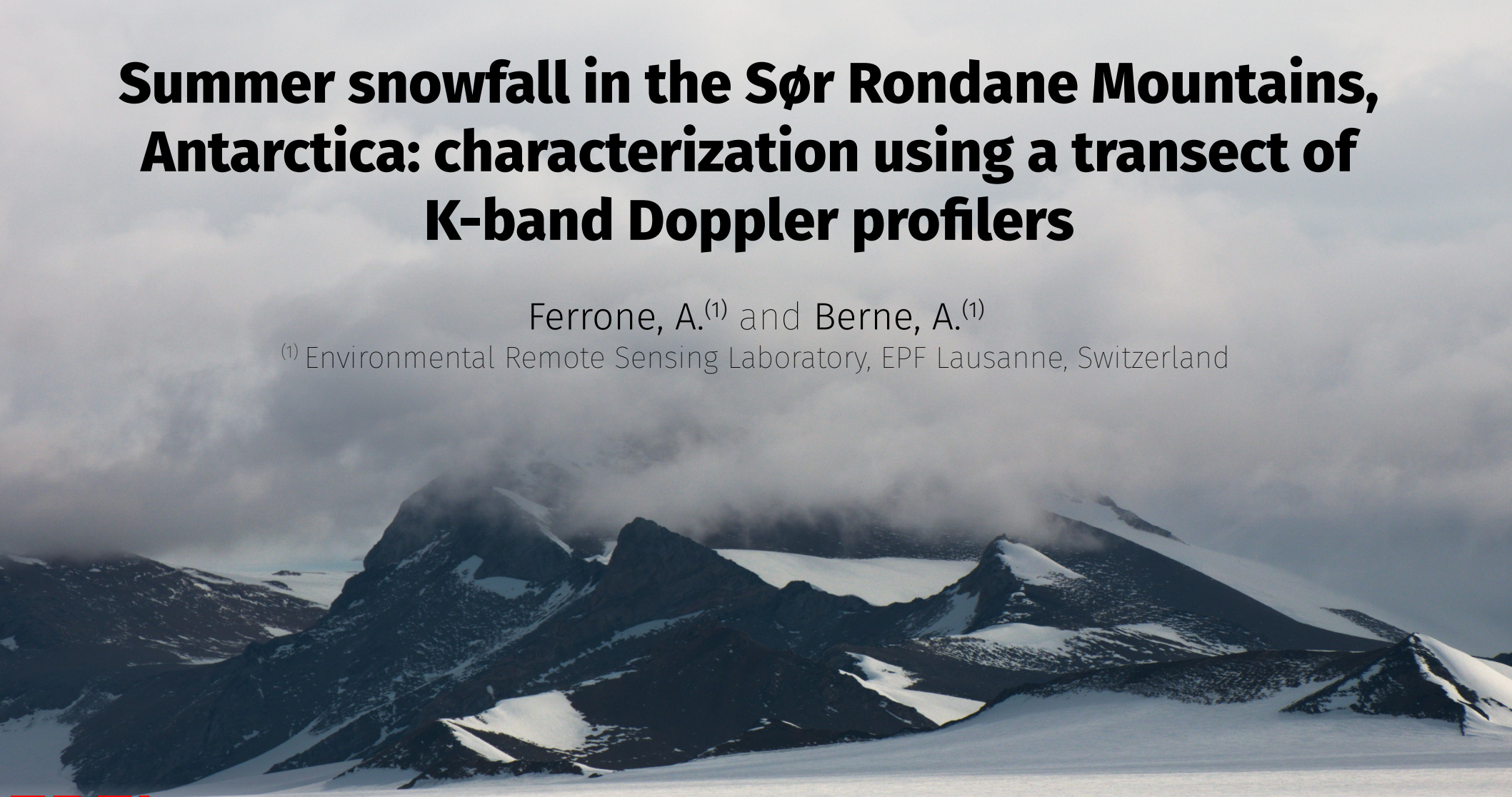
Summer snowfall in the Sør Rondane Mountains, Antarctica: characterization using a transect of K-band Doppler profilers

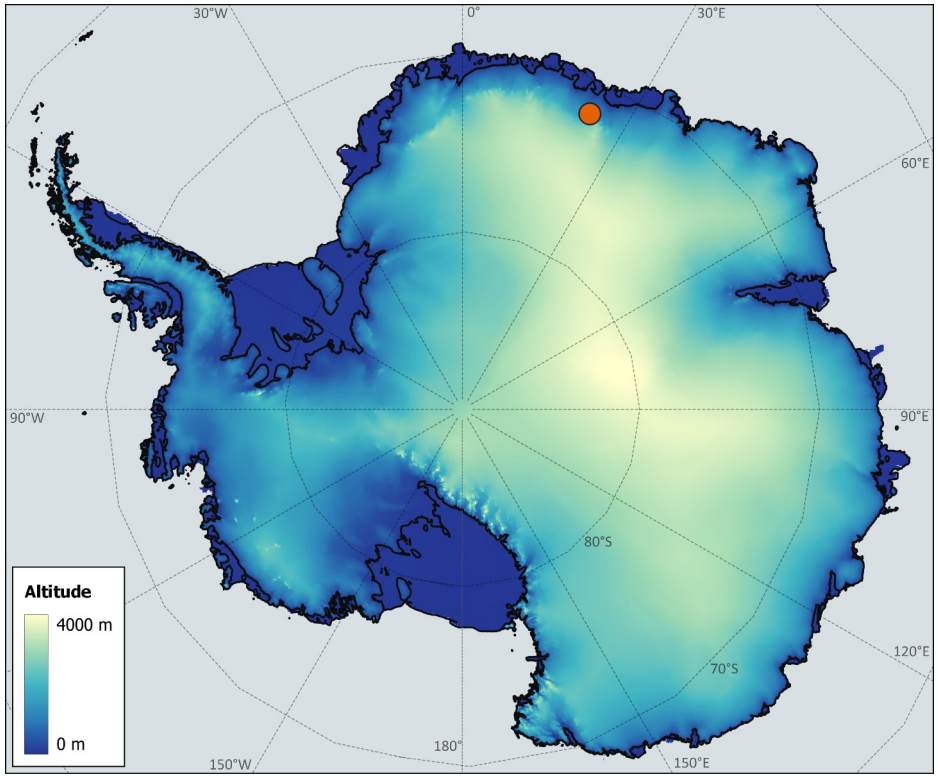
Ferrone, A.[1] and Berne, A.[1]

[1] Environmental Remote Sensing Laboratory, EPF Lausanne, Switzerland

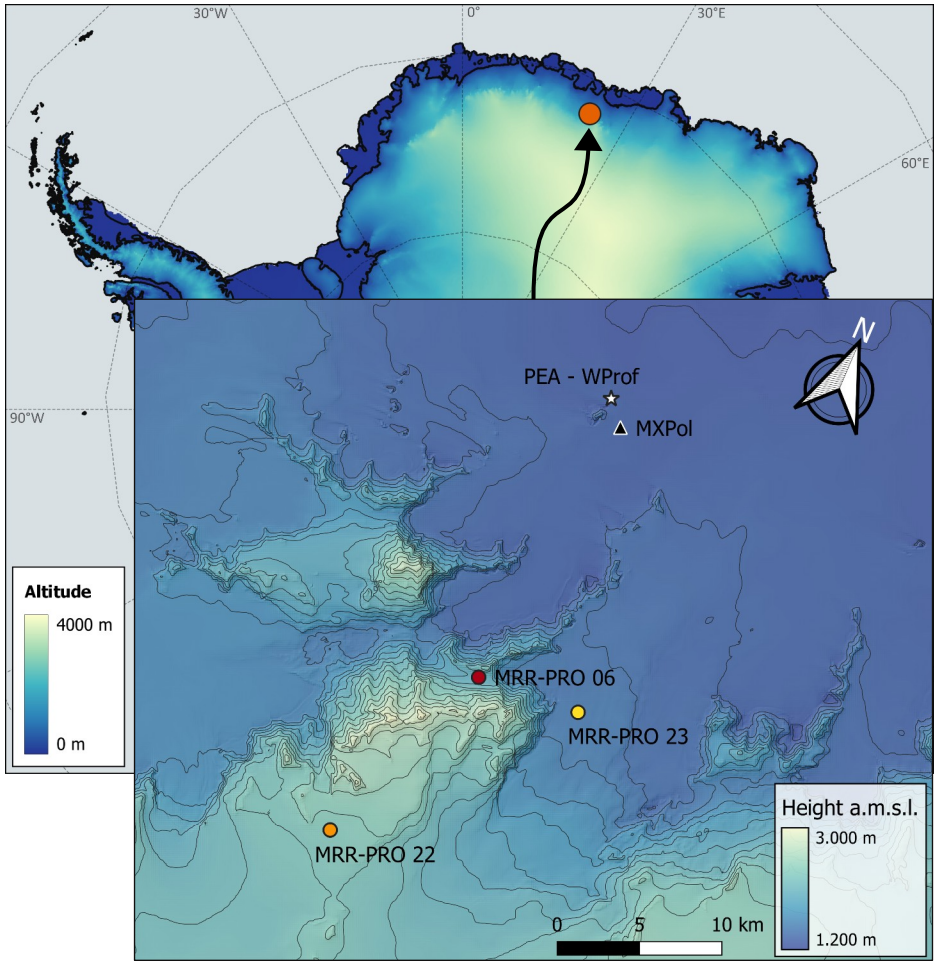


EGU General Assembly, 23-27 May 2022, Vienna, Austria

Measurement campaign

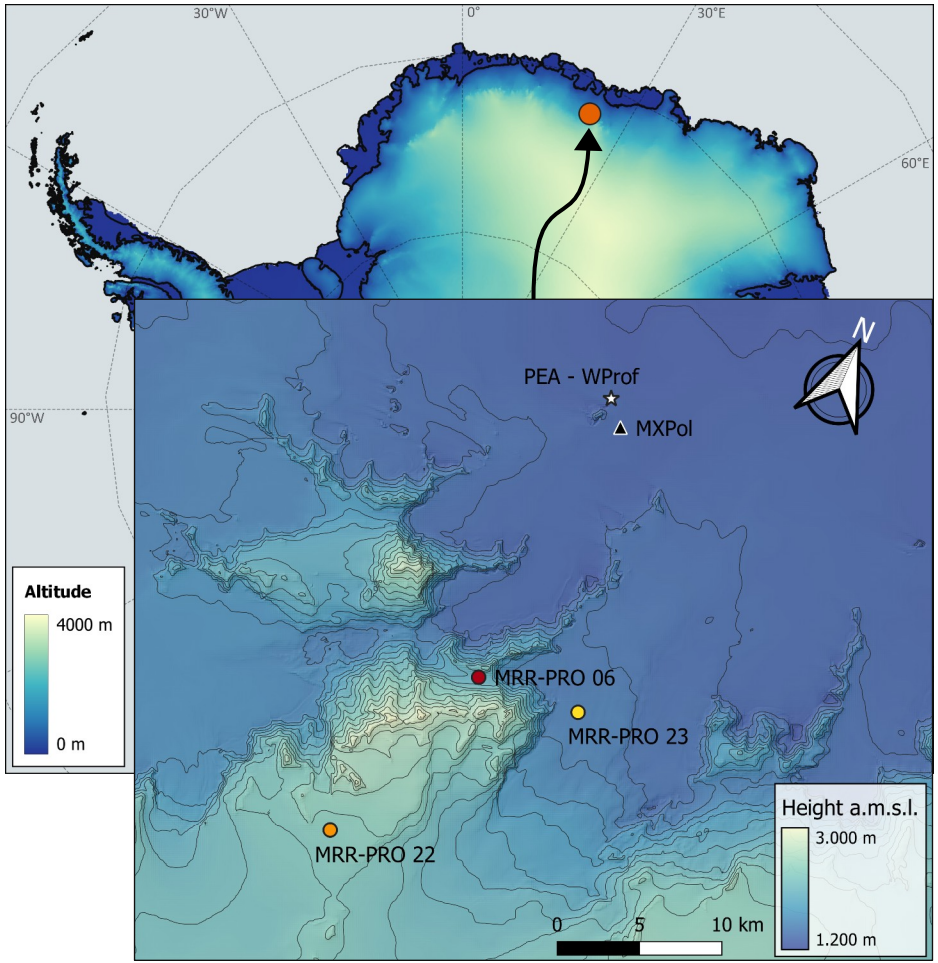


Measurement campaign



- Duration: **Oct 2019 to Feb 2020**
- **Princess Elisabeth Antarctica** (PEA) is located north of the Sør Rondane Mountains
- **Complex terrain** surrounds the base: transition to the Antarctic plateau, mountain peaks and valleys

Measurement campaign



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Motivation: Investigate how the **complex terrain** and the structure of the **lower troposphere** affect **precipitation over the mountains**

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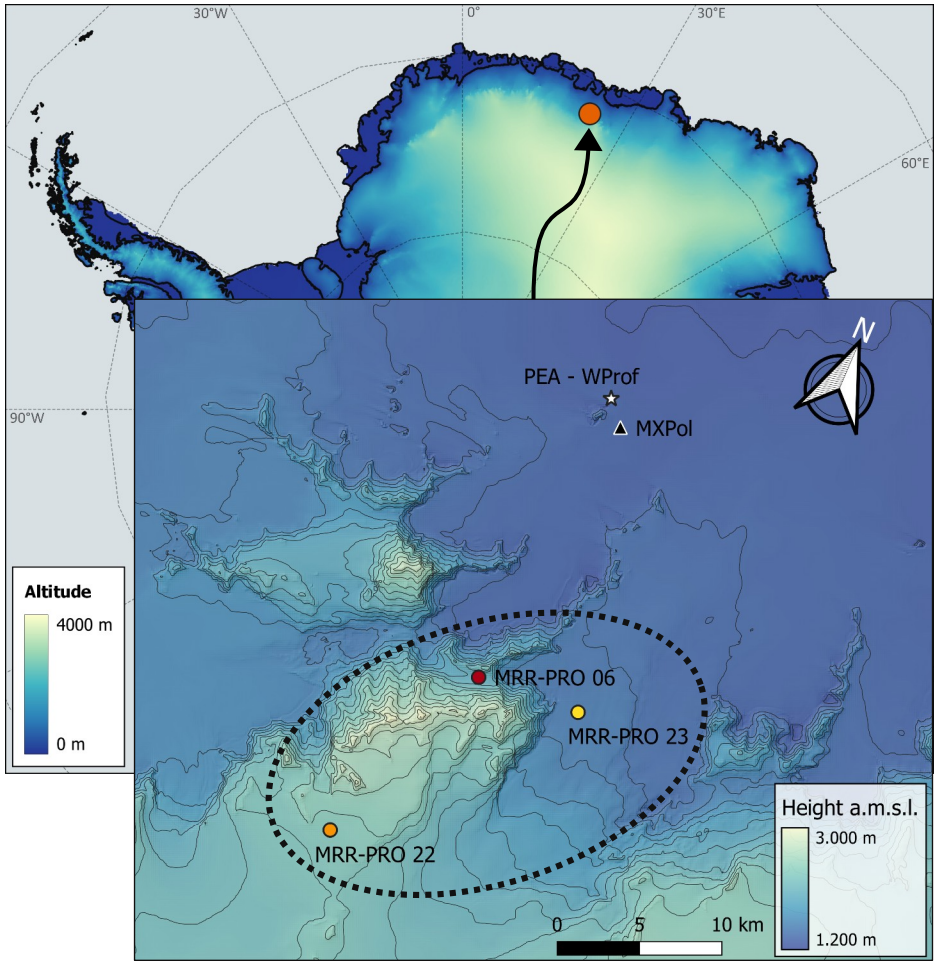

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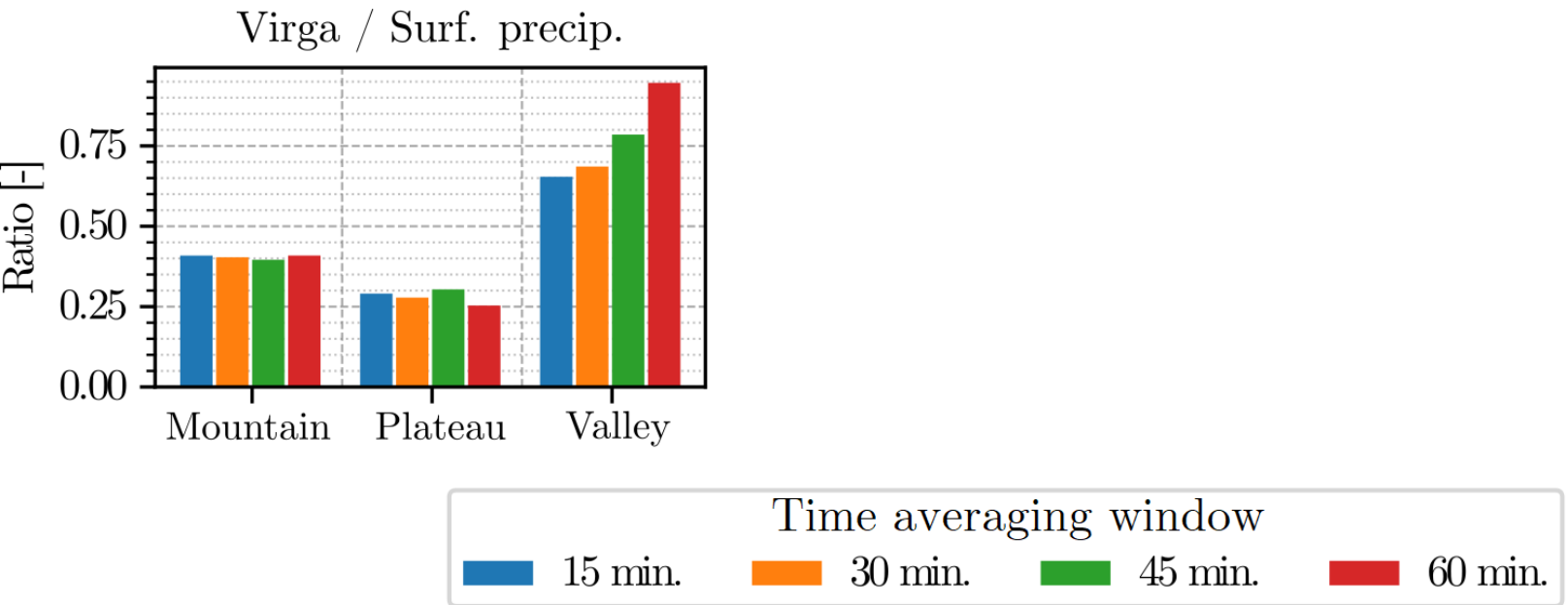
Relevant data sources:

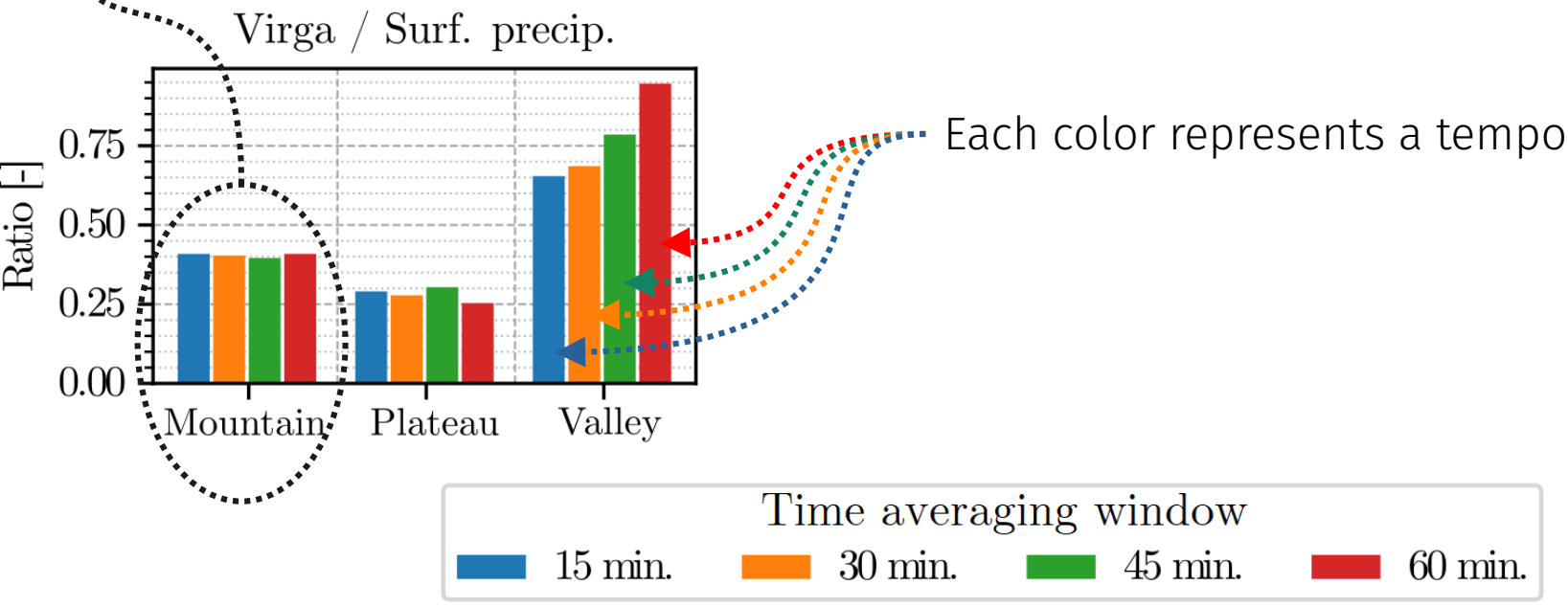
- Transect of **MRR-PRO** (K-band Doppler profilers)
- **WRF simulations** for the 3 past austral summers

Virga / surface precipitation statistics



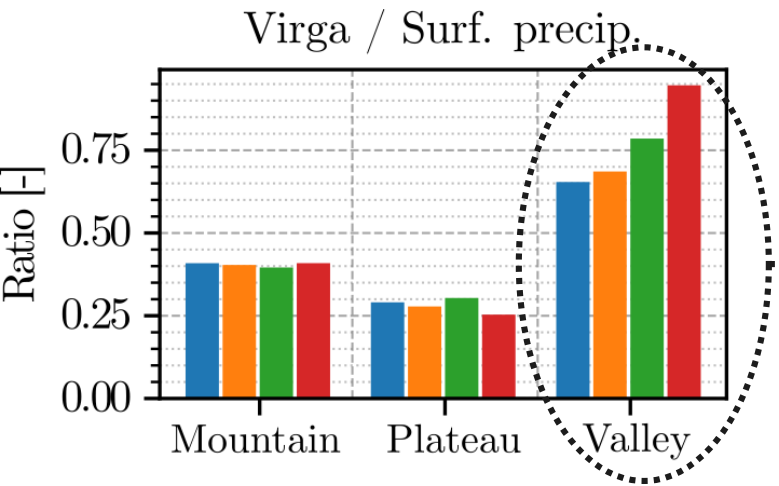
Virga / surface precipitation statistics

Each group of columns represents a site



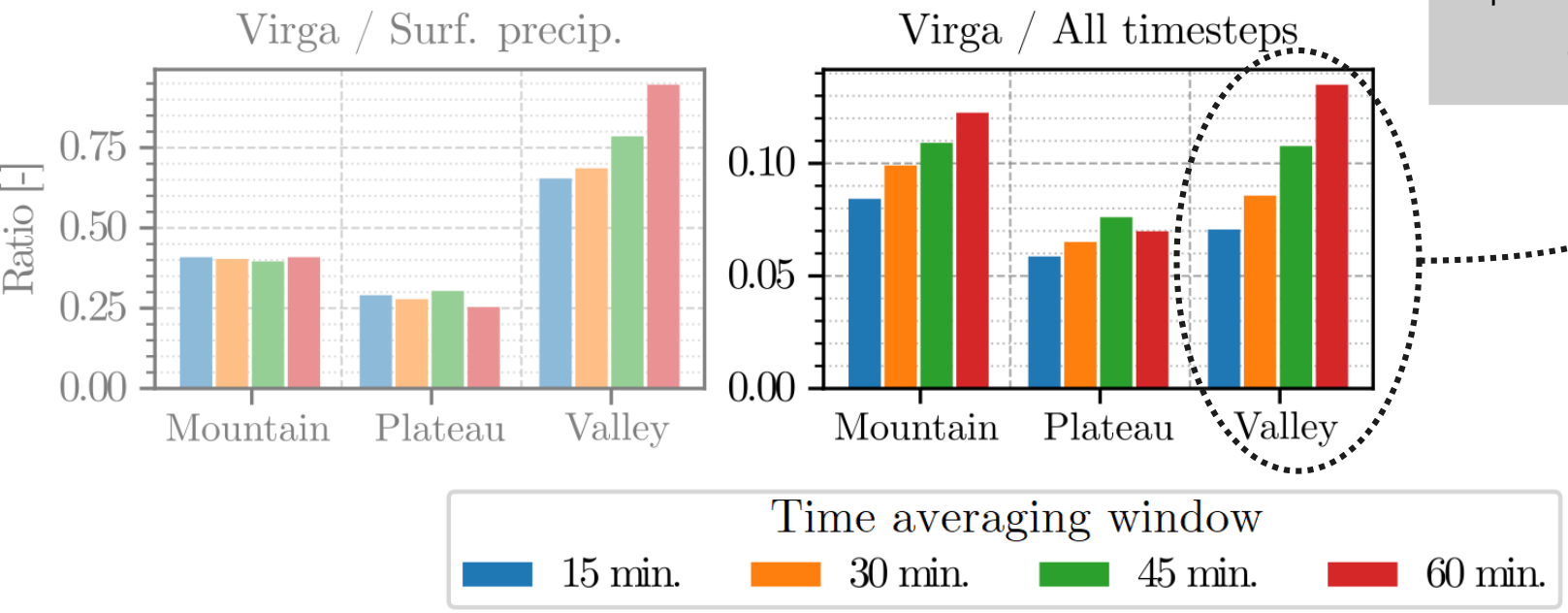
Each color represents a temporal window

Virga / surface precipitation statistics



In the valley, **virga** are **relatively frequent** compared to surface precipitation

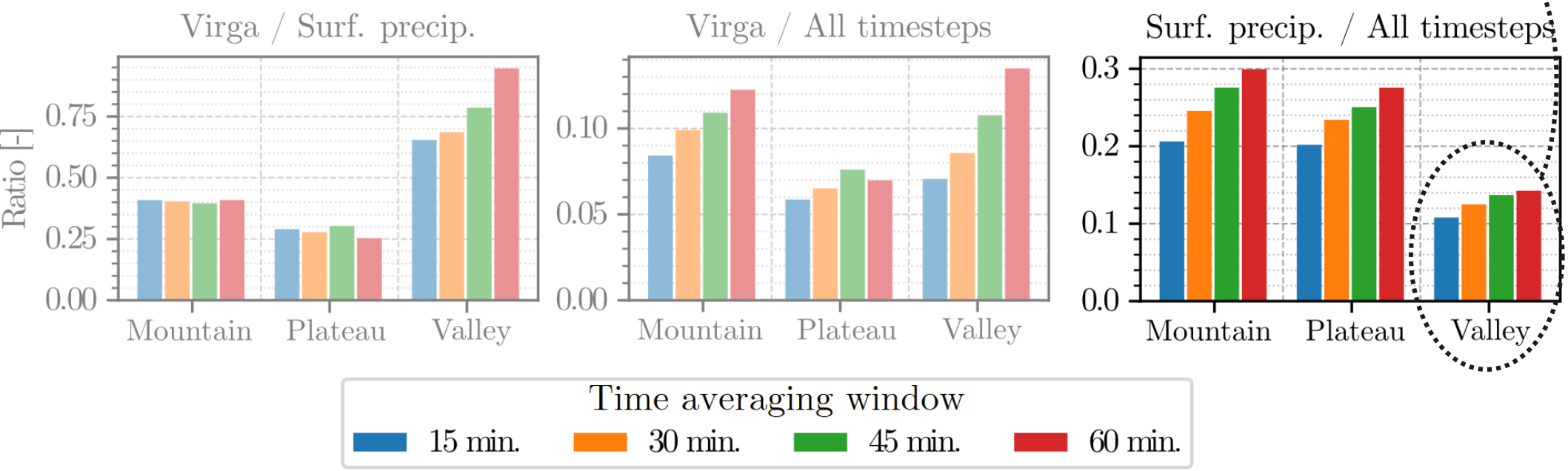
Virga / surface precipitation statistics



However, virga are not particularly frequent in **absolute terms**

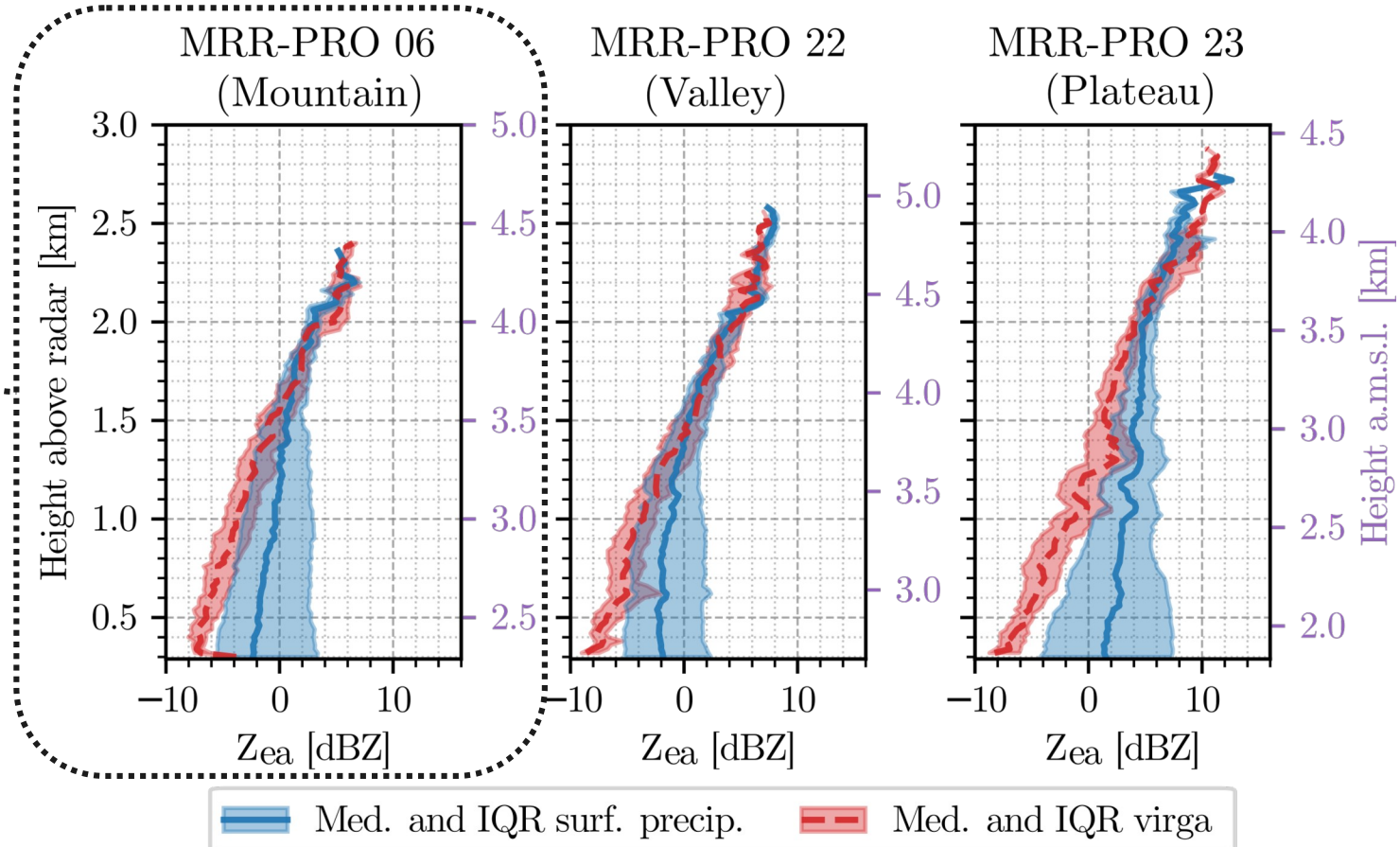
Virga / surface precipitation statistics

Surface precipitation is less frequent

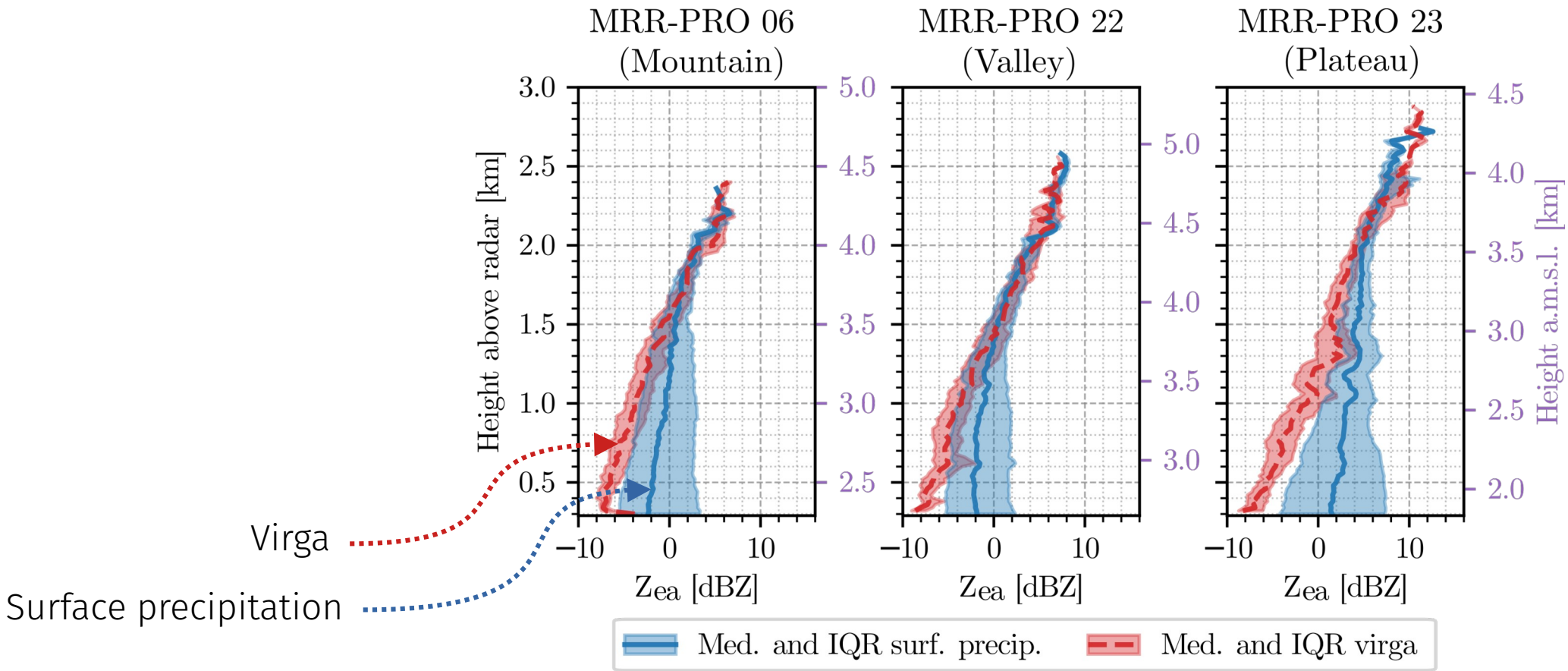


Median profiles of Z_{ea}

Each panel represents a site

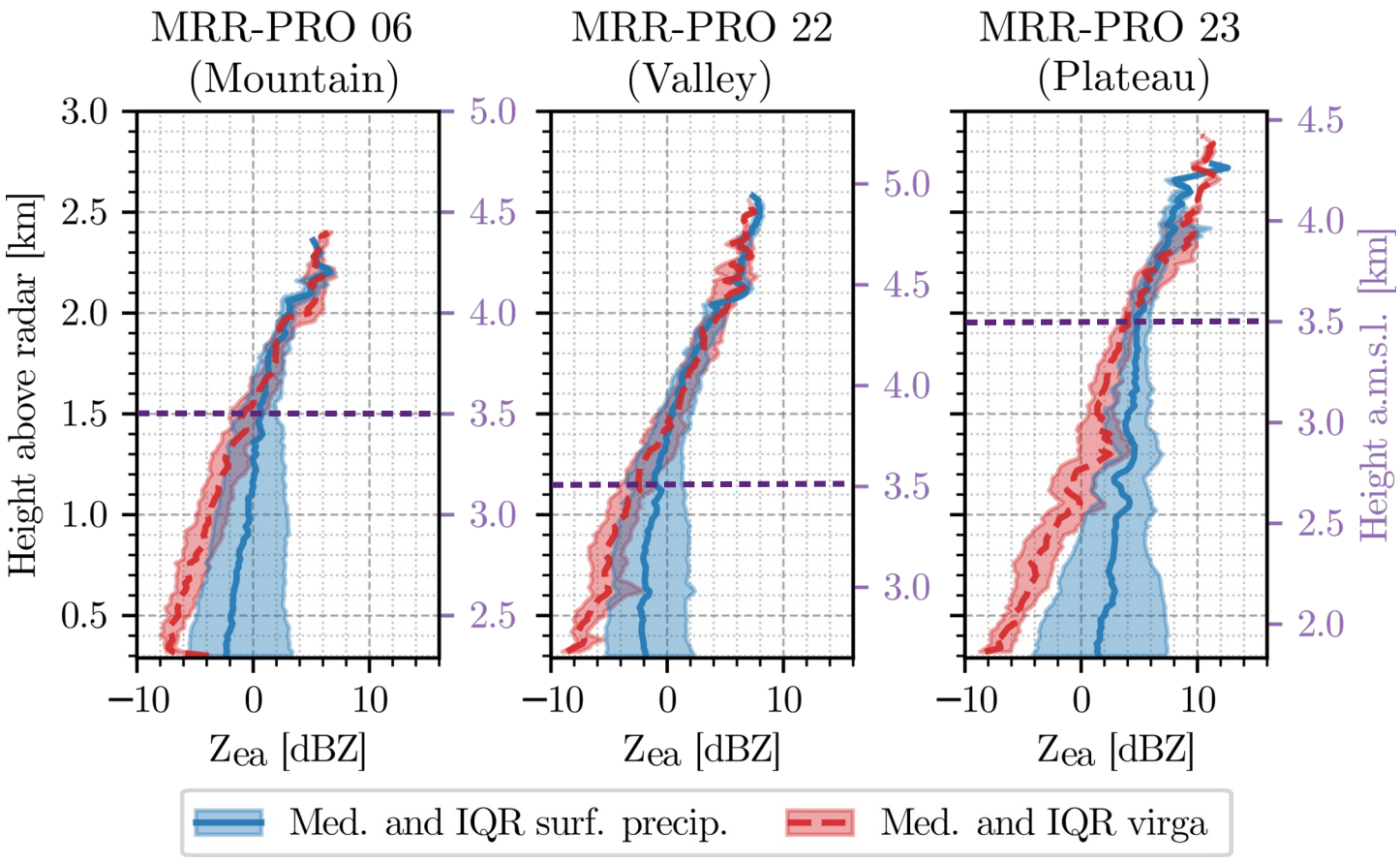


Median profiles of Z_{ea}



Median profiles of Z_{ea}

Divergence of the median profile of virga and surf. precipitation at about **3.5 km a.m.s.l.**

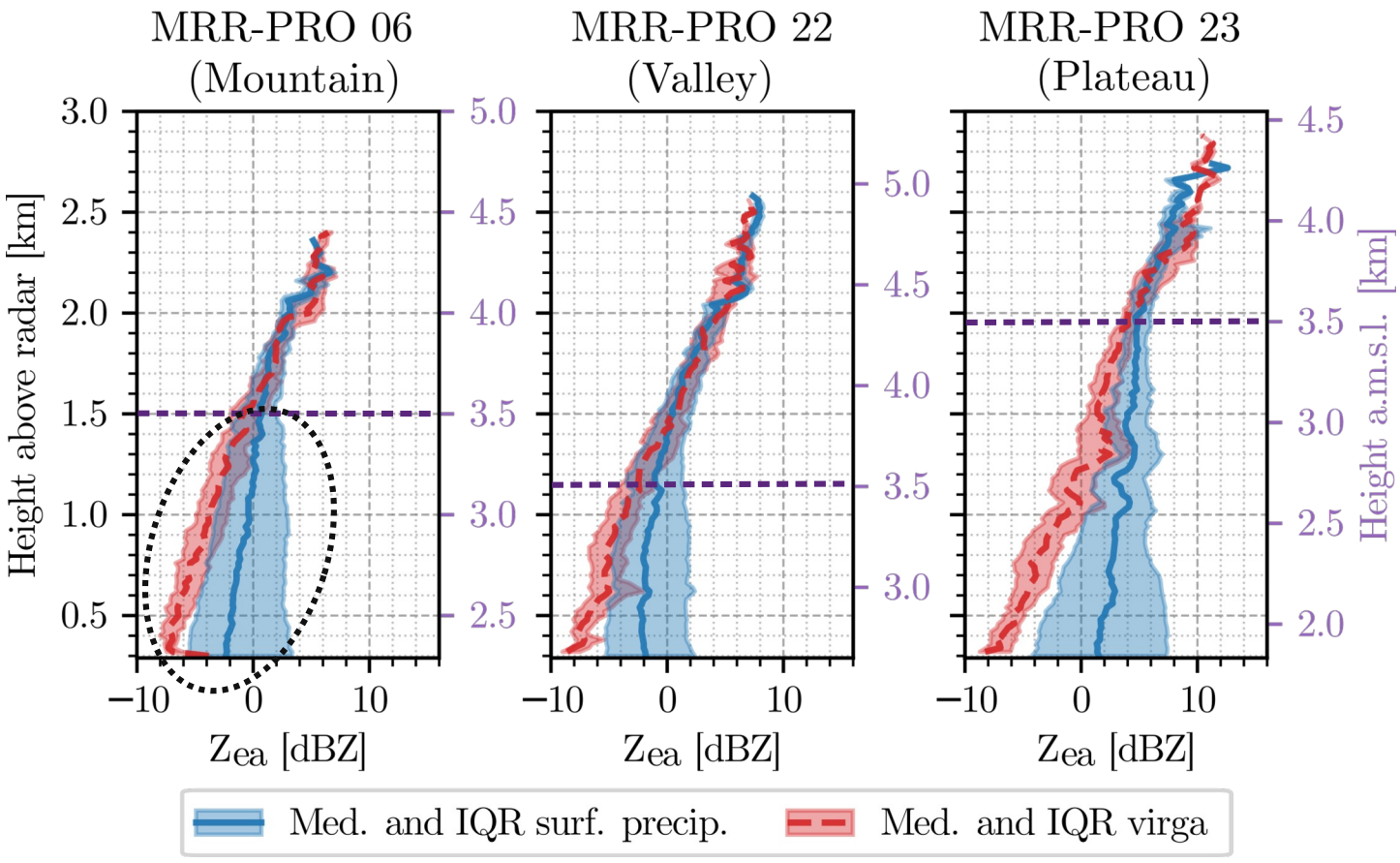


Median profiles of Z_{ea}

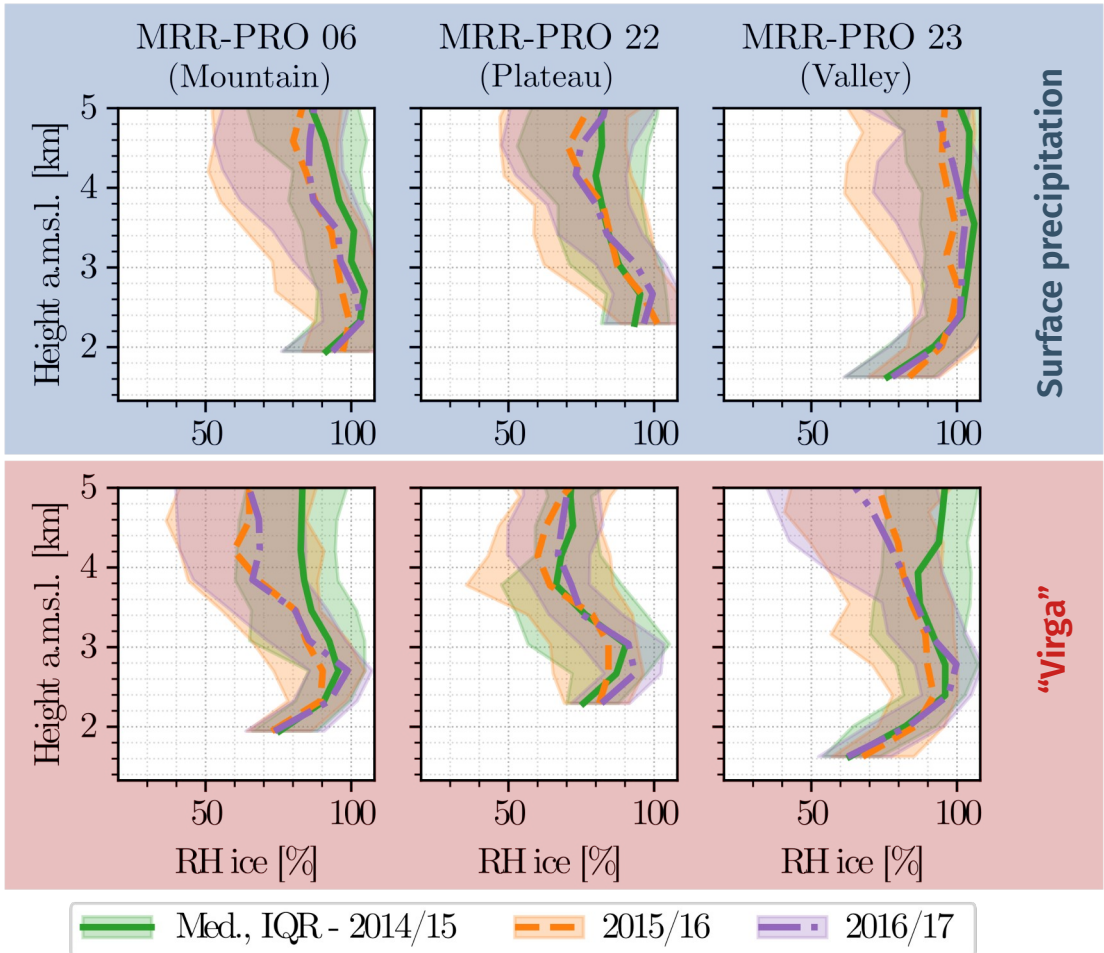
Divergence of the median profile of virga and surf. precipitation at about **3.5 km a.m.s.l.**

Z_{ea} decreases during virga events

→ **sublimation**

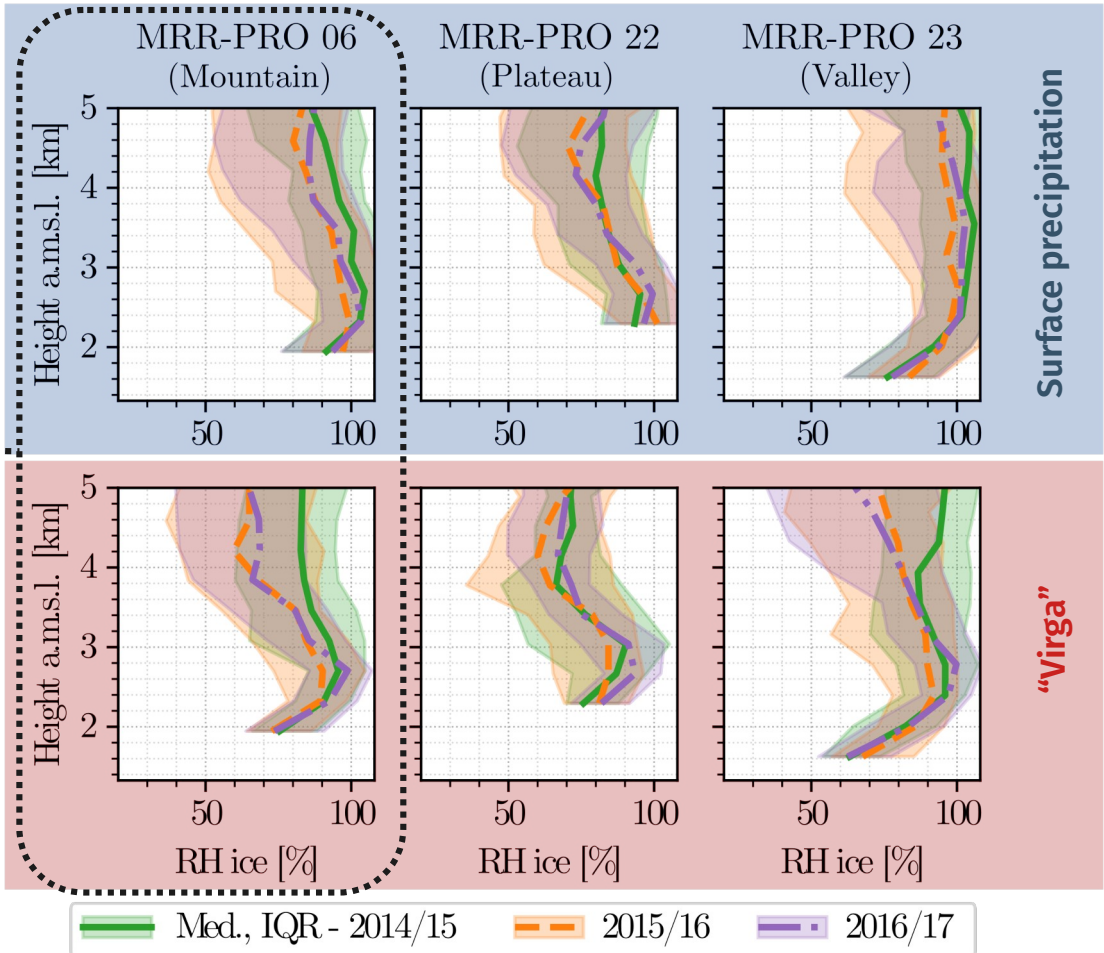


WRF: Relative humidity profiles



WRF: Relative humidity profiles

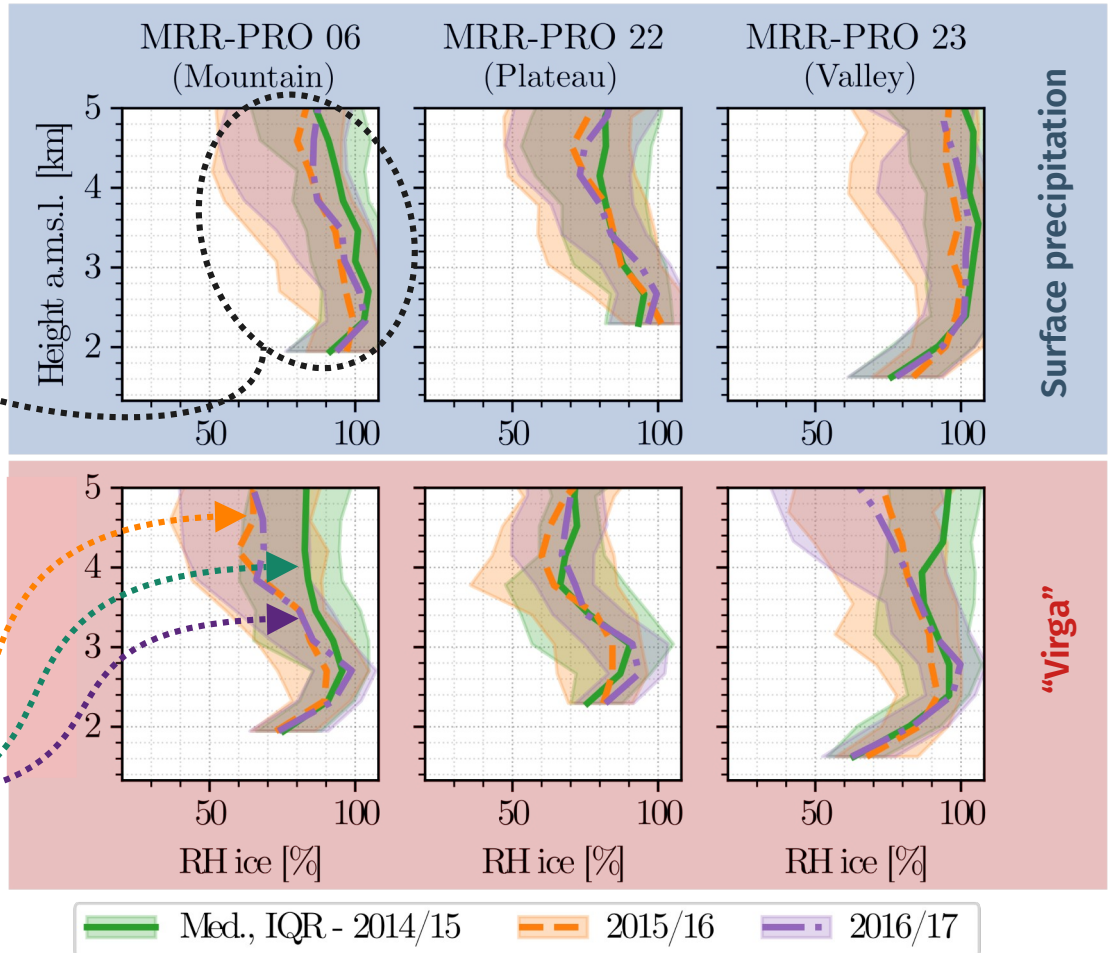
Each column of panels represents a site



WRF: Relative humidity profiles

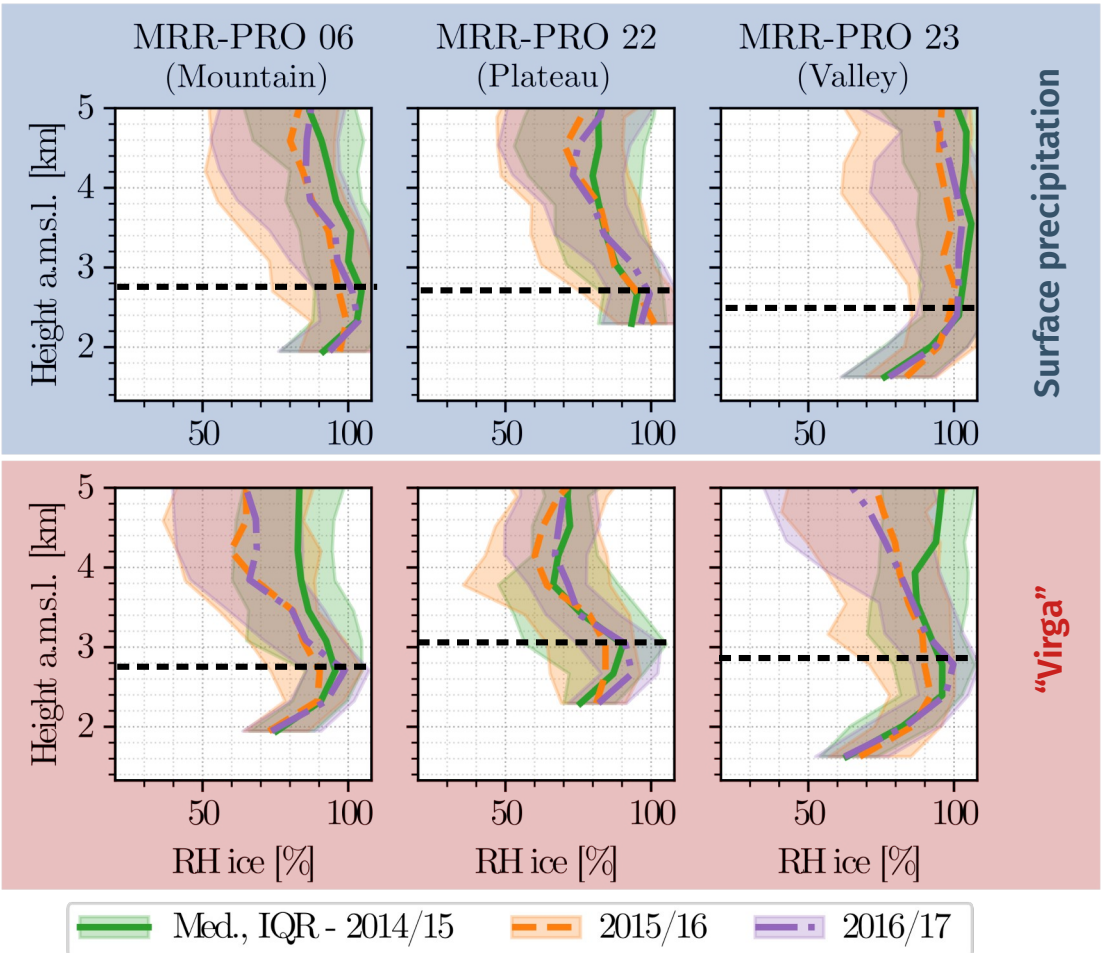
Median and interquartile range

Each color represents a simulated summer



WRF: Relative humidity profiles

Similar altitude of the lowest RH_i peak

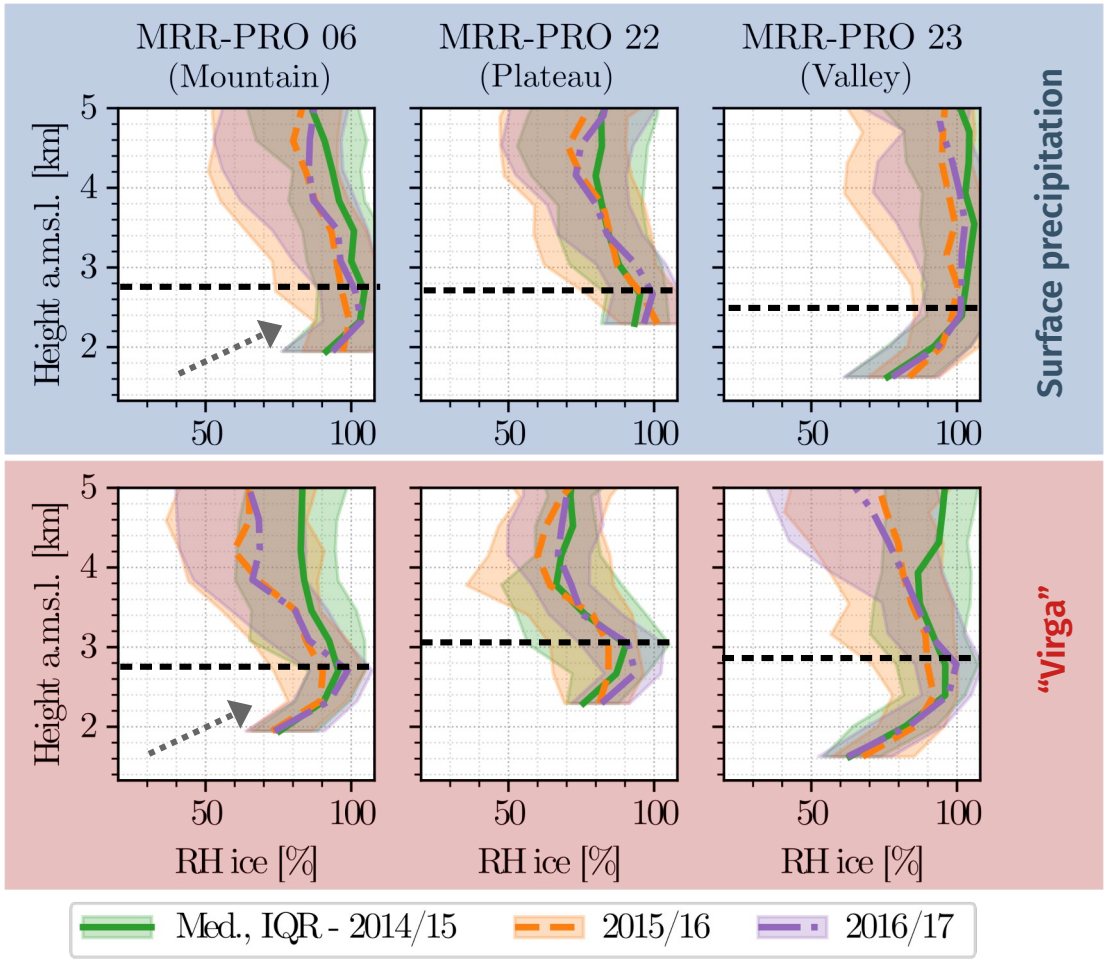


WRF: Relative humidity profiles

Similar altitude of the lowest RH_i peak

The lowest layer is less saturated

→ **The terrain height controls the depth of the "dry layer"**



Conclusions

Main results

The terrain height controls the depth of a **sub-saturated layer** in the lower troposphere

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- The depth of this layer influences the **ratio virga/surface precipitation** across the transect

Implication

- **Terrain variability** can significantly affect precipitation even over small spatial scales

Conclusions

Main results	The terrain height controls the depth of a **sub-saturated layer** in the lower troposphere
	The depth of this layer influences the **ratio virga/surface precipitation** across the transect
Implication	**Terrain variability** can significantly affect precipitation even over small spatial scales
Future prospect	Further investigation on the link with the **local** and **large-scale circulation**

"[...] sol ab his circulis semper abest longe, ventique assiduos habent flatus"

G. J. Hyginus, *De Astronomica*, Book I, VIII.2