RAMI4ATM with Eradiate

ERADIATE Using RAMI4ATM to benchmark and test Eradiate

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Rayference

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RAMI4ATM : objectives for Eradiate

1. Develop new features
- 3D canopies with atmosphere
- Combining aerosols with molecular atmospheres
- BOA measurement setup (BHR/HDRF)
- CKD mode
- Improve the API and end user experience
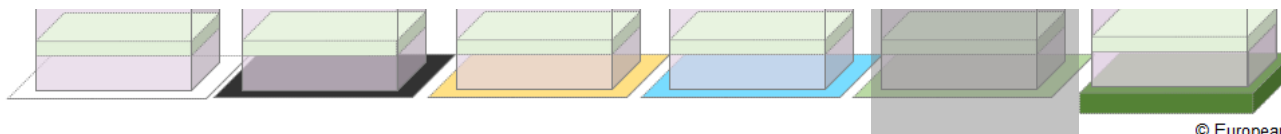
2. Testing Eradiate
- Improve the overall performance (i.e. reduce wall clock compute time)
- Bugfix issues in the modelling
- Improve our set of system tests

Eradiate Submissions

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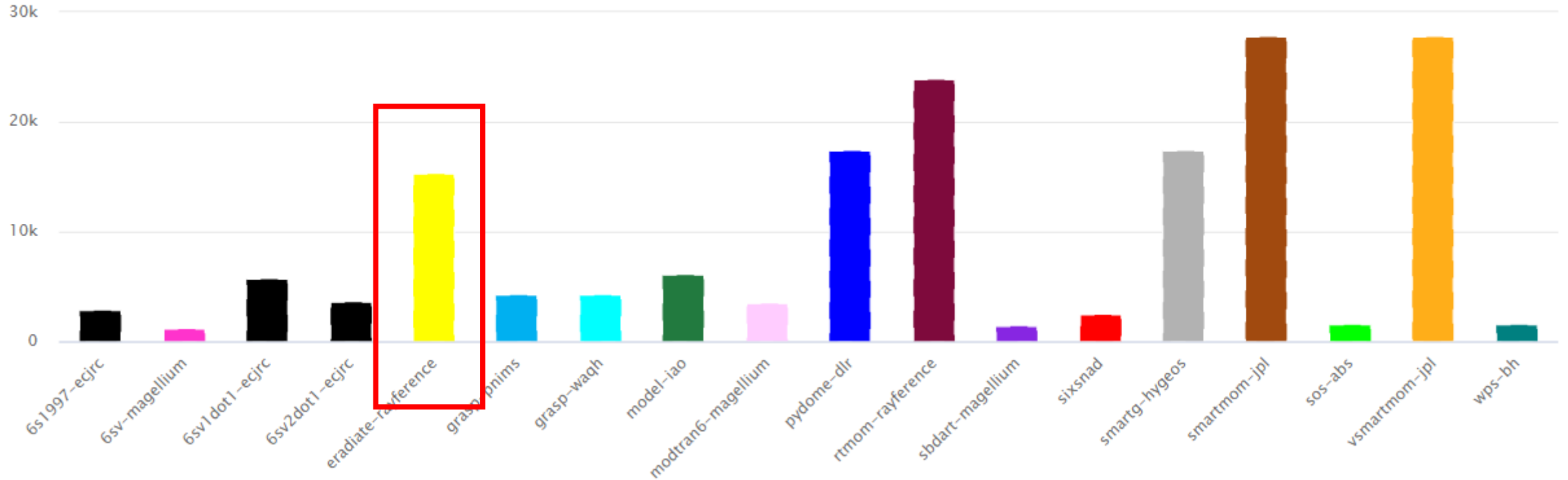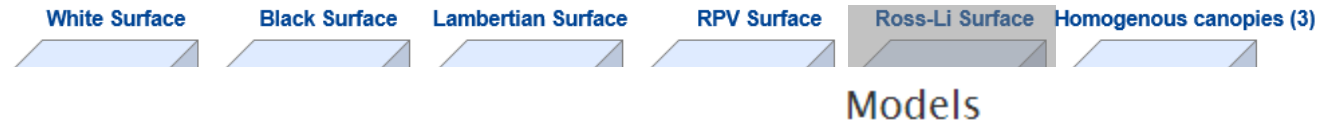
Using RTMOM as an internal reference

- **Eradiate** is a 3D Monte Carlo model for radiative transfer currently developed at Rayference *(presented by the Eradiate team on Wednesday)*
  - One of the few models able to model the atmosphere on top of 3D canopies
  - In active development

- **RTMOM** is a 1D model previously developed by Yves Govaerts, thoroughly tested, used for vicarious calibration
  - Implement the semi discrete canopy model by Gobron et al. (1997)
  - Can fail to accurately model the hot spot of a measurement
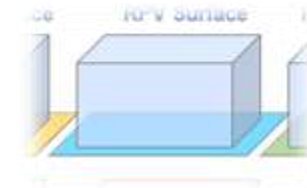 - Used as a **comparison point** during development (with 32 angular quadrature points)

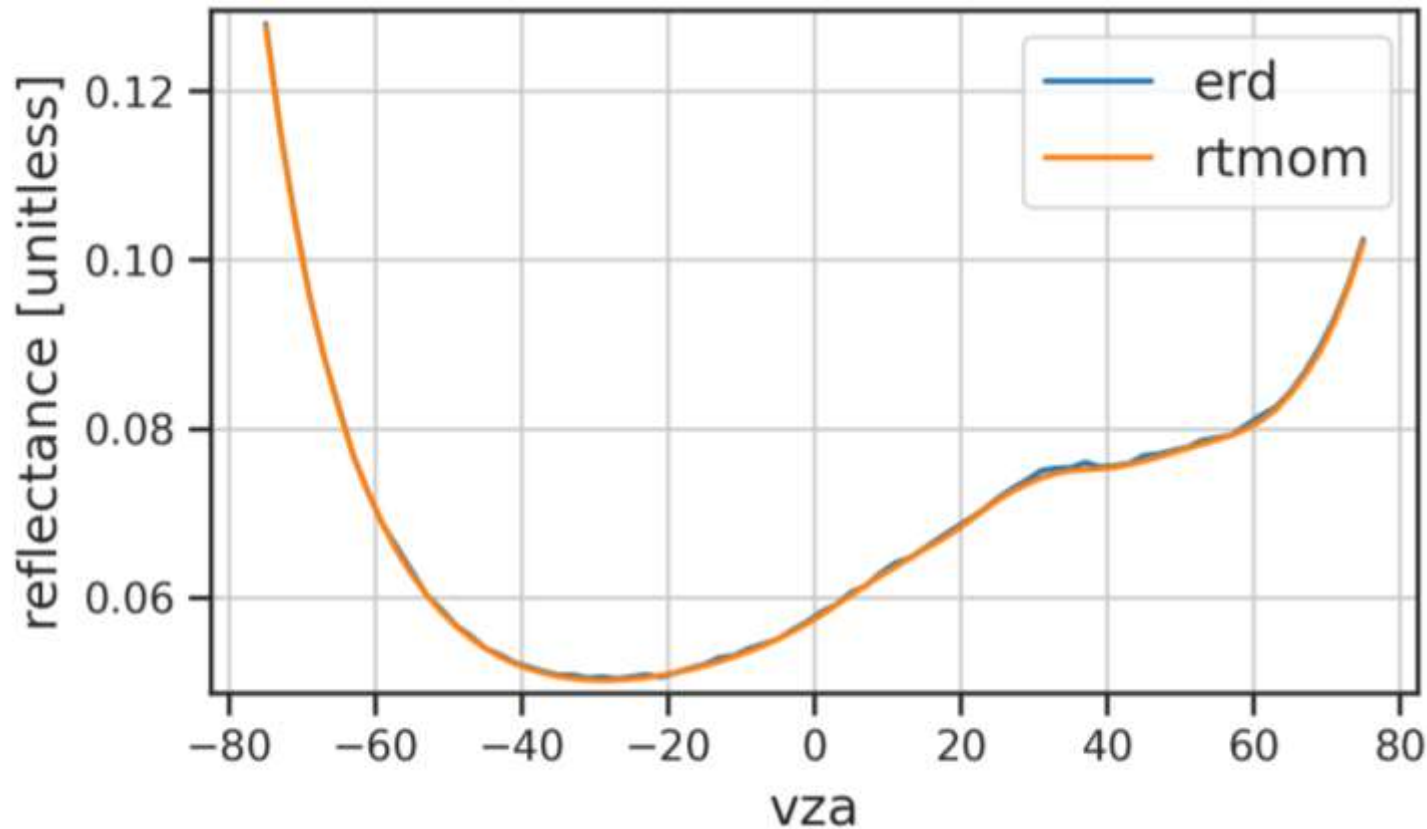**=> We also submitted the RTMOM results**

HOM00_RPV_S00S_M04_z30a000
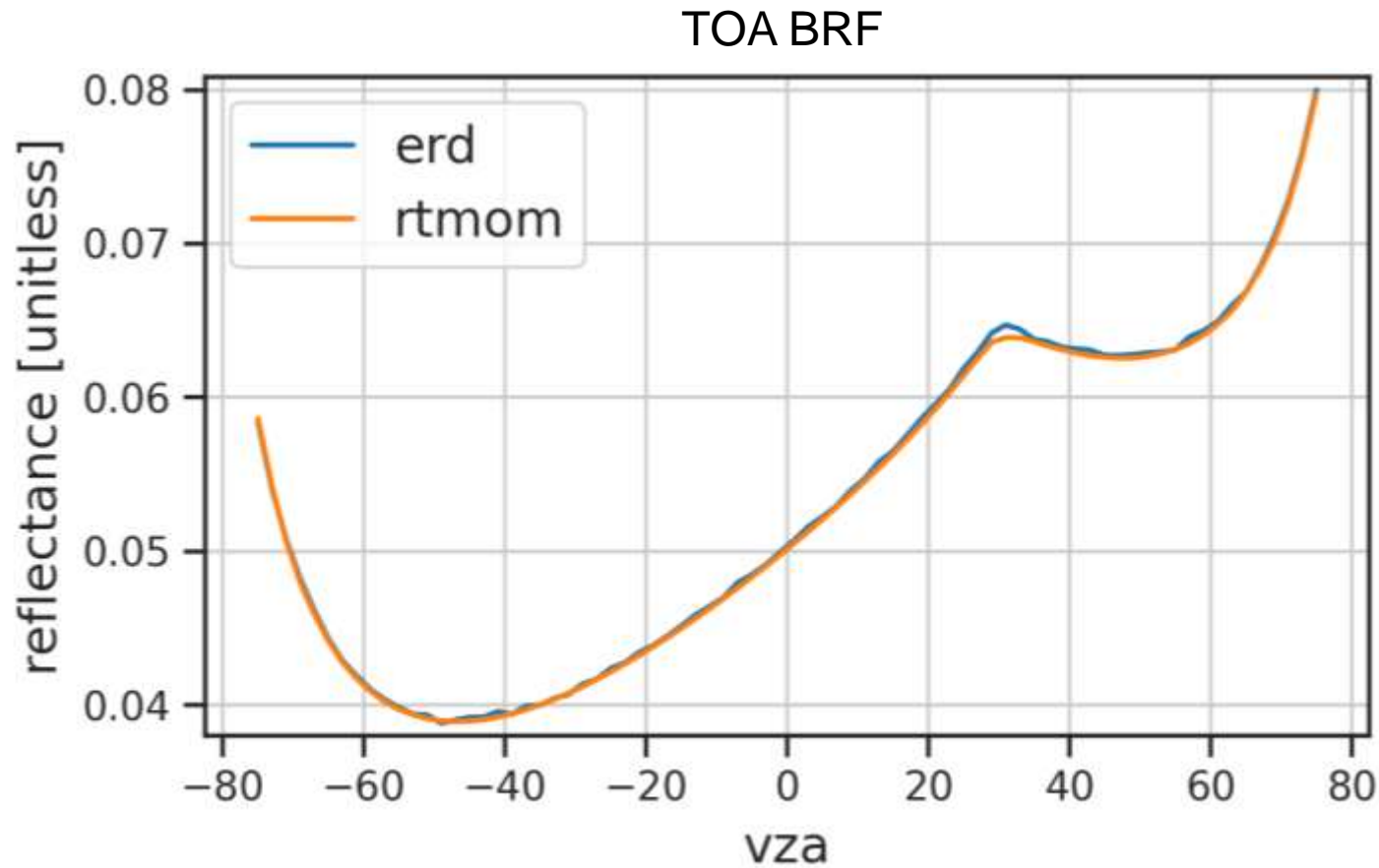
TOA BRF

- No canopy
- SZA=30°
- Scattering only
- MSI band 4 (664nm)
- RPV surface
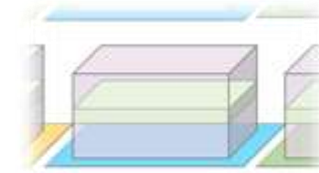
Mean relative bias TOA BRF = 0.35%

TOA BRF

- No canopy
- SZA=30°
- Complete atmosphere
- Desert aerosol with AOD=0.2
- MSI band 4 (664nm)
- RPV surface

Mean relative bias TOA BRF = 0.36%

3D Canopies with an atmosphere

3D render of a homogeneous canopy with a SZA at 0° using Eradiate
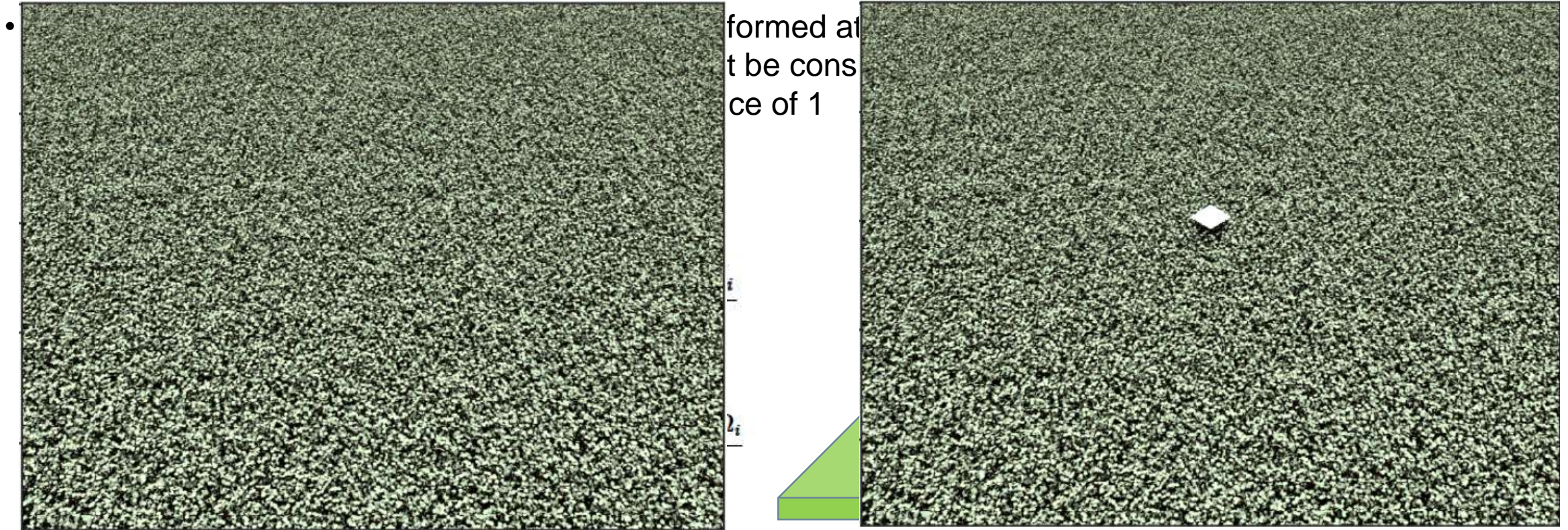
3D Canopies with an atmosphere

3D render of a homogeneous canopy with a grazing SZA using Eradiate

BOA measurements: Experimental setup
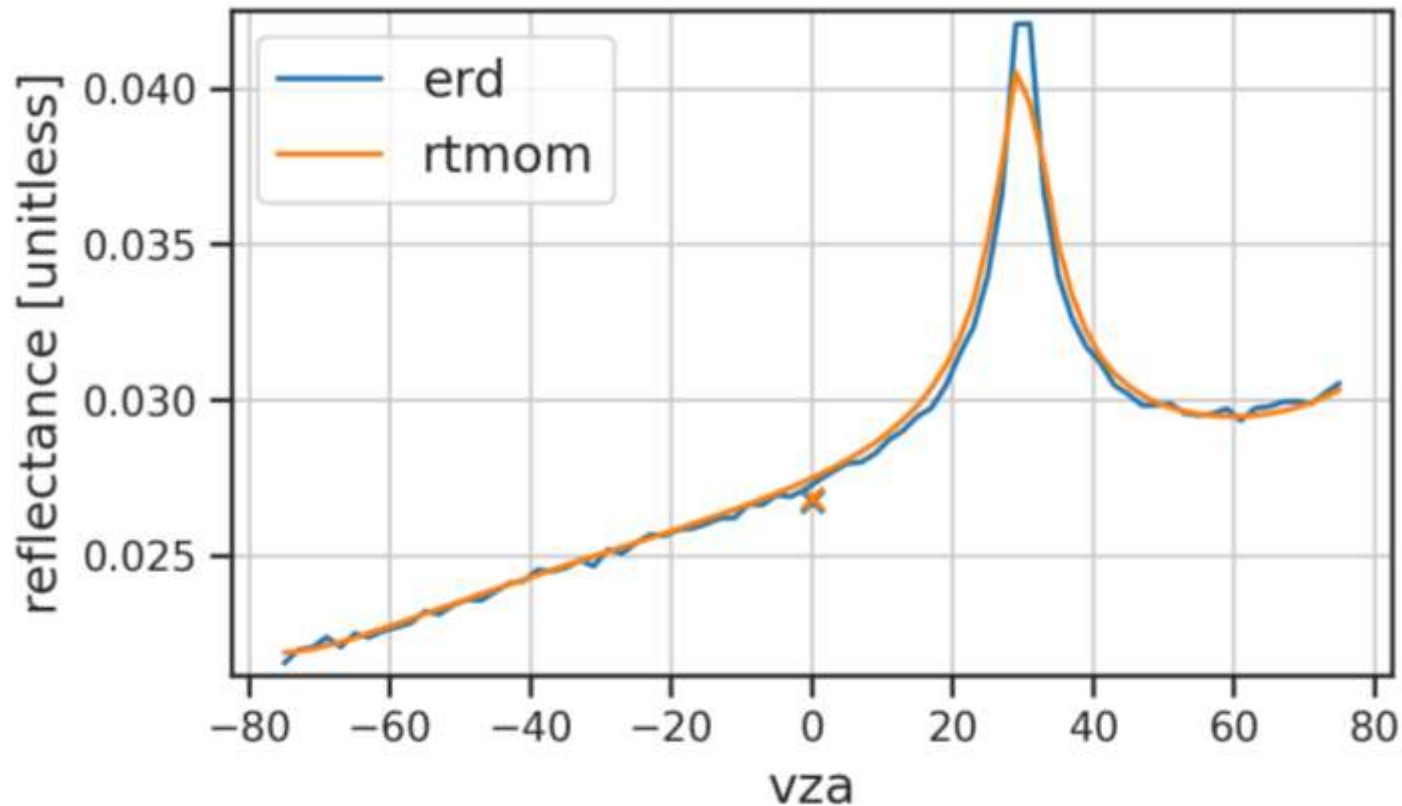
- HDRF and BHR measurements in Eradiate require a specific setup, since the model can not measure the ingoing and outgoing fluxes due the nature of the illumination and the path tracer.
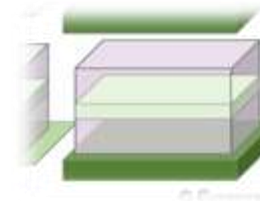
BOA HDRF and BHR
TOA BRF

- Planophile canopy
- SZA=30°
- Complete atmosphere
- MSI band 4 (664nm)
- RPV surface
- Desert aerosol with AOD=0.2

Bias TOA BRF = 2.35%
Bias HDRF = -0.40%
Bias BHR = -0.38%

RAMI4ATM with Eradiate: takeaways

- Participating to RAMI4ATM helped us:
  - Decrease the computation time
  - Identify specific bugs thanks to the progressive complexity of the scenarios
  - Develop and test new features (aerosols combined with molecular atmosphere, CKD mode)
  - Experiment with a new protocol (BOA reflectance measurements)

- The next step for the Eradiate team is the integrations of more RAMI(4ATM) cases in our system tests

Feedbacks as RAMI4ATM users [1/2]

- Reprioritize or reduce the number of cases with simple analytical solutions?
  - BOA measurements on black and white surfaces are always all zeros and all ones respectively

- Continue to improve the submission process
  - Max file size is 2MB, increasing this would be convenient
  - Provide an API to programmatically upload submission files could also help

- How robust to noise are the RAMI4ATM result metrics?
  - The nature of Eradiate as a MC model results in some noise that is visible in the measurement results.
  - Always centered around the target value
  - Simply increasing the sampling will reduce the noise
  - Yet the current criteria to flag outliers in the RAMI4ATM preliminary result pages would often mark Eradiate as such

Feedbacks as RAMI4ATM users [2/2]

- Lower the homogeneous canopies leaf area index to be more sensitive to diffuse illumination?
  - RAMI4ATM LAI is fixed to a rather high value of 3,0
  - The underneath surface of the canopy has little effect on the output reflectance in many cases

- Scenario complexity increased from previous phases to RAMI4ATM
  - It may be a good opportunity to explore new ways to display the scenario and result data on the website
  - Latest changes on the result pages look promising

Questions?

Thanks to the JRC for the RAMI initiative