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LACy X band meteorological radar 2022 observations of cyclonic rains in La Réunion

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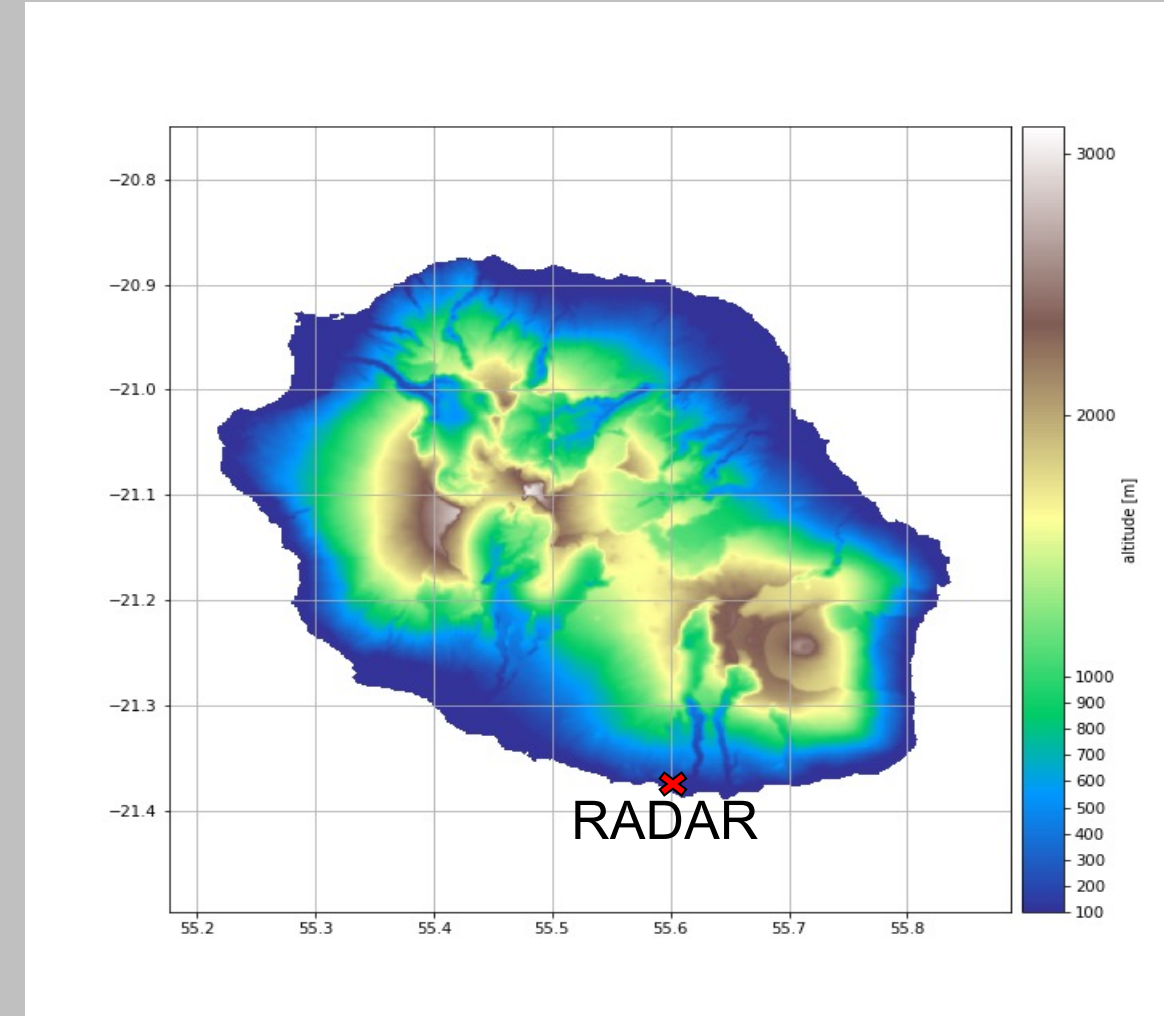
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Guillaume LESAGE, Olivier BOUSQUET and Joël VAN BAELEN

Context



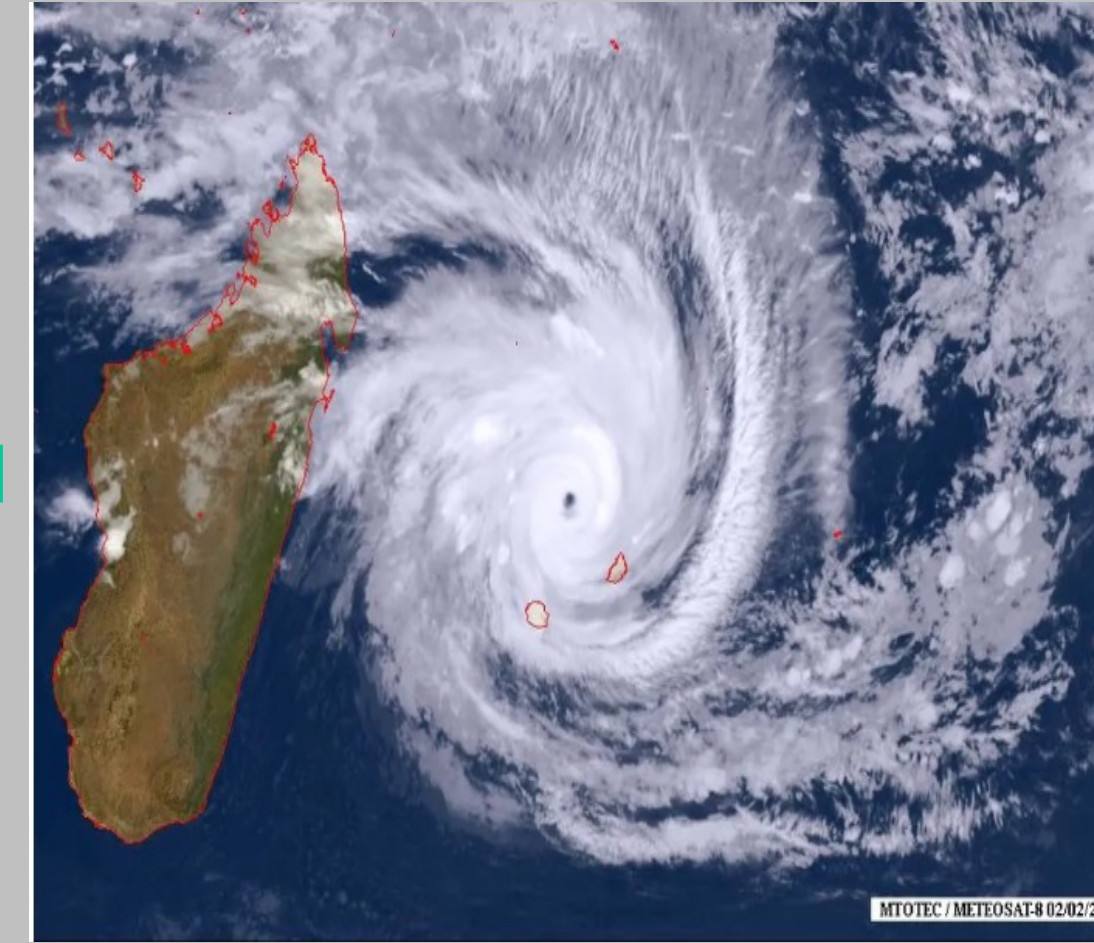
Reunion Island is located in the Southwest Indian Ocean basin (SWIO), a cyclogenesis zone and is characterised by a tropical climat.

Meteo France is the CMRS in charge to monitor tropical cyclone activity in the SWIO basin.



Reunion Island is marked by a very steep terrain with a peak of 3070 m:

- Generate strong spatial gradients of precipitation
- Intensified precipitation



A very intense tropical cyclone (BATSIRAI) passed near the island (~200 km) on February 3, 2022 :

- Caused heavy damages
- Brought intense precipitation



Contacts



Damages during
Batsirai in La
Réunion

Main instrumentation



Dual polarization Doppler X-band radar :

- For examining cloud dynamics , microphysics and making quantitative precipitation
- Installed at low altitude (20 m), to study the system approaching the island and its interaction with the relief

Some available weather products :

Plan Position Indicator (PPI), Range Height Indicator (RHI), Maximum display (MAXDISPLAY), Velocity Azimuth Display (VAD)

Data :

PPI's resolution : 125 m, range : 75 km, temporal resolution: 10 min
RHI's resolution : 25 m, range : 50 km, temporal resolution: 20 min



Perspectives 2022 - 2024

One of the ESPOIRS project overarching goal is to study the internal (dynamic, microphysical) and external (interactions with the relief) processes driving the formation and life cycle of extreme meteorological rain events in the South West Indian Ocean.

Thus, beyond this first deployment in the south of La Réunion, there will be deployments in Seychelles and Madagascar to document the 2022_2023 cyclonic season.

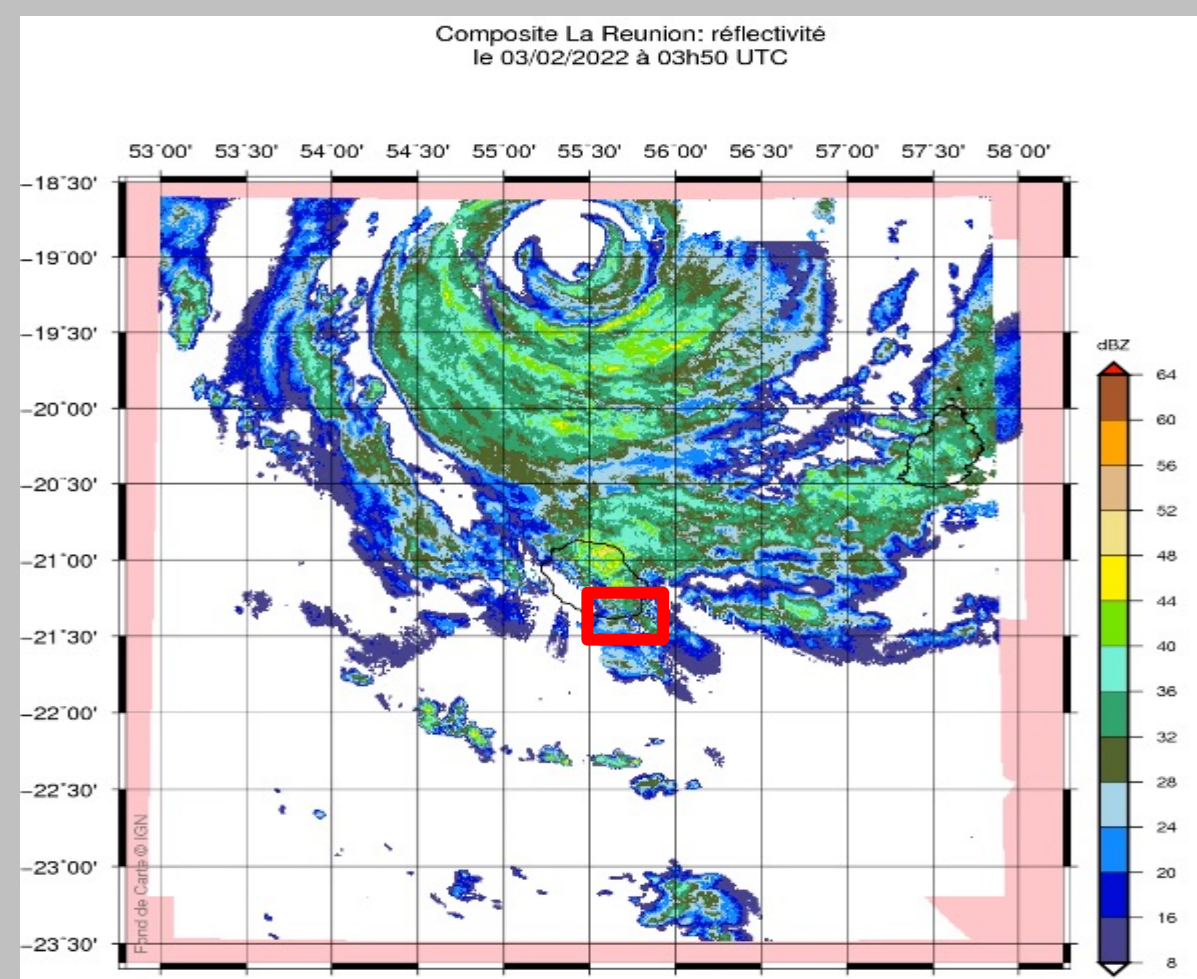
Objectives

Reunion Island holds world records of precipitation, often associated with cyclone activity while rainfall intensification with respect to orography often enhance the societal impact.

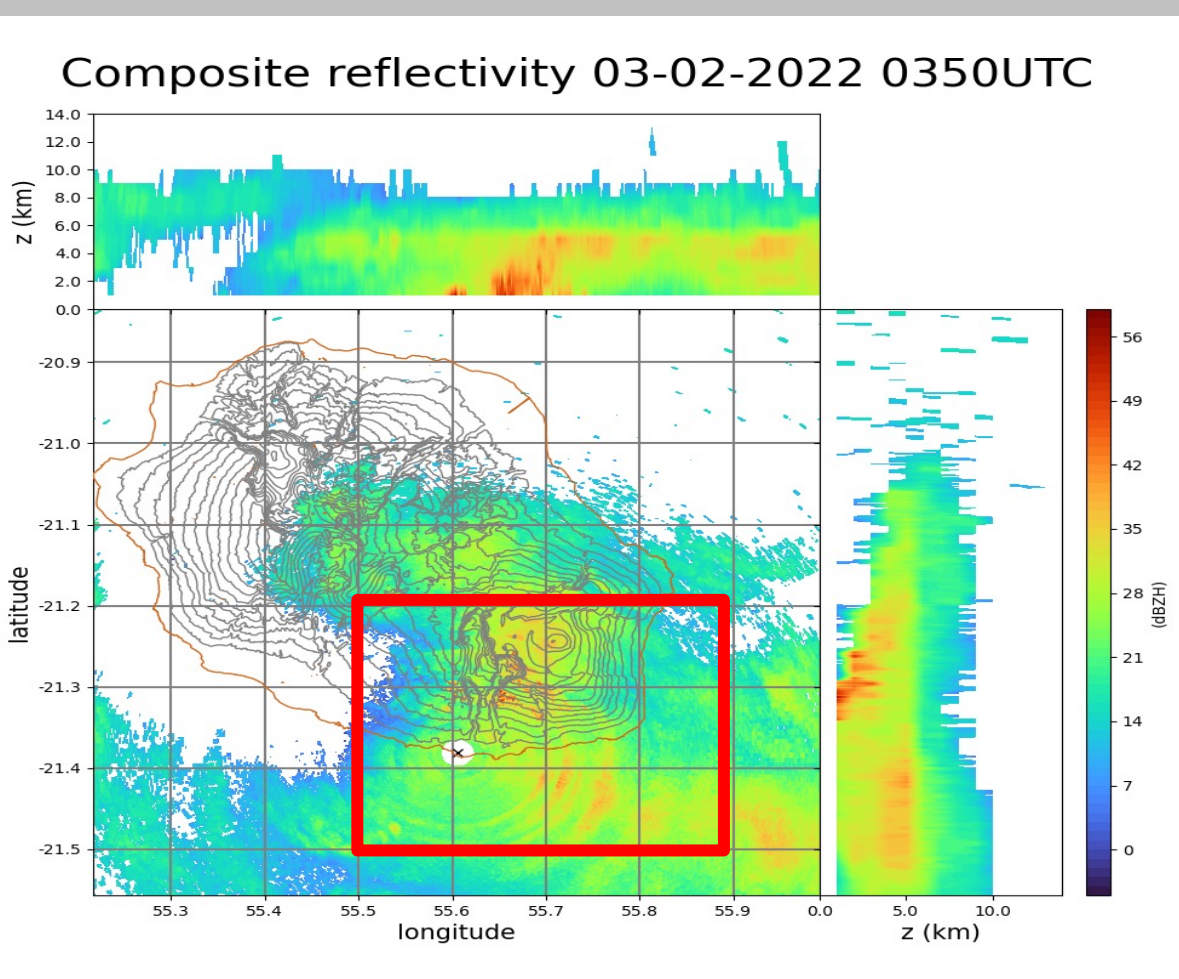
Hence, in this work, we will study the rainfall dynamics and it's interaction with the relief during the passage of Batsirai close to La Réunion island on February, 3 2022.

Preliminary Results

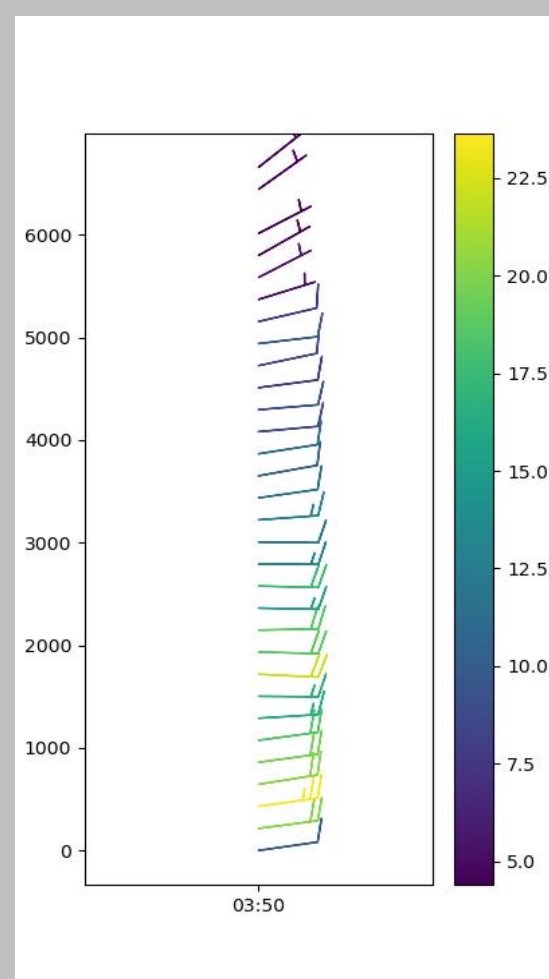
Morning: stratiform rain



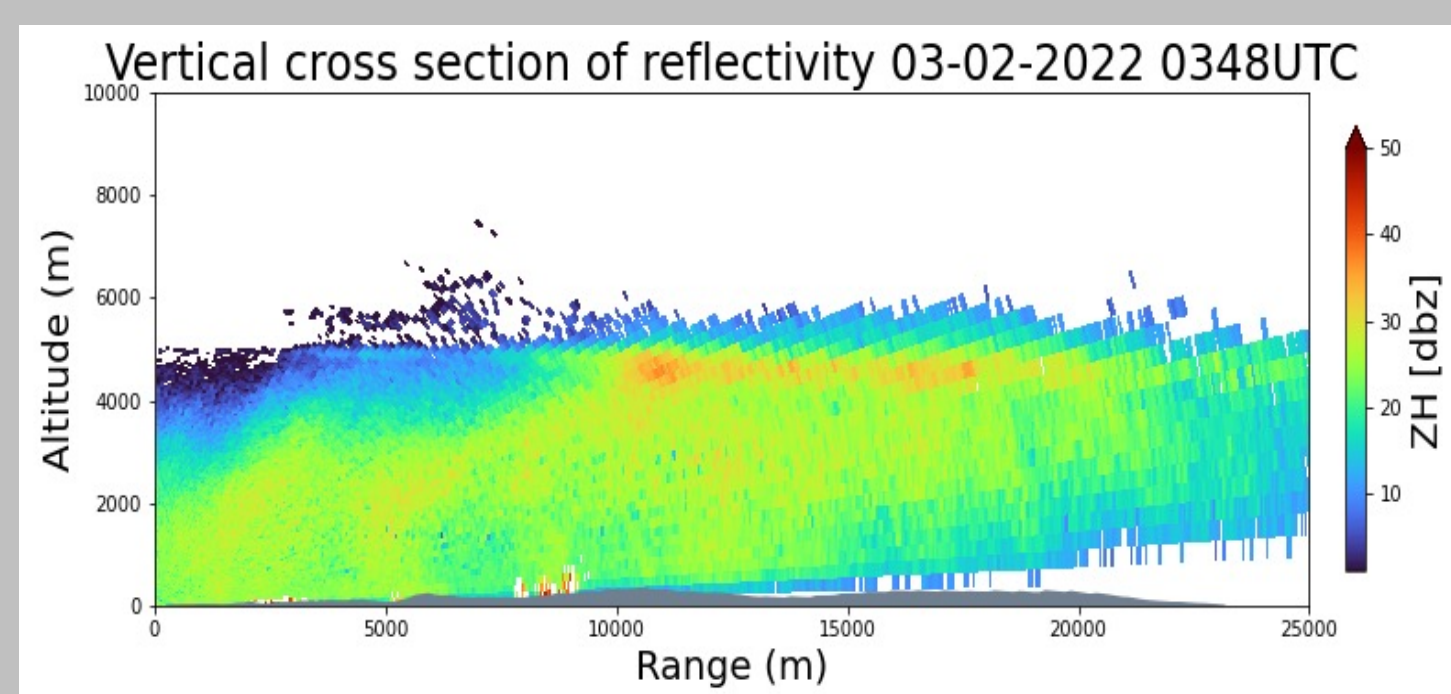
Composite reflectivity measured with S-band radar (Météo-France) at 7:50 in local time



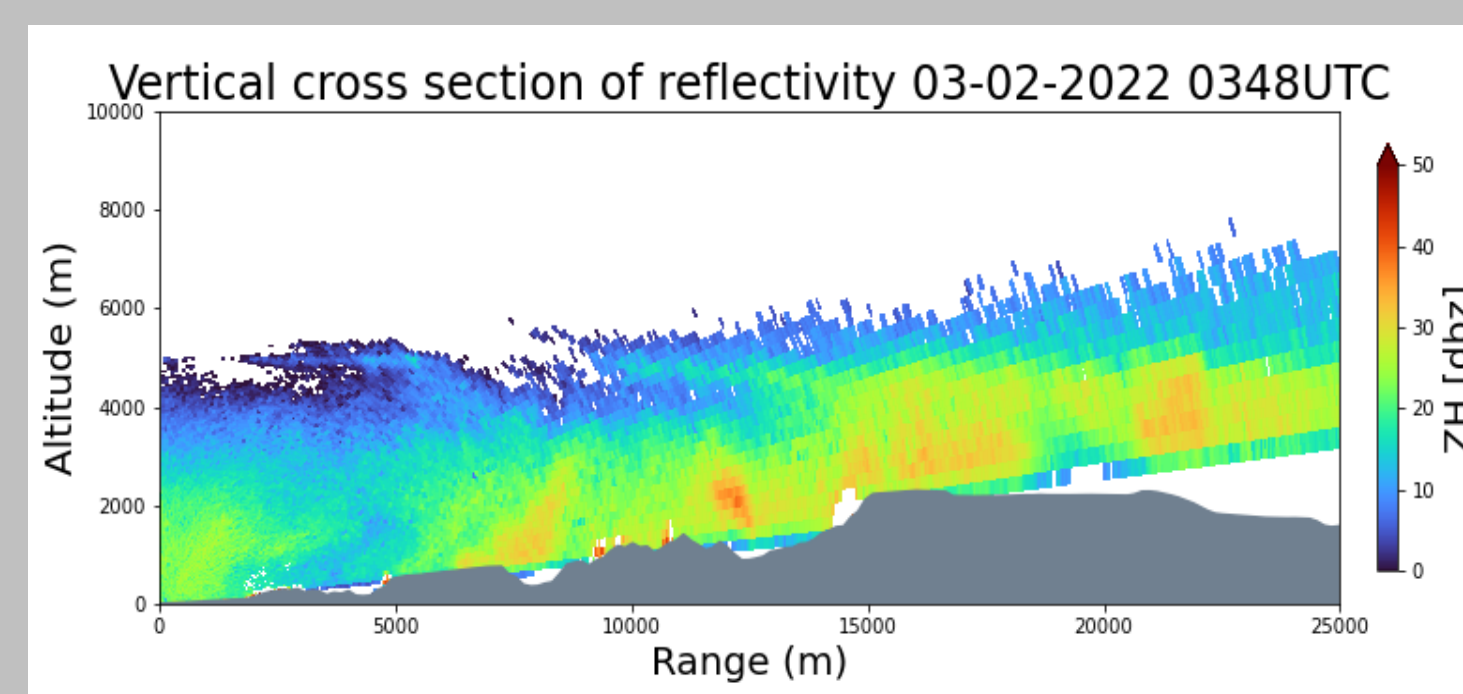
Composite reflectivity measured with X-band radar, showing bright band signature, characteristics of stratiform rain



VAD measured with X-band radar

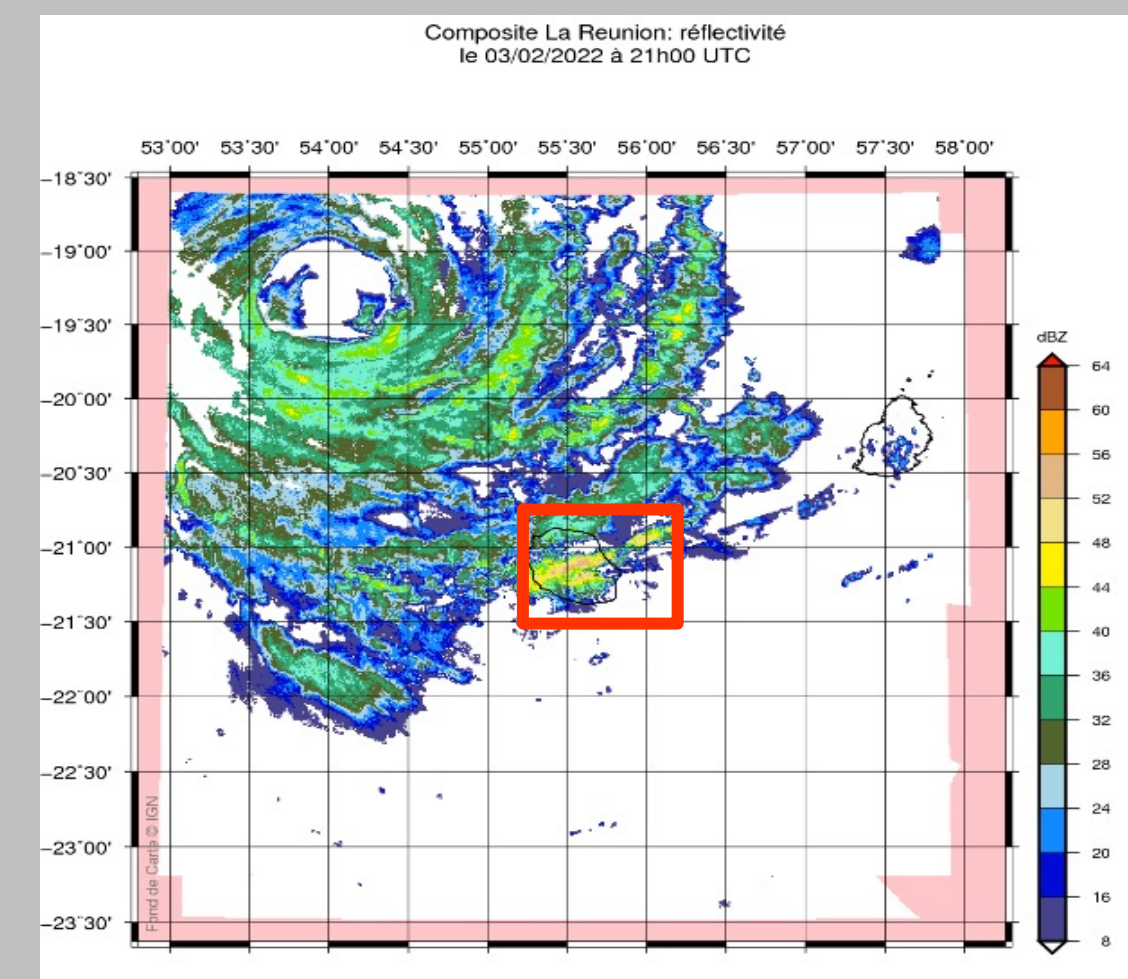


RHI along the coast showing the bright band at about 5 km of altitude, corresponding to 0°C of temperature (not shown)

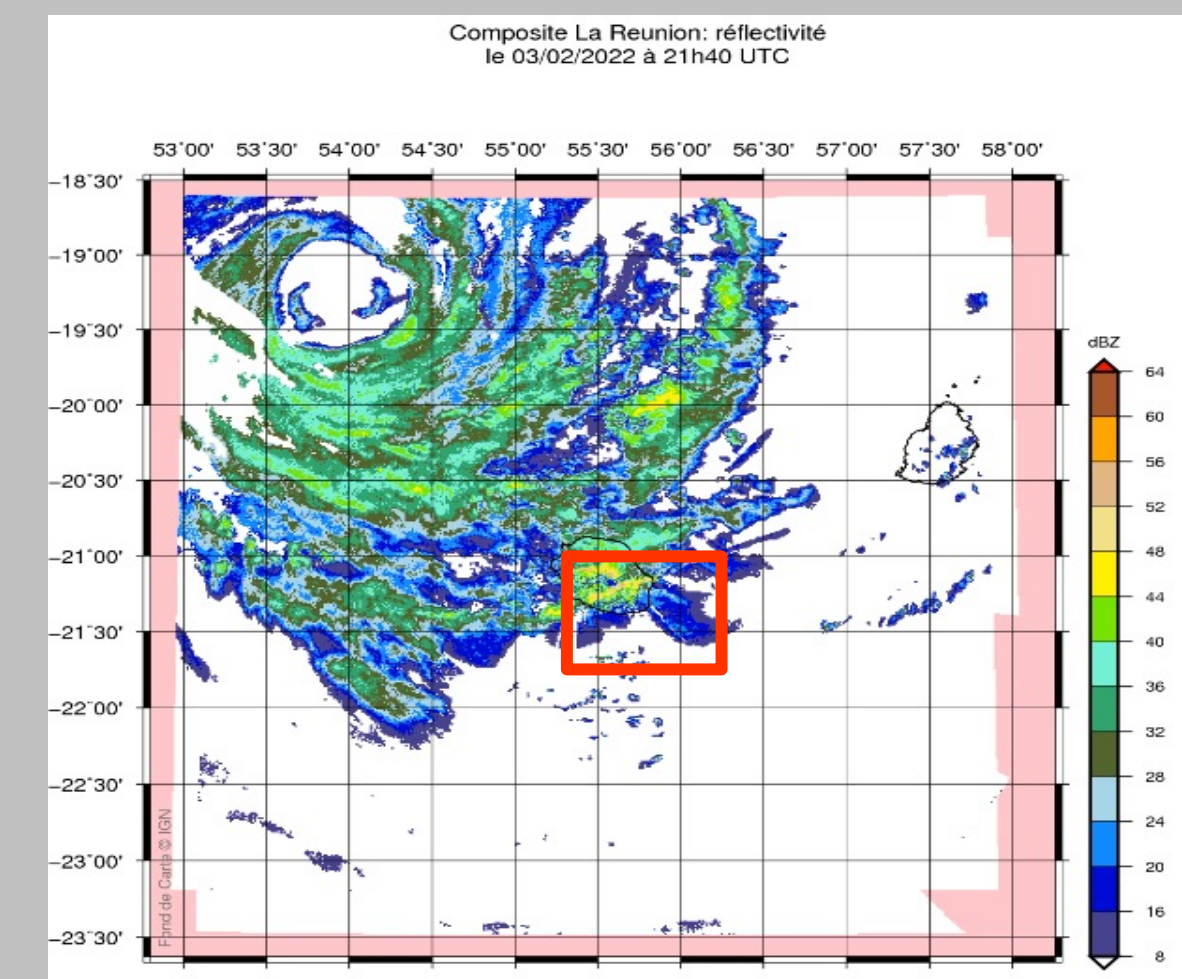


RHI towards the mountain orography showing areas of increased reflectivity as the rain evolves with altitude towards the ridges of salient orographic features. The bright band appears disrupted above the higher orography.

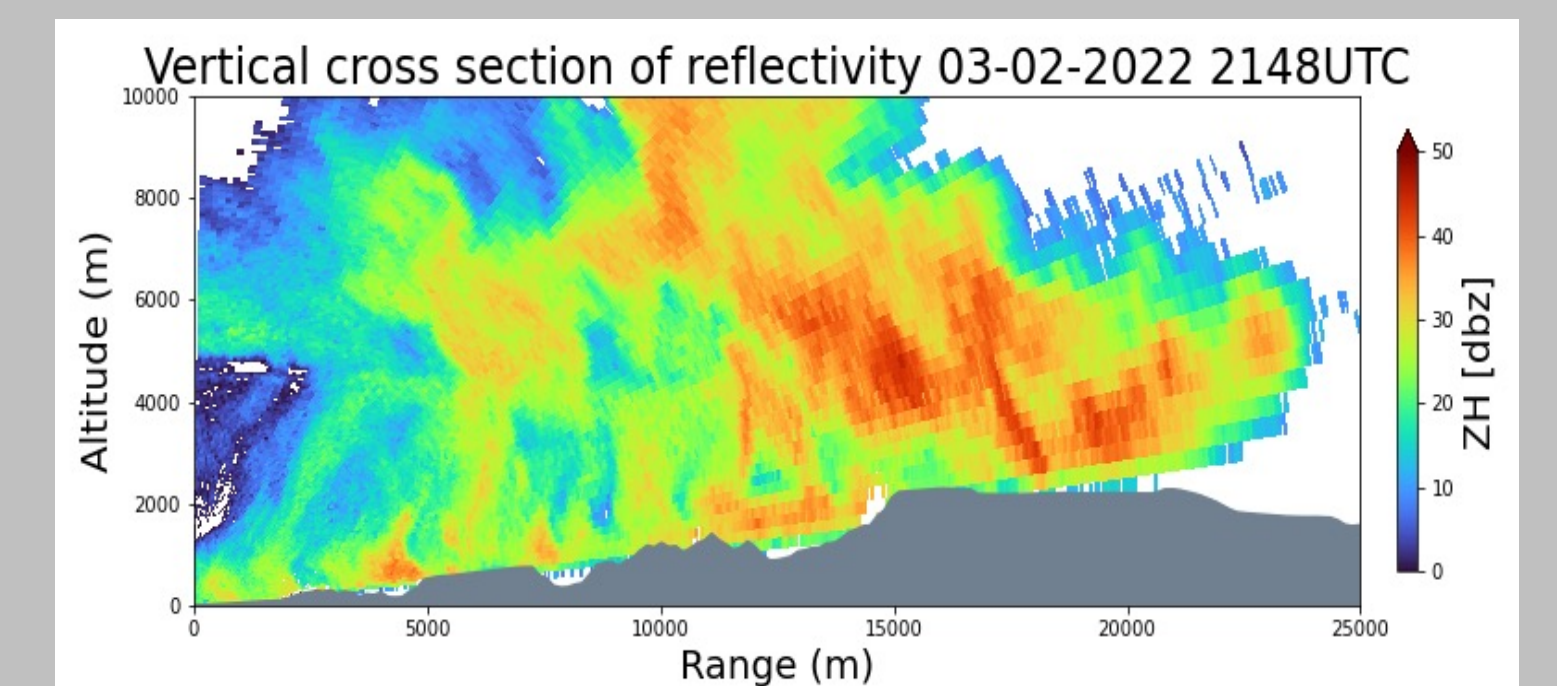
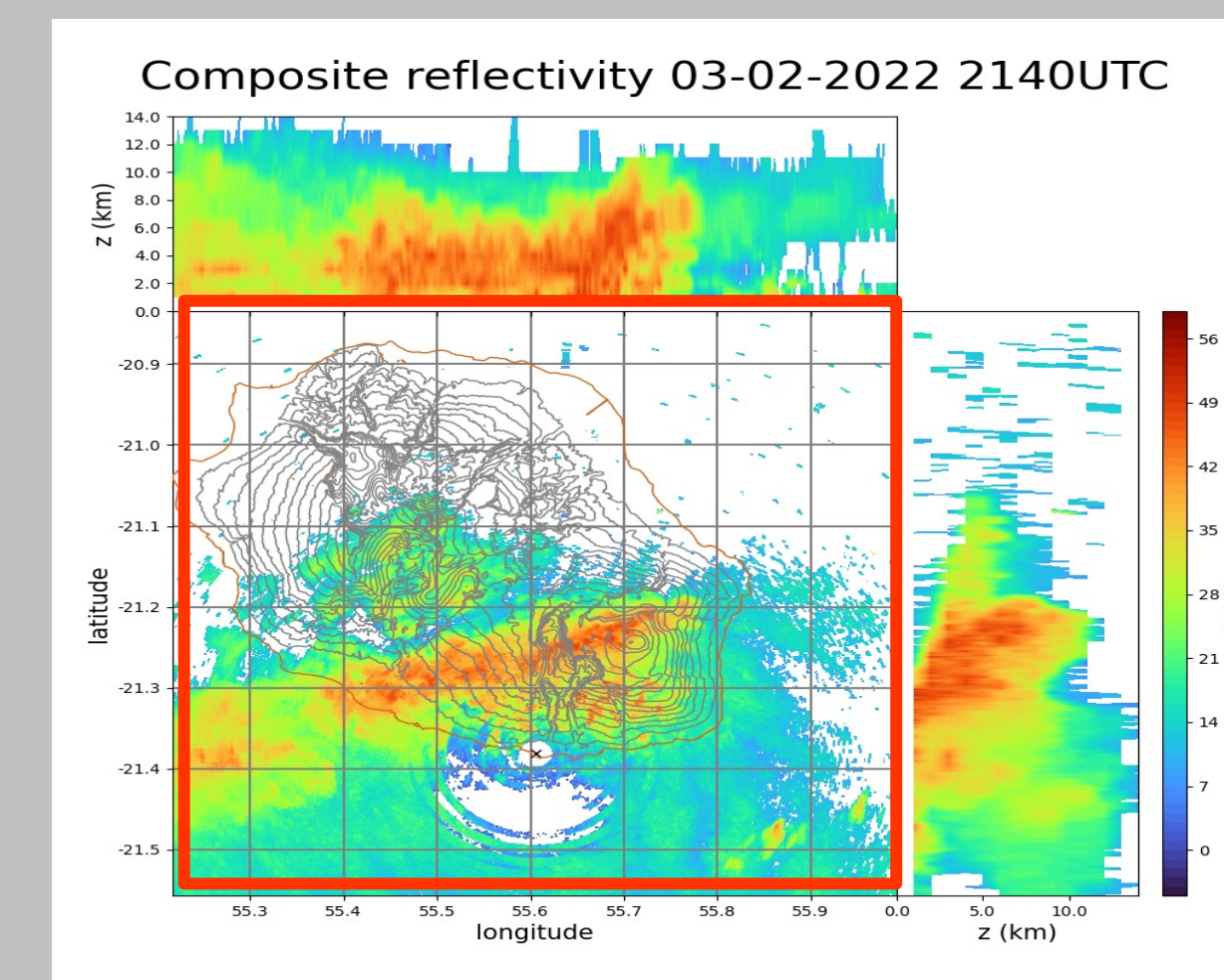
Evening: convective rain



The cyclone moves southwesterly, these two figures are spaced 40 minutes apart, indicating the arrival of convective cells, we note the intensification of reflectivity in contact with the relief.

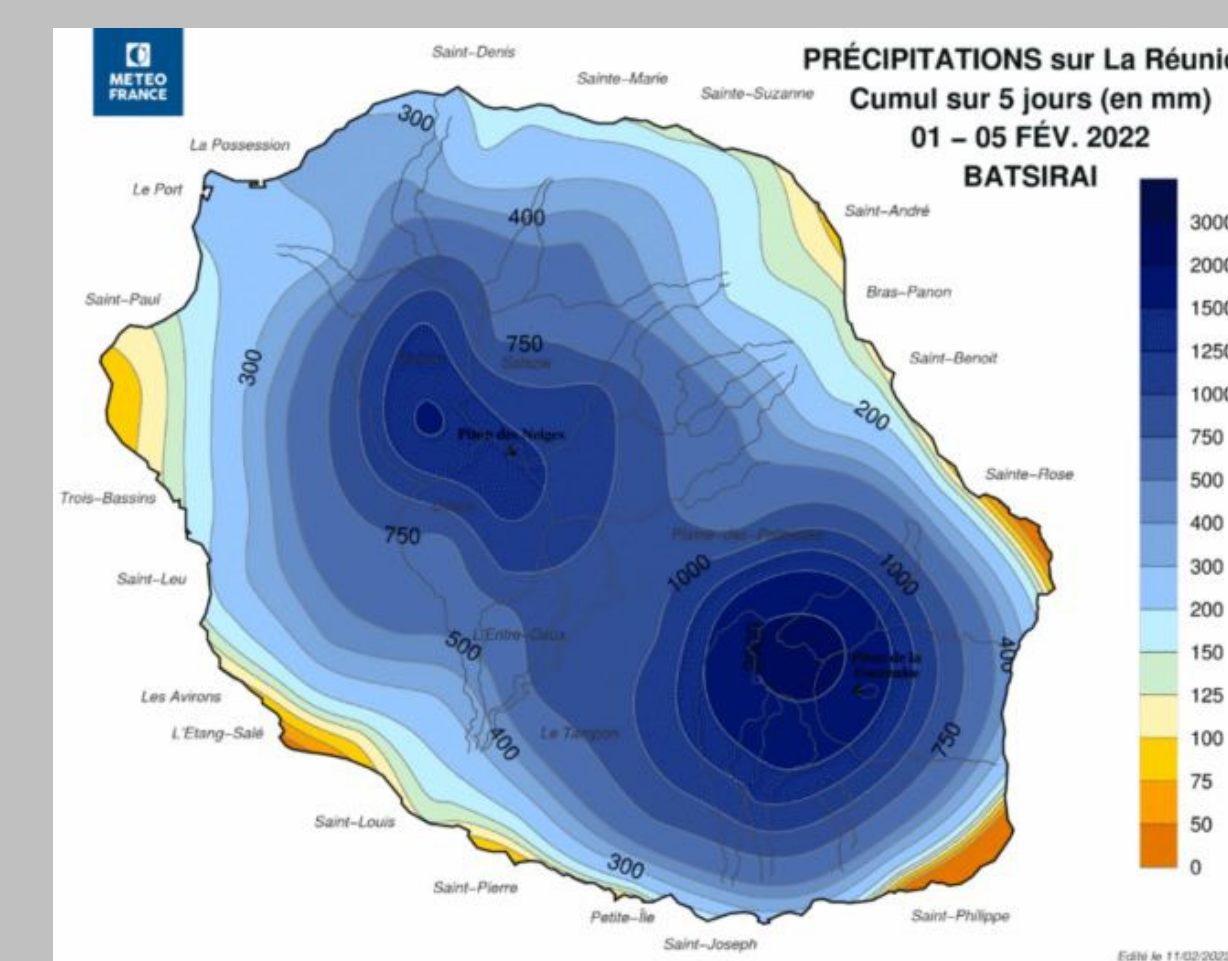


VAD measured with X-band radar



In these figures, high reflectivity level (>40 dbz) reach up to 12 km as shown on the maxdisplay figure top left. Such occurrences are often associated with the development of cumulonimbus towers extending towards the tropopause when the precipitating system interacts with the mountain slopes, bringing intense precipitation to the top of the mountain as shown by the RHI plot on the top right figure.

Total accumulated rain for the Batsirai event over La Réunion island (01-05 February 2022) (Météo France / DIROI)



Conclusions

During the passage of the BATSIRAI cyclone close to La Réunion island, the LACy X-band meteorological radar observed different stages of the cyclonic precipitation bands.

In the first stages of the event, mainly stratiform precipitations were noticed, extending up to the bright band level.

Later they developed into convective systems with higher developments also associated with heavier rains especially along the steepest slopes of the island mountains.

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