# QA4EO WP2322

## Extended Ground-Based Remote Sensing of NO2: Continuous Sun and Lunar DOAS Measurements with New Correction Methods

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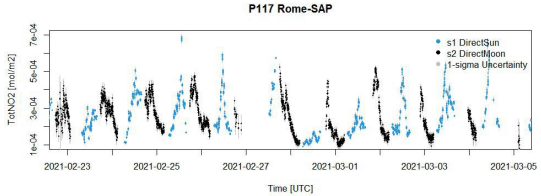
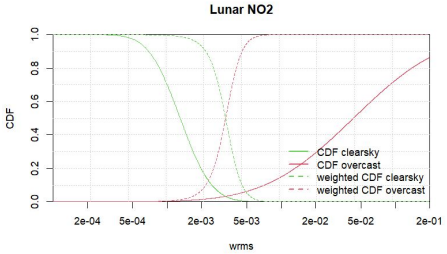
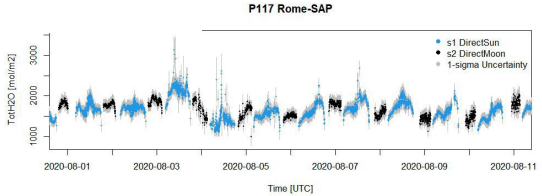
# What was done in the previous WP phases …

- ➔ **Retrieval** settings defined (and refined) for **lunar $NO_2$, $O_3$, $H_2O$** and **$NO_3$**
- ➔ **Quality limits** defined
- ➔ Impact of **reference selection** and **lunar albedo model**



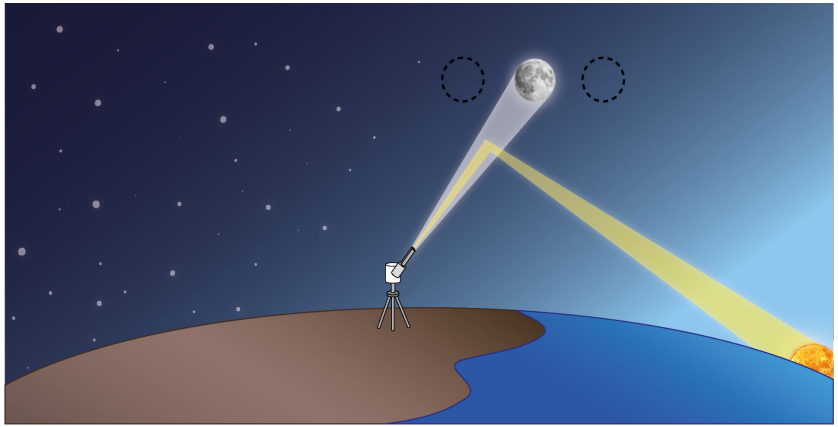

# What was the focus in this phase …

**Improve** the **data quality** during the **transition period** between lunar and solar measurements. That is improving …

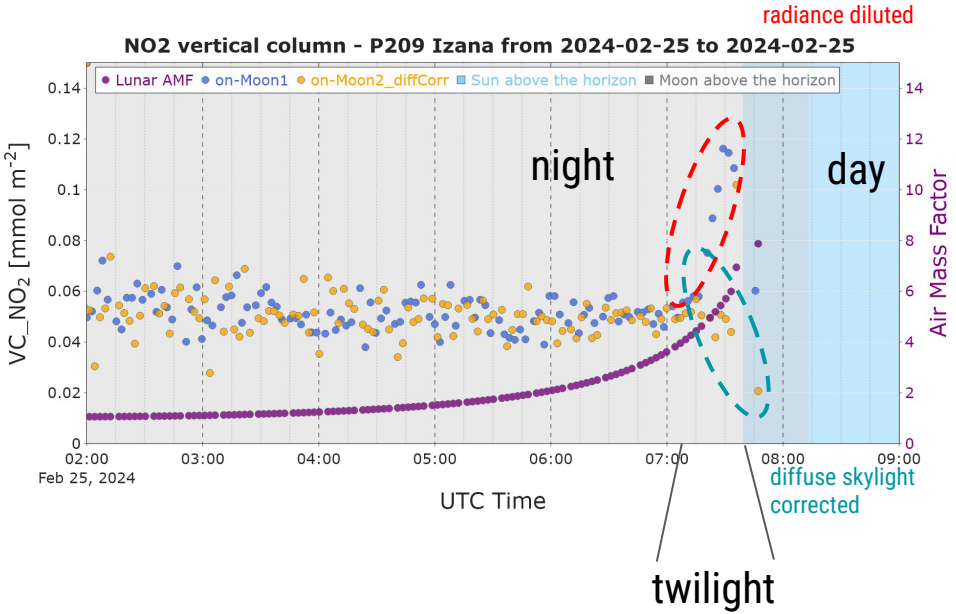
- ➔ **… lunar** measurements during **twilight**
- ➔ **… solar** measurements at very **high AMFs**

# **Lunar** measurements during **twilight**

- Measurements near the **horizon** or during **twilight** suffer from enhanced **scattered light** with **high AMFs**, causing systematic biases in retrieved NO2 columns.



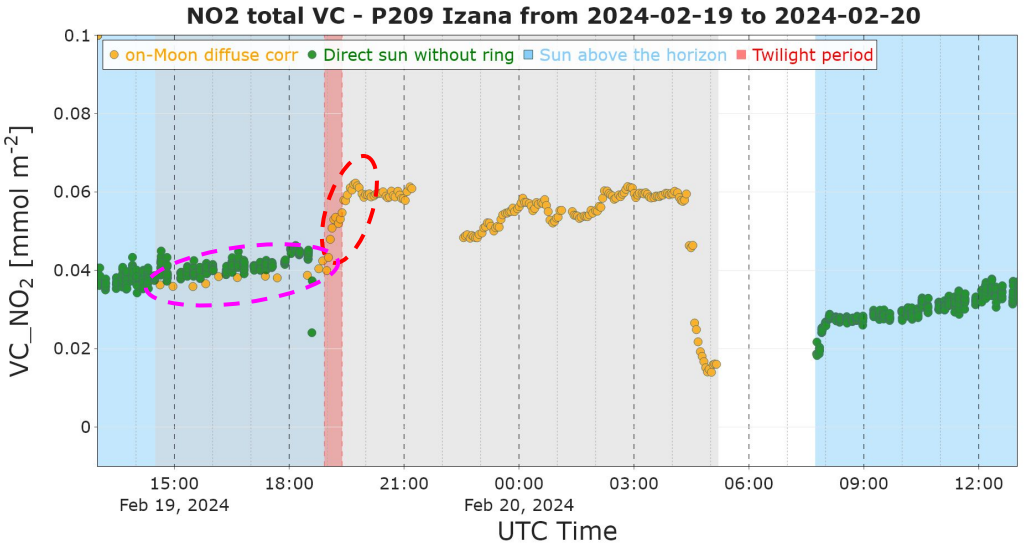
Scattered solar light is removed by subtracting **off-moon measurements**




We **improved** the schedule in terms of **timing**

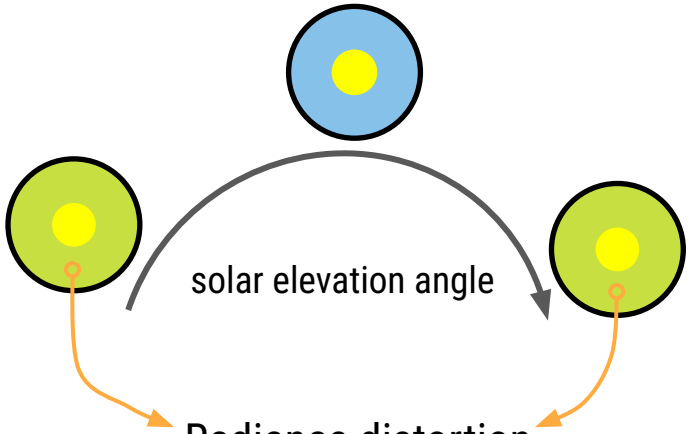
# **Lunar** measurements during **twilight**

- Schedule **improvement** of on-/off moon measurements **expands lunar measurements** into whole twilight
- New lunar routine enables to measure NO2 during day, as soon as **moon rises** above horizon
- Shows a **good alignment** with direct sun measurements

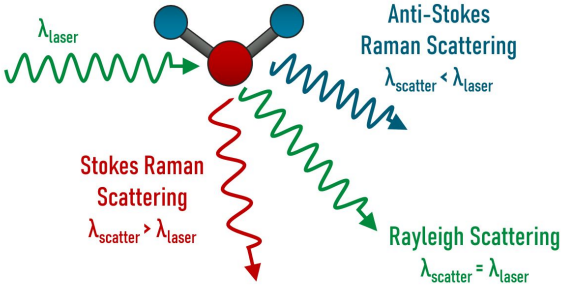


# **Solar** measurements at very **high AMFs**

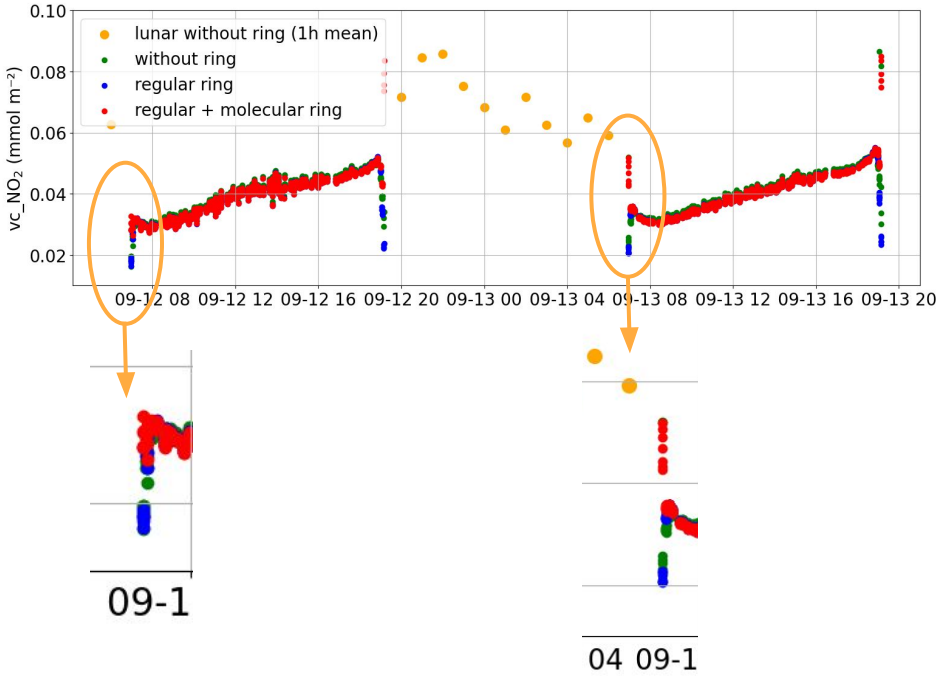
instrument FOV




Radiance distortion part is inelastically scattered




Total columns **NO2** at Izana

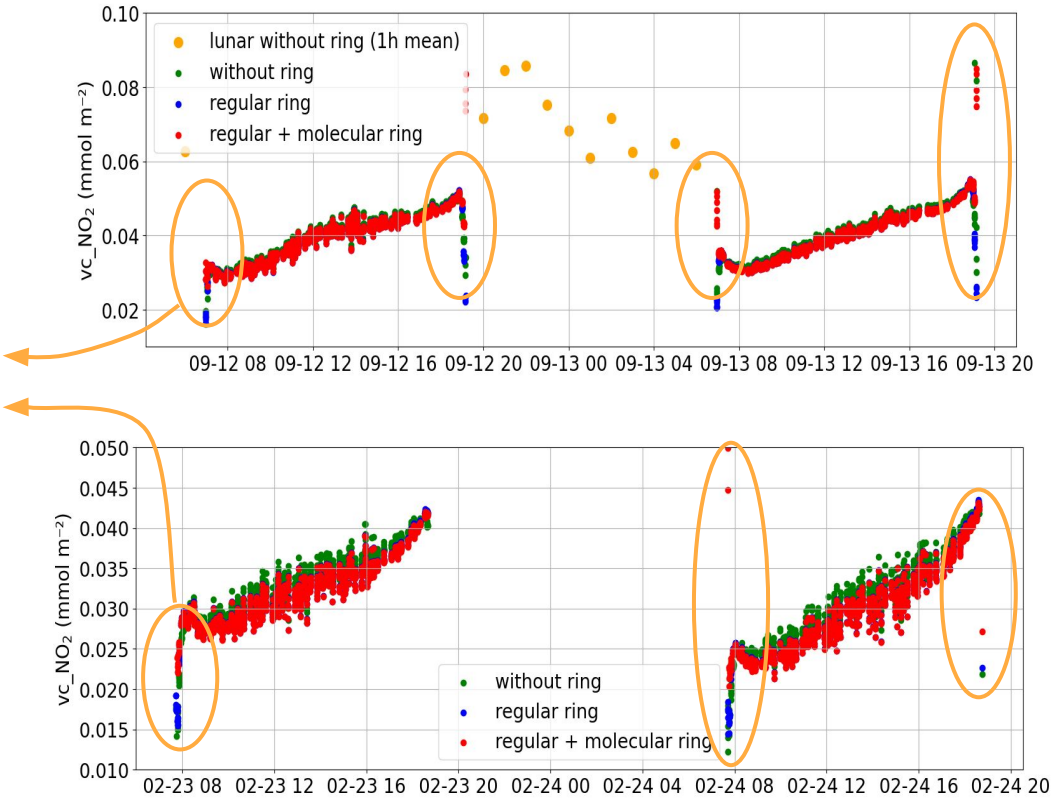



➔ unphysical biases removed if "molecular Ring effect" is considered!

# **Solar** measurements at very **high AMFs**

- **molecular Ring correction upwardly corrects** the vertical NO2 column immediately **after sunrise** and **before sunset**, respectively

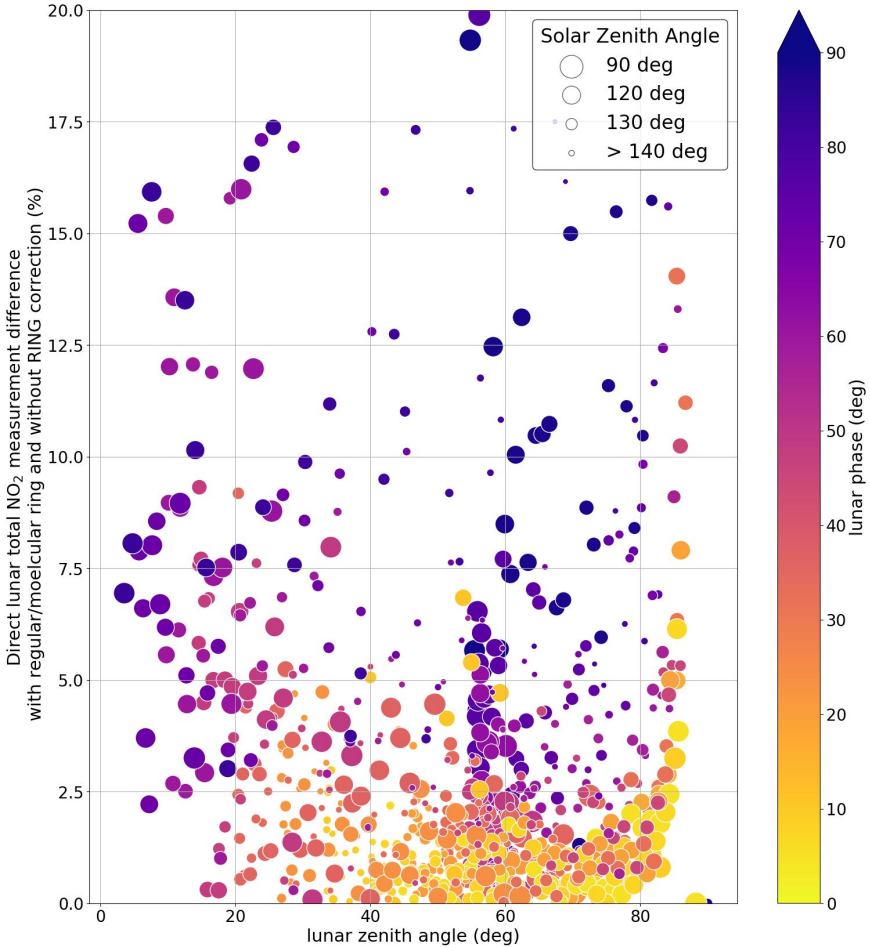
- correction **towards lunar measurements** into "right" direction



# **Lunar** measurements at very **high AMFs**

- **molecular ring correction** removes **unphysical biases** also for direct **lunar measurements** during **twilight**

- **increases** vertical NO2 columns, especially during **high AMFs** away from full moon



# What future work holds the greatest interest…

- ➔ Special **focus** on **NO3** in view of validation support for ALTIUS mission
  - ◆ No validation source for NO3 available
  - ◆ PGN could fill this gap for the ALTIUS mission

- ➔ Preparation of **official release** of lunar retrievals for **NO2** and **H2O**
  - ◆ No global network available offering continuous time series of NO2 and H2O