

Pointing errors in sky radiance measurements from sunphotometers. Influence on inversion-retrieved aerosol properties.

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September 14, 2011

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 - Working scheme with Dubovik's code
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1.- Introduction

Current situation

...with principal plane and almucantar retrievals

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- ① There are disagreements between both inversions.

Current situation

...with principal plane and almucantar retrievals

- 1 There are disagreements between both inversions.
- 2 Only almucantar retrievals are shown in Aeronet website

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- ① They keep constant the air mass during the measurement
- ② They present symmetry between right-left branches.
 - It allows a cloud screening
 - It offers the possibility of doing the average between them: **More reliable**

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- ① They contain less information than PPL regarding scattering angles.

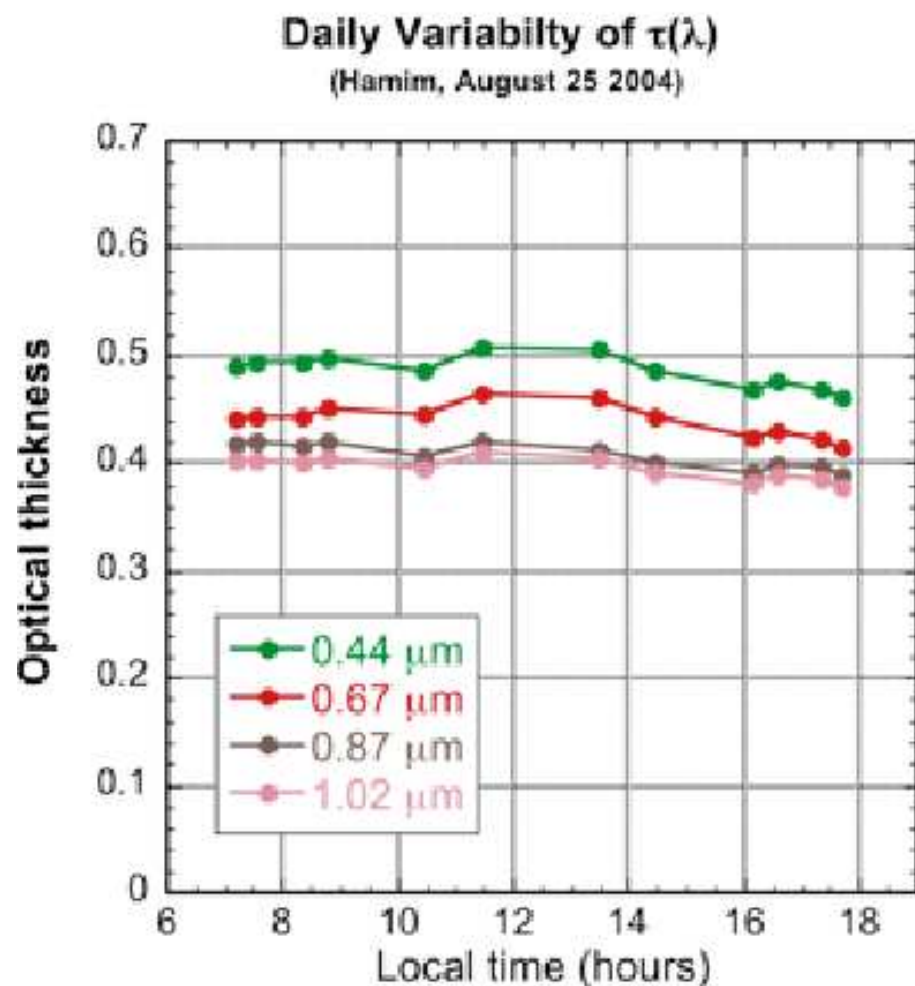
However, ...

...they present the following disadvantages:

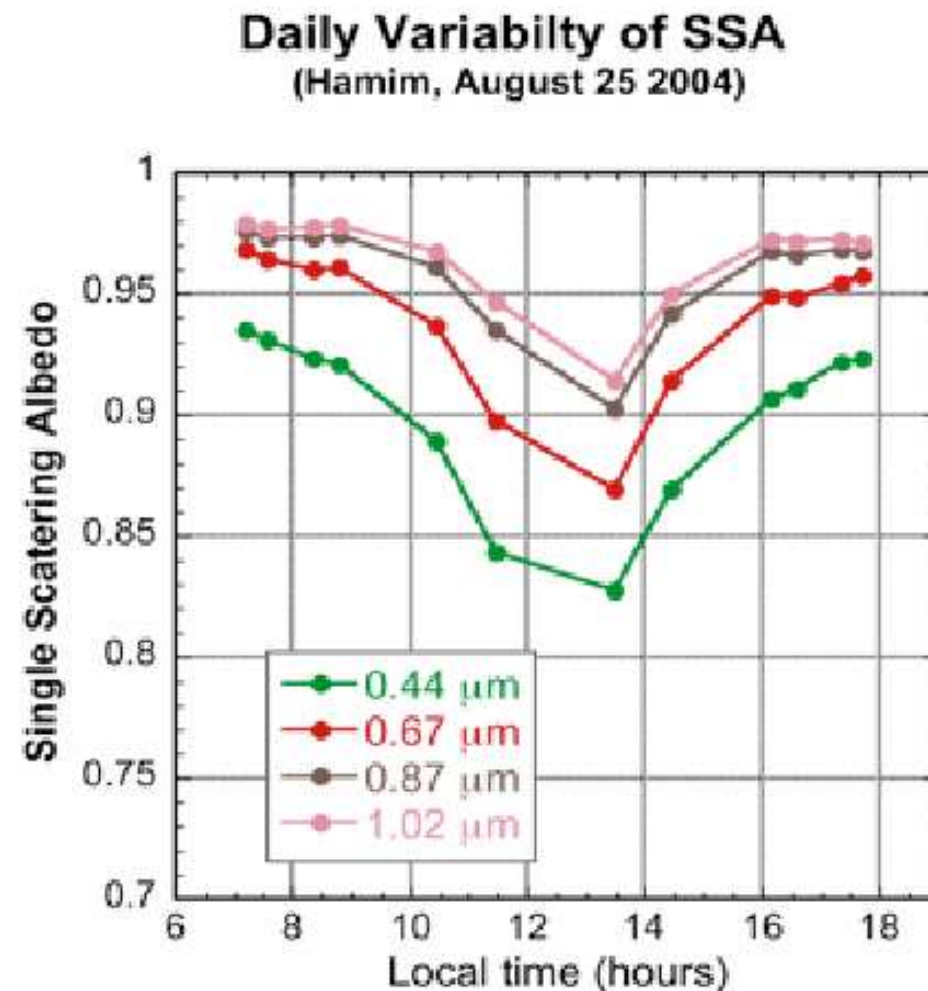
- 1 They contain **less information** than PPL regarding scattering angles.
- 2 This is **noticeable for $SZA < 50^\circ$** and specially **critical for $SZA < 20^\circ$**

Photo. #002 - 25th August 2004 at Hamim site

AOD



Single scattering albedo



Aerosol retrievals from AERONET sun/sky-radiometers: Overview of inversion principles, products and advances
Dubovik, O. et al.

The Second International Conference of Aerosol Science and Global Change, Hangzhou, China, August 2009

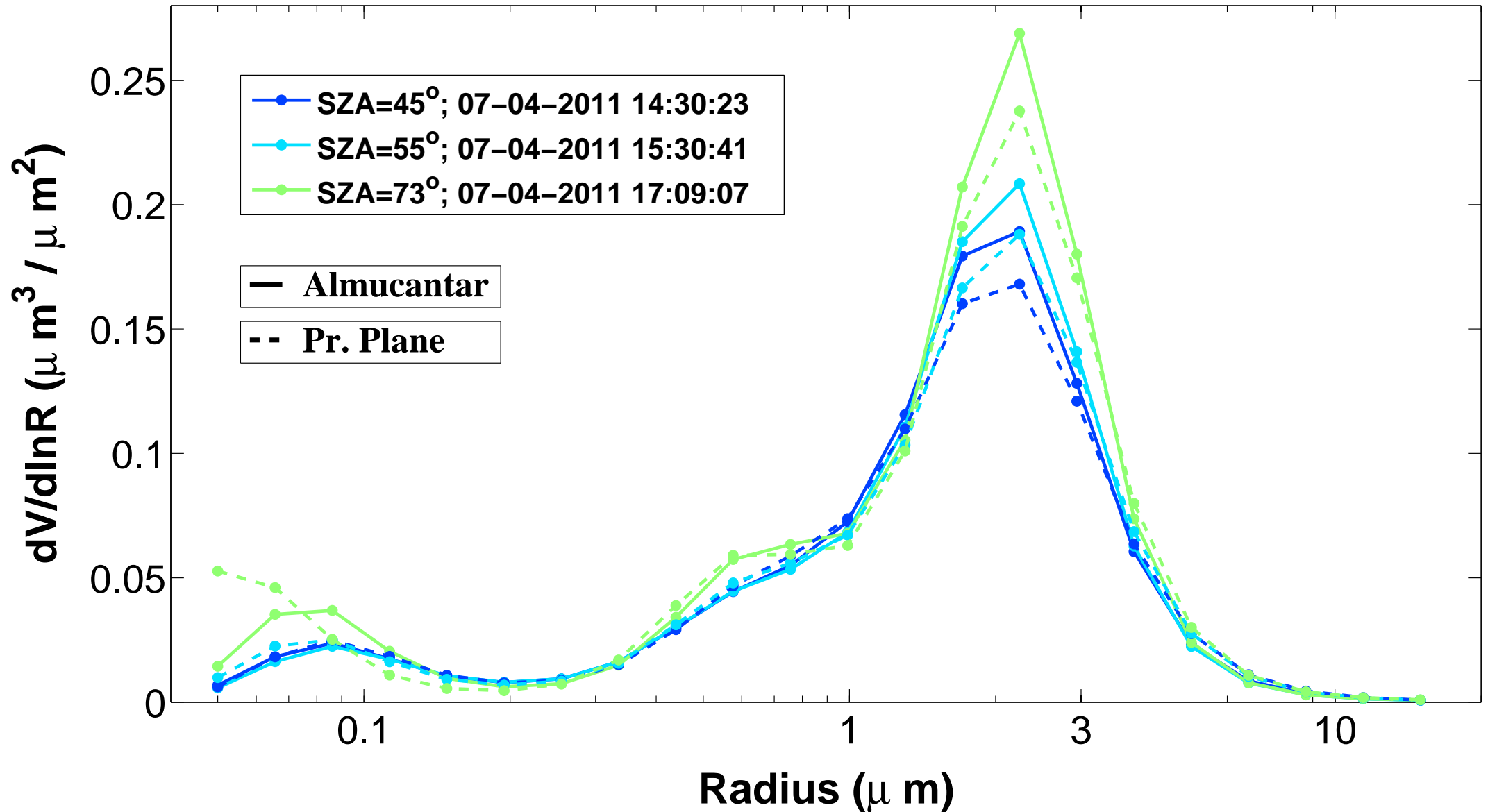
However, ...

...they present the following disadvantages:

- 1 They contain **less information** than PPL regarding scattering angles.
- 2 This is **noticeable for $SZA < 50^\circ$** and specially **critical for $SZA < 20^\circ$**
- 3 Inverted products have large errors at low SZA.

#627 Differences between ALM and PPL results.

Photo. #627 - 7th Abril 2011. Autilla, Spain.- Principal Plane/Almucantar retrievals



Reasons for the disagreement

Causes of the disagreements

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- 1 Model

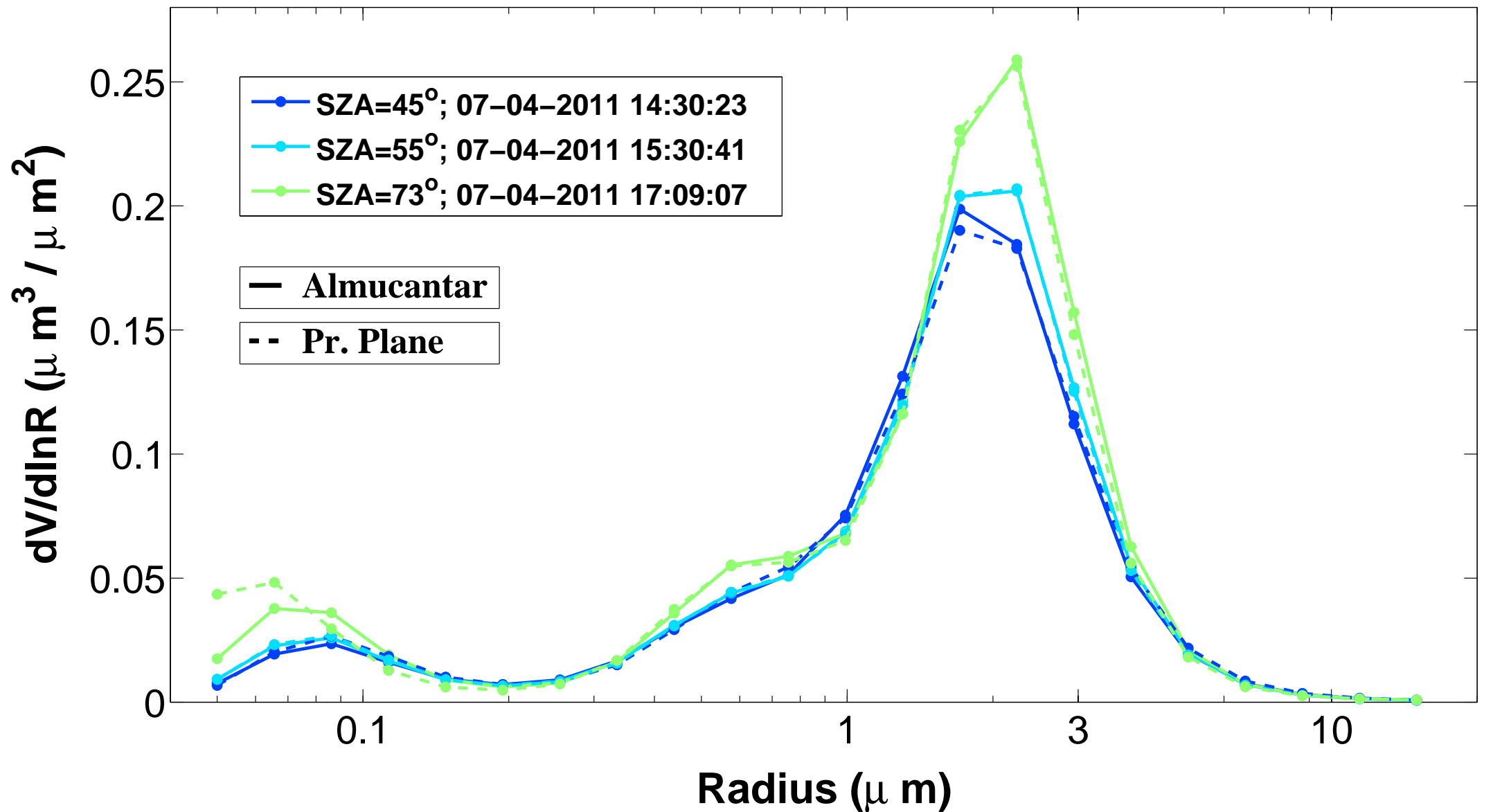
Reasons for the disagreement

Causes of the disagreements

- 1 Model
- 2 Measurements

A new hope: Same station, same day... Photo. #421

Photo. #421 - 7th April 2011. Autilla, Spain (Intercal site).- PPL/ALM retrievals



Reasons for the disagreement

- 1 Model
- 2 Measurements

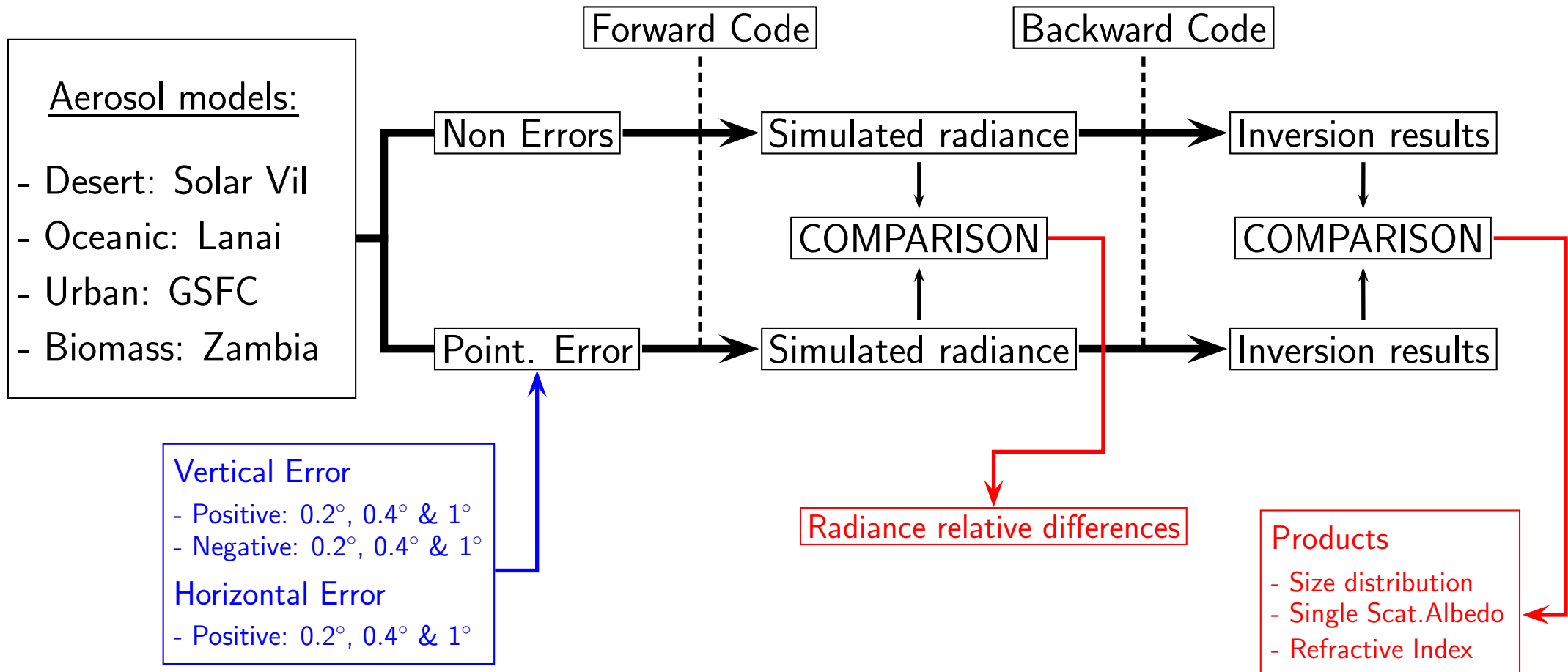
Reasons for the disagreement

- ① Model
- ② Measurements
 - Calibration
 - Temperature
 - Field of View
 - Pointing Errors

2.- Radiance simulation study introducing pointing errors

Working scheme with Dubovik's code

Methodology diagram



Variability of Absorption and Optical Properties of Key Aerosol Types Observed in Worldwide Locations

Dubovik, O. et al. (2002)

Journal of the Atmospheric Sciences, 59, 590-608

Comparison I: Radiance relative differences per degree of incorrect pointing

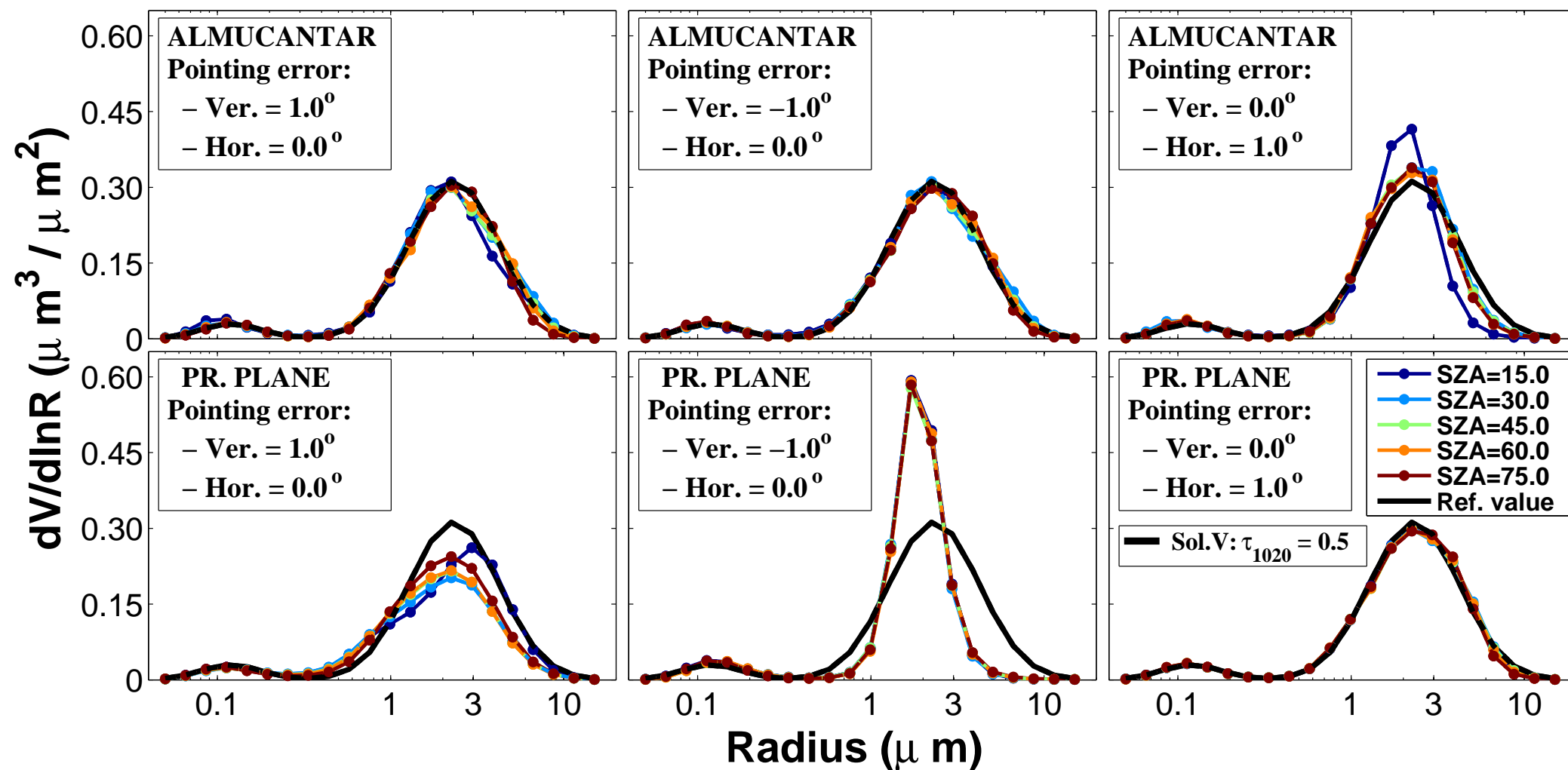
- 1 Almucantar with vertical error
- 2 Principal plane with vertical error
- 3 Almucantar with horizontal error
- 4 Principal plane with horizontal error

Comparison I: Radiance relative differences per degree of incorrect pointing

- 1 Almucantar with vertical error
 - Maximum radiance differences up 7 – 8%
- 2 Principal plane with vertical error
 - Maximum radiance differences up 30 – 40%
- 3 Almucantar with horizontal error
 - Maximum radiance differences up 7 – 9% → Due to the average between right and left
- 4 Principal plane with horizontal error
 - Maximum radiance differences under 2%

Pointing error simulation II: Impact on products of Dubovik inversion.

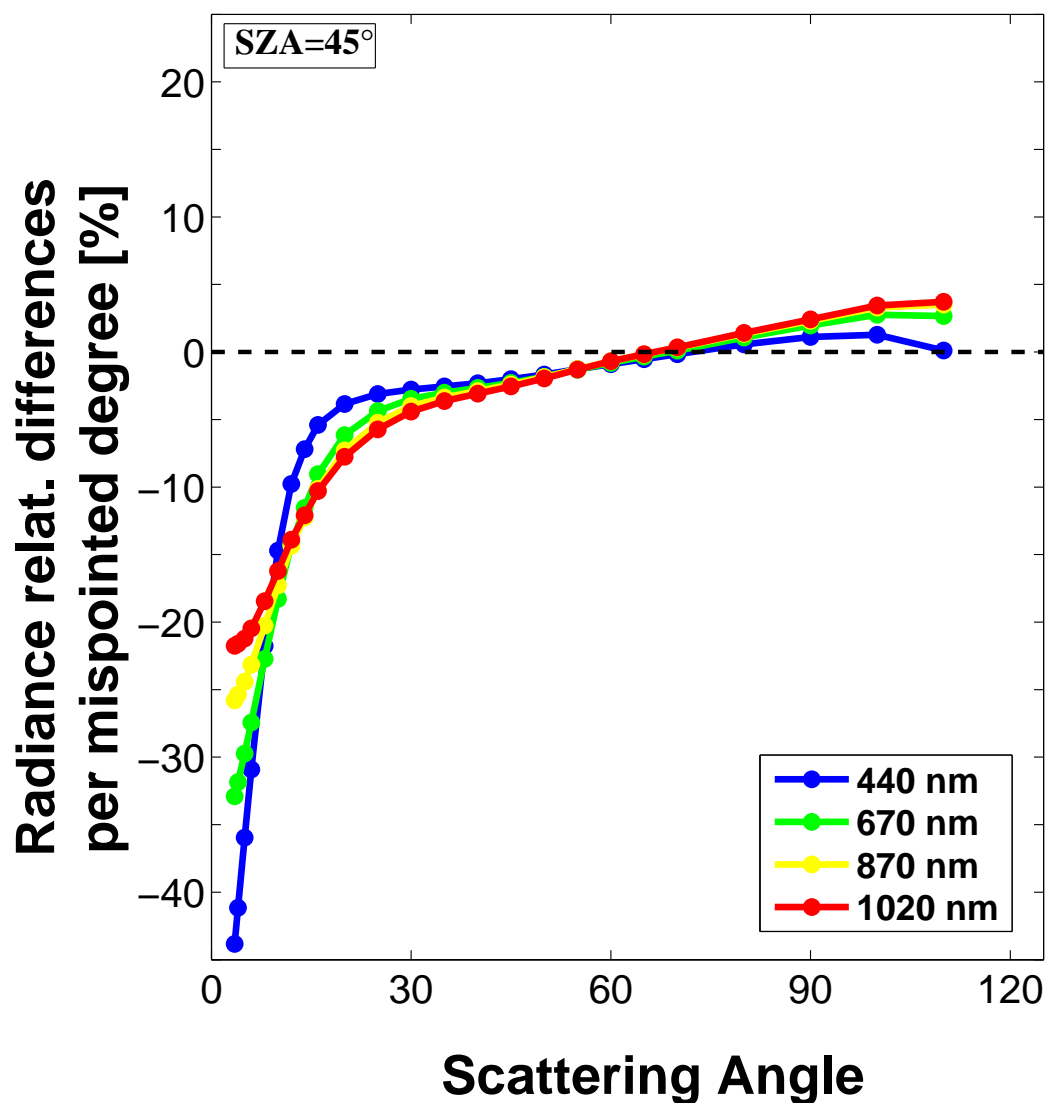
Example: Desert Dust (Solar Vil)



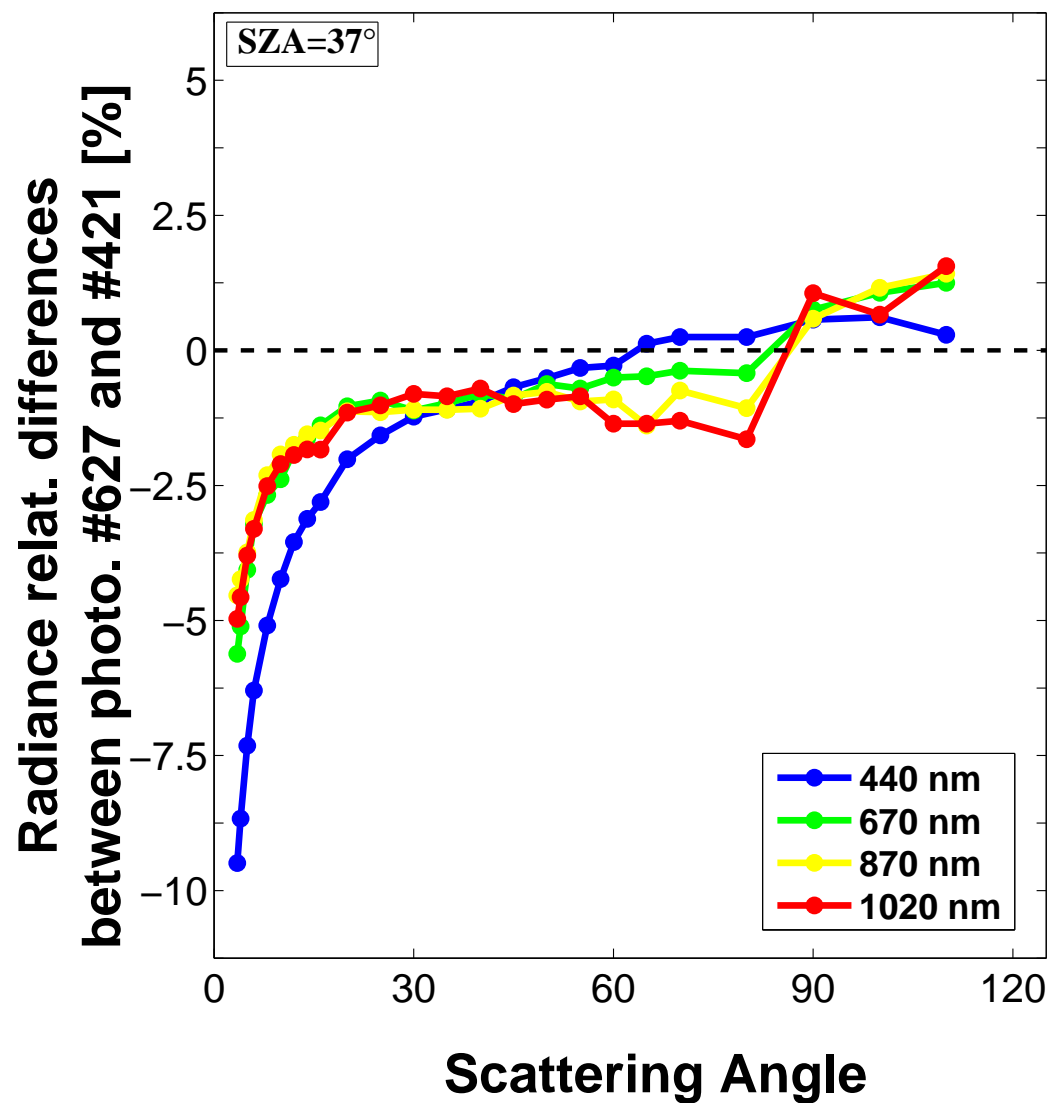
3.- Pointing error correction on principal plane real measurements

Differences

Radiance relative differences per ONE DEGREE of incorrect pointing (desert dust case)

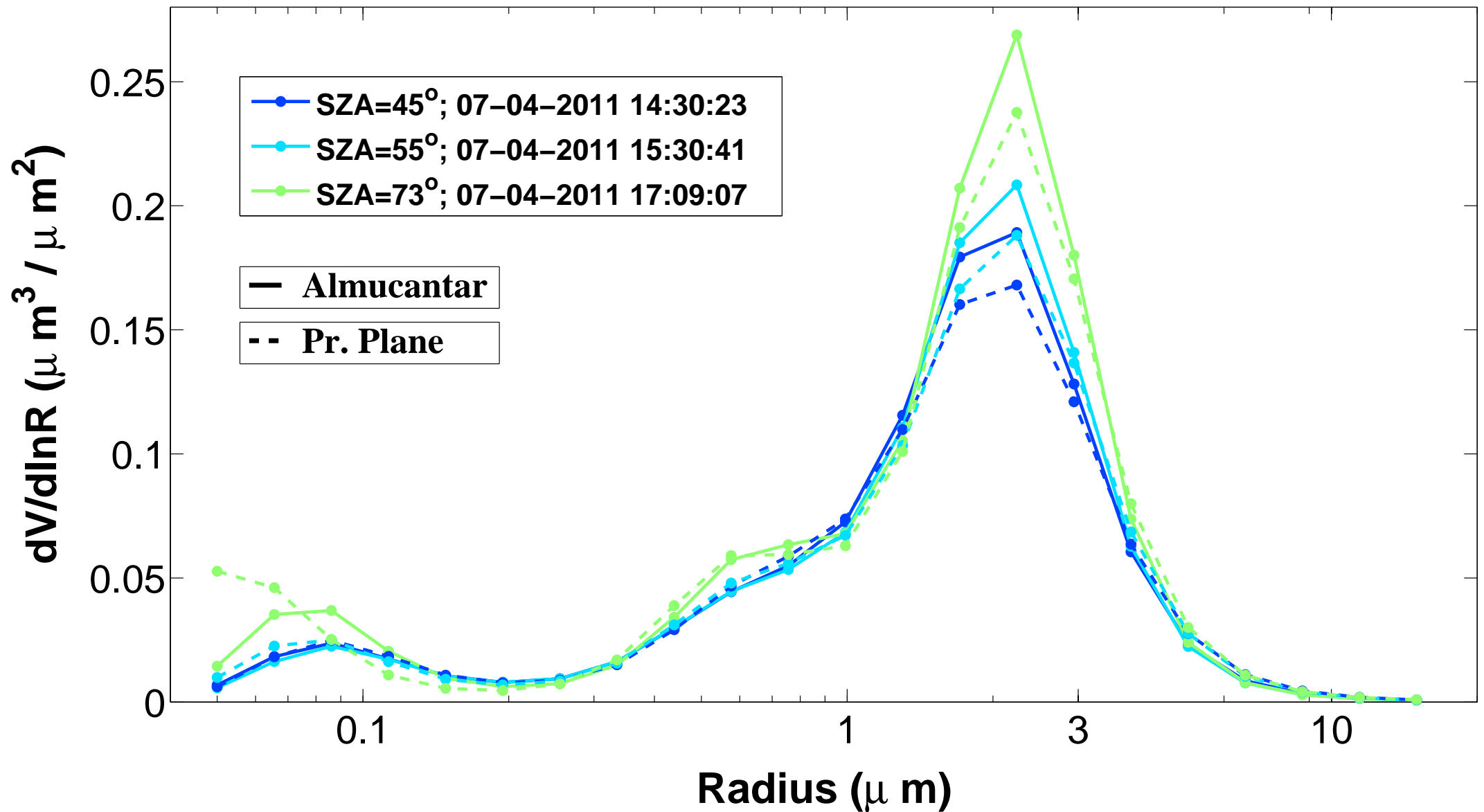


Radiance relative differences between photo. #627 and #421



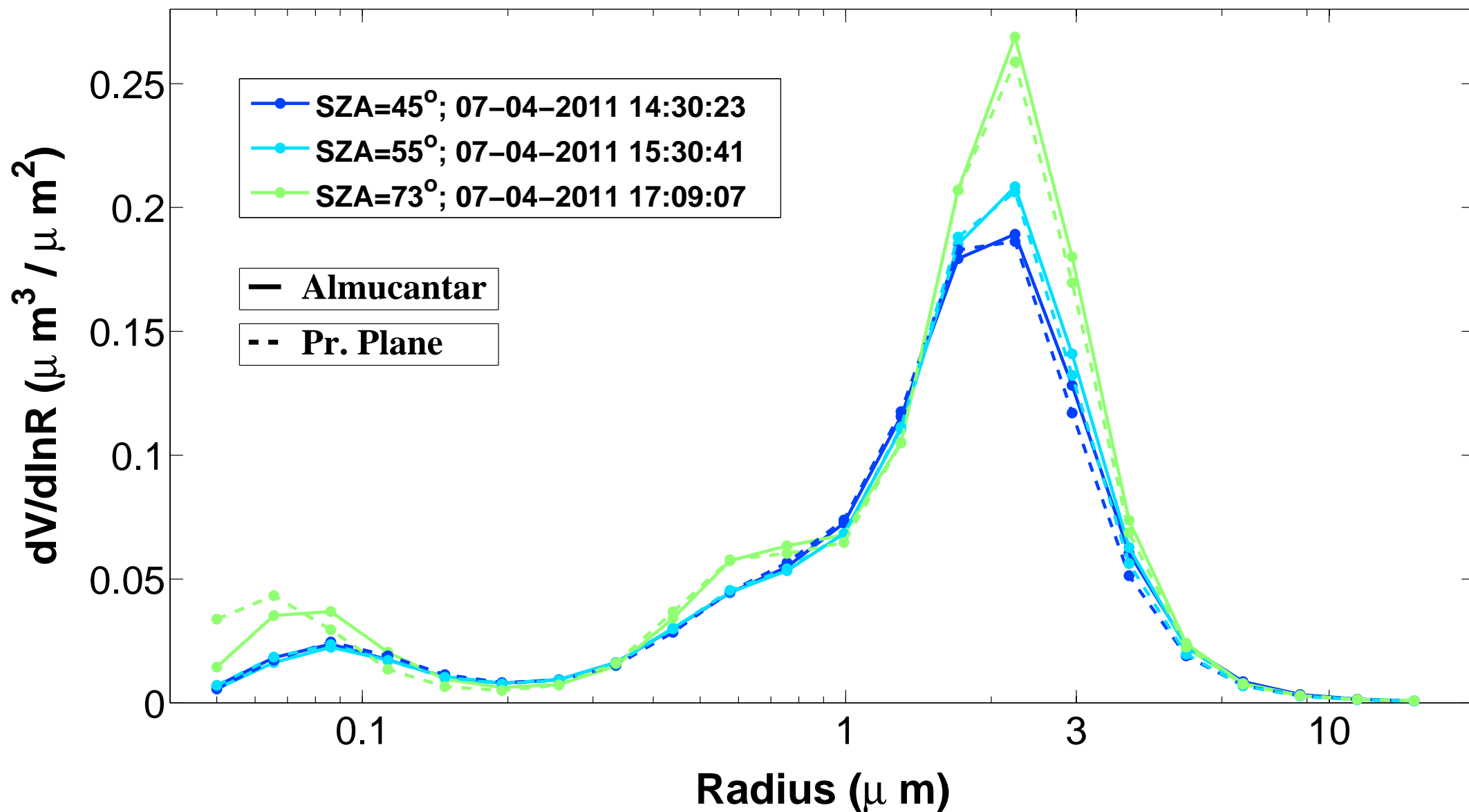
Correction over #627

Photo. #627 - 7 Abril 2011.- UNCORRECTED



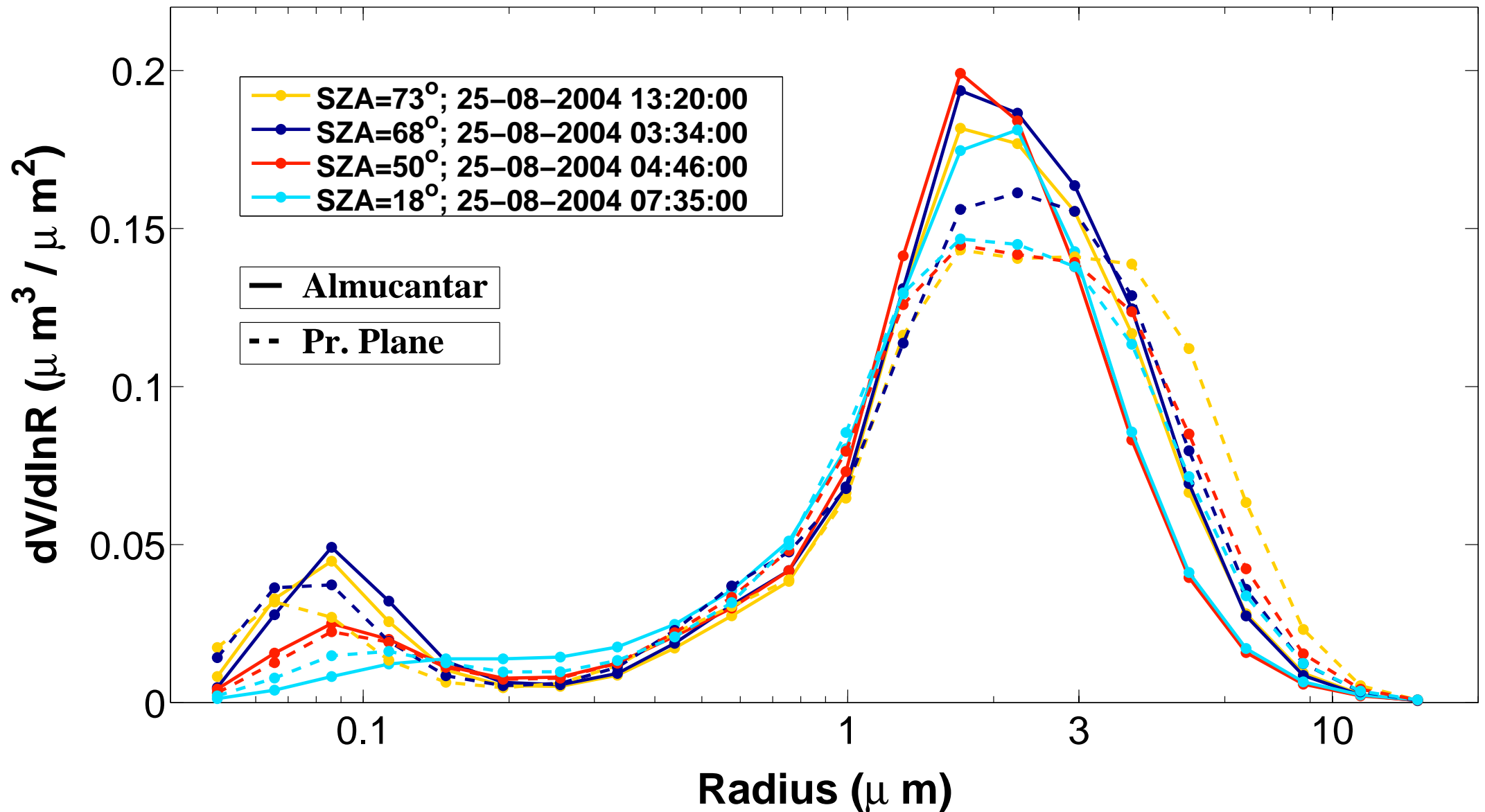
Correction over #627

Photo. #627 - 7 Abril 2011.- CORRECTED 0.25°



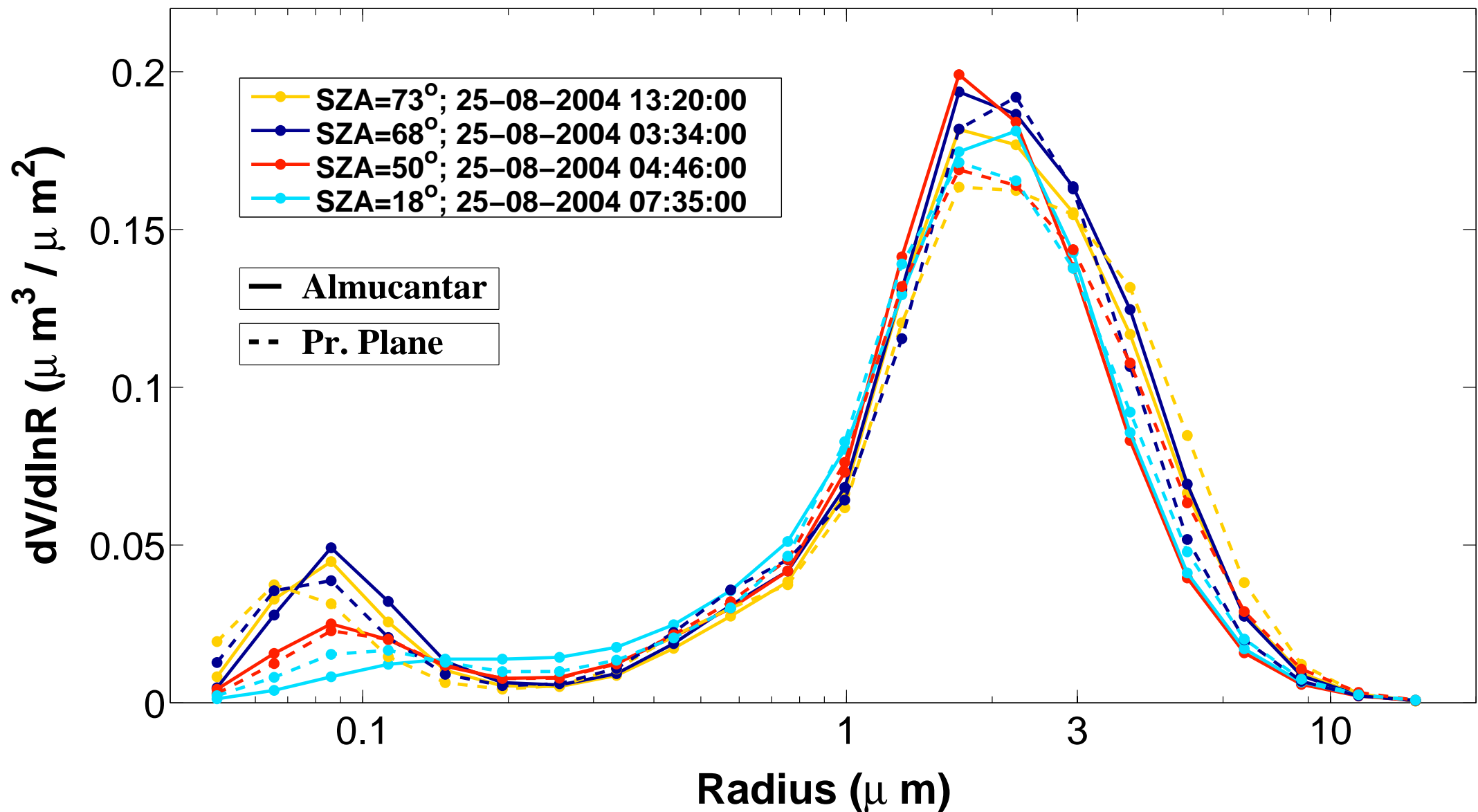
Corrections over principal plane: Photo. #002 - 25th August

Photo. #002 - Hamim - 25th August - UNCORRECTED



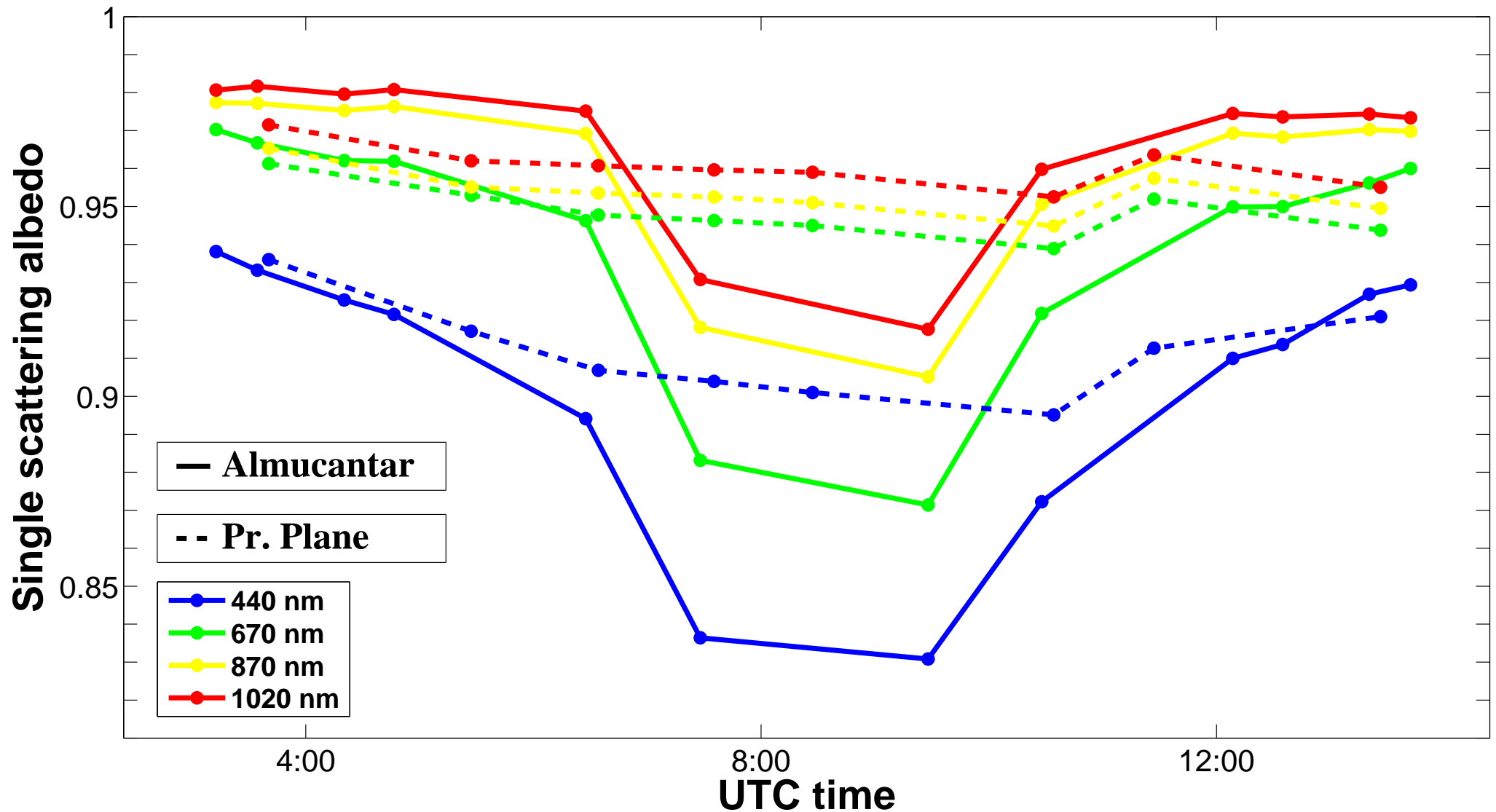
Corrections over principal plane: Photo. #002 - 25th August

Photo. #002 - Hamim - 25th August - CORR. 0.3°



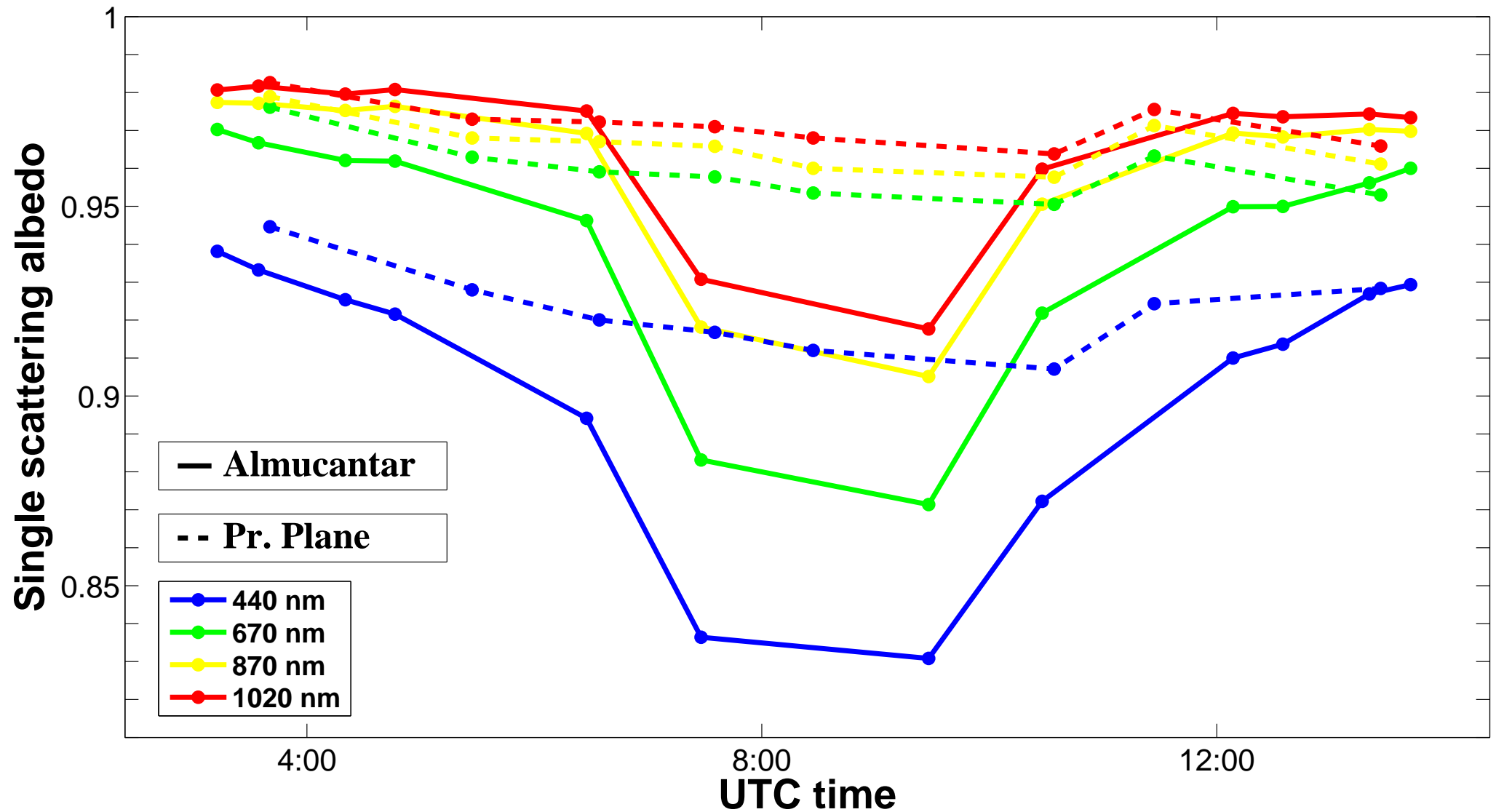
Single scattering albedo

Single scattering albedo: PPL (no corrected) and ALM inversions



Single scattering albedo

Single scattering albedo: PPL (corrected 0.3°) and ALM inversions



Conclusions/Future work

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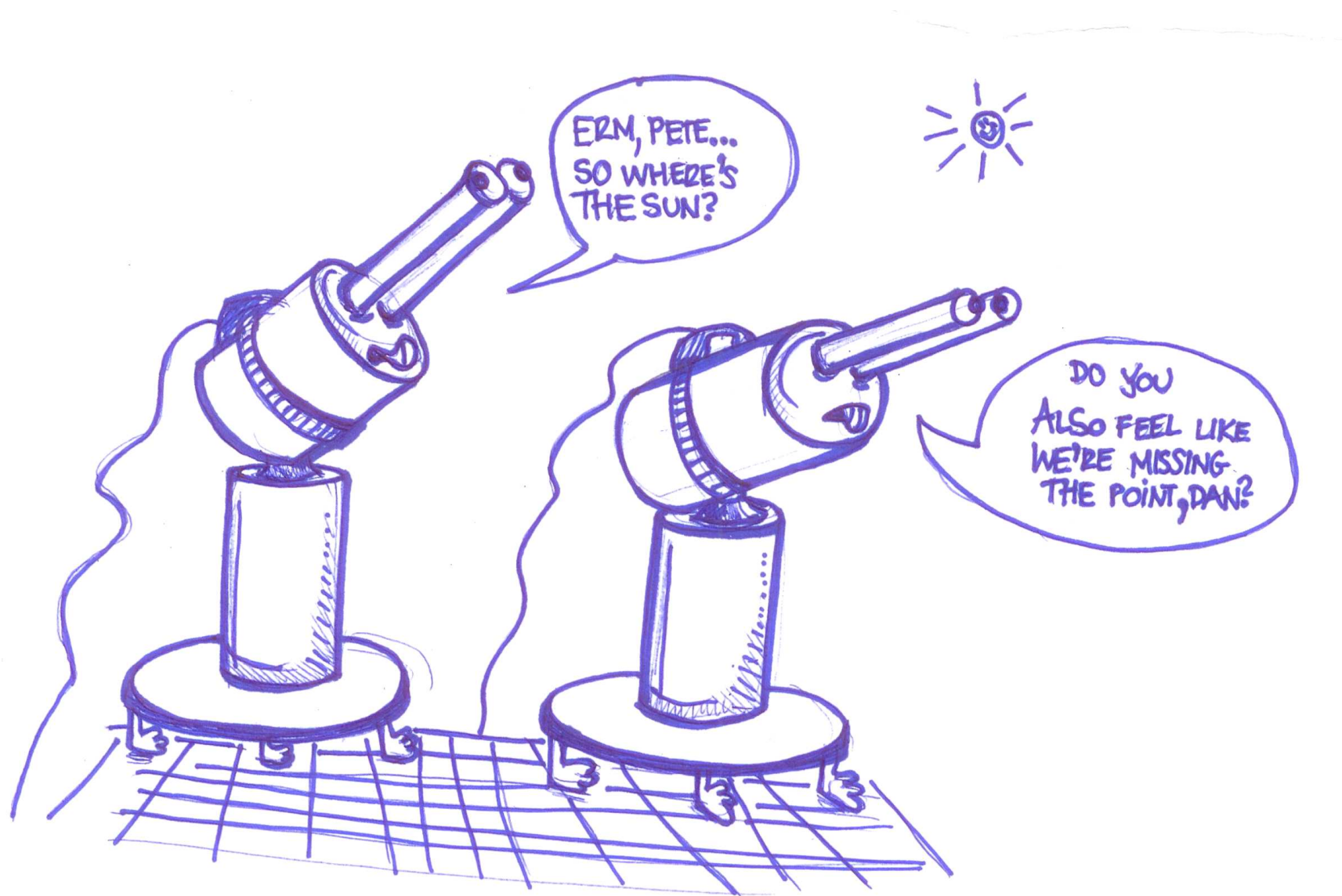
- 1 Almicantar retrievals present problems around noon for short solar zenith angles
- 2 Typical pointing errors in Cimel instruments do not present influence over inverted products except for vertical pointing error in Principal Plane measurements.
- 3 Corrections of vertical pointing errors can explain the discrepancies between ALM and PPL inversion results.

Future work

- 1 Evaluation of pointing errors in AERONET field instruments (New Eeprom by M. Canini)
- 2 Analyze more error sources

Merci!

Thank you!



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