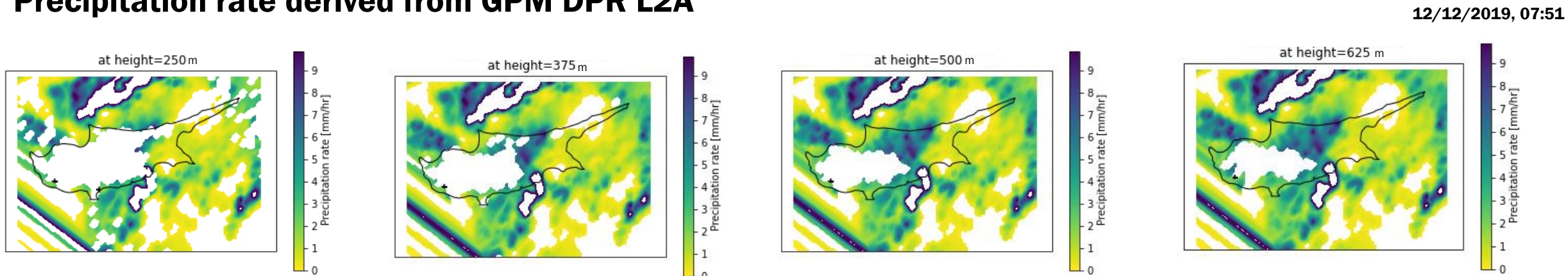
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Precipitation rate

Precipitation rate after Marshall–Palmer relation (1948)
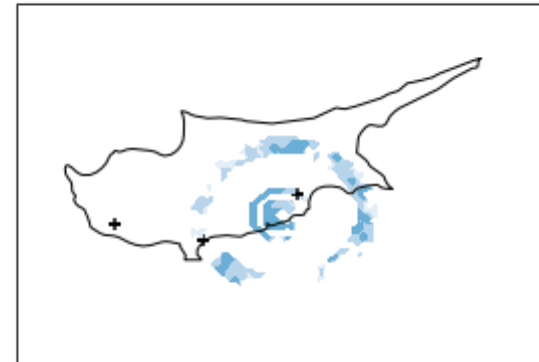
Precipitation rate derived from GPM DPR L2A
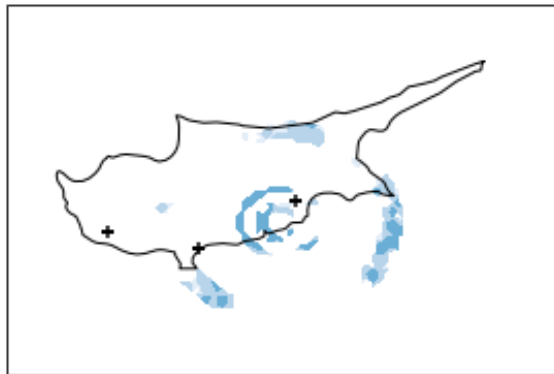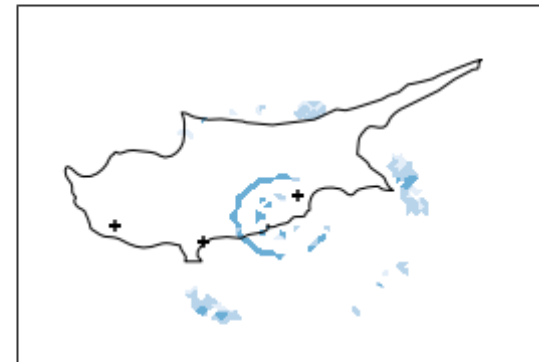
Precipitation classification

at height=250 m

at height=375 m

at height=500 m

at height=625 m

Heavy rain

Light rain

Mist

12/12/2019, 07:50

Discussion

- Preliminary results show agreement between the precipitation rate derived from X-Band measurements and the precipitation rate of GPM DPR L2A datasets

    o Kalogiros et al (2006) Standard Z_h-R relation for X-Band: higher precision in terms of spatial distribution

    o Marshall–Palmer relation (1948): better results in terms of quantitative accuracy

Future steps

- Application of further **rainfall retrieval algorithms** on both X-Band horizontal reflectivity and GPM DPR zFactor

- Comparison between vertical profiles of X-Band and GPM DPR L2A datasets

- Investigation of further **calibration methods** needed based on signal-noise ratio

- **Attenuation correction**

- Calculation of **drought level** per cell

Thank you for your attention

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