Uncertainty Quantification for Retrieving BRFs from bottom-of-atmosphere radiometers

Sebastian Schunke, Vincent Leroy, Yves Govaerts
Rayference

LPVE23 - WORKSHOP ON LAND PRODUCT VALIDATION AND EVOLUTION

12 14 June 2023 | ESA-ESRIN | Frascati (Rome), Italy

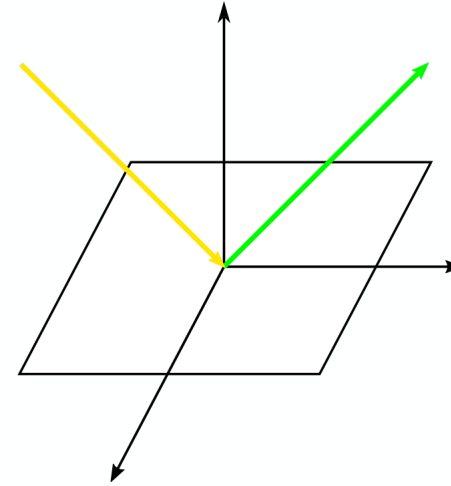# Terminology

BRF
(**b**idirectional **r**eflectance **f**actor)

- Intrinsic to the surface
- Experimentally not accessible in the field

2

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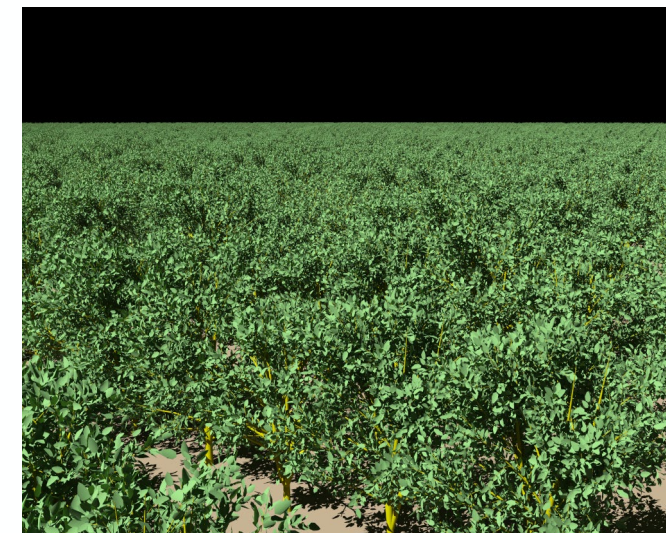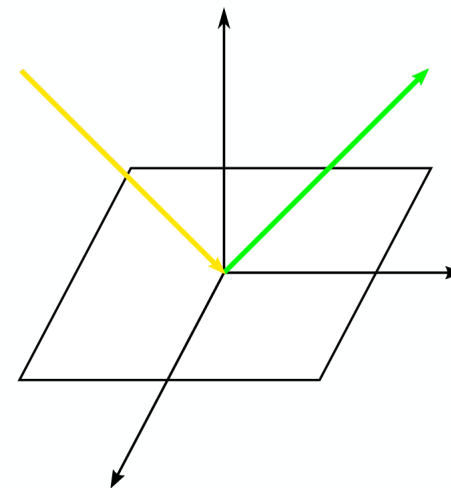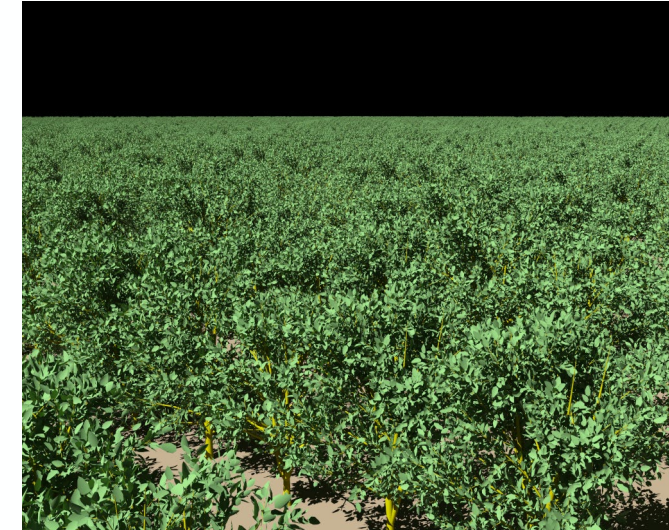
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- Black-sky reflectance

4

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Scene source: Stuckens et al. (2009)

Terminology

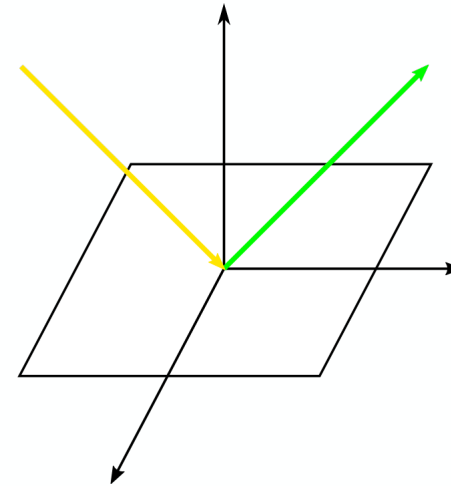## BRF
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HDRF
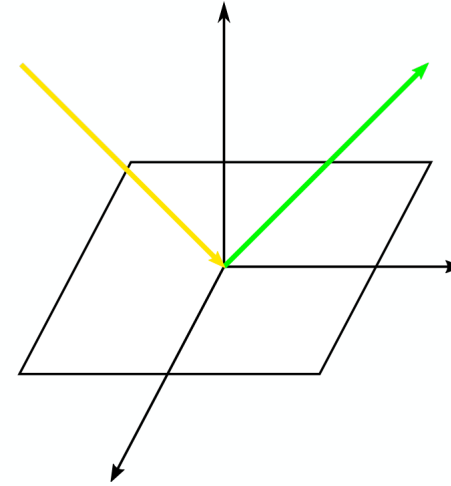(**h**emispherical-**d**irectional **r**eflectance **f**actor)

- Depends on surface and atmosphere
- Experimentally accessible in the field

5

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Scene source: Stuckens et al. (2009)

Terminology

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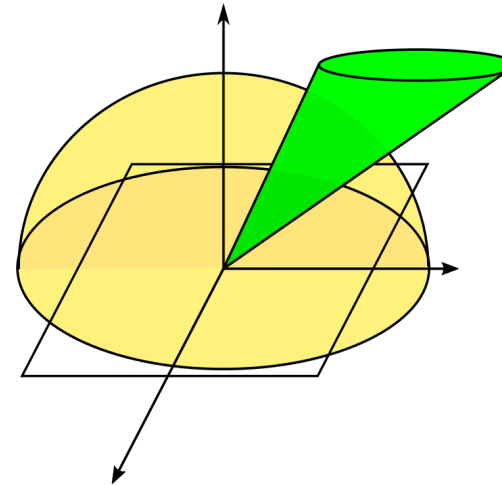(**b**idirectional **r**eflectance **f**actor)
- Intrinsic to the surface
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HDRF
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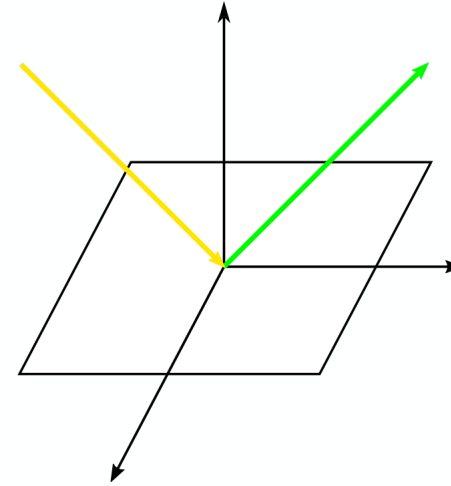
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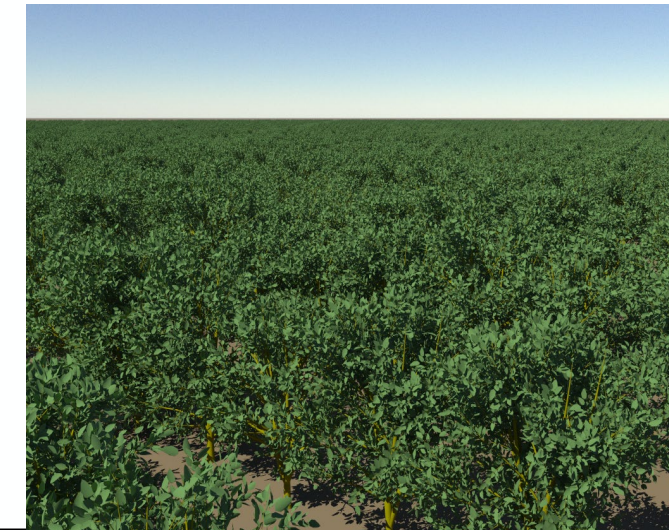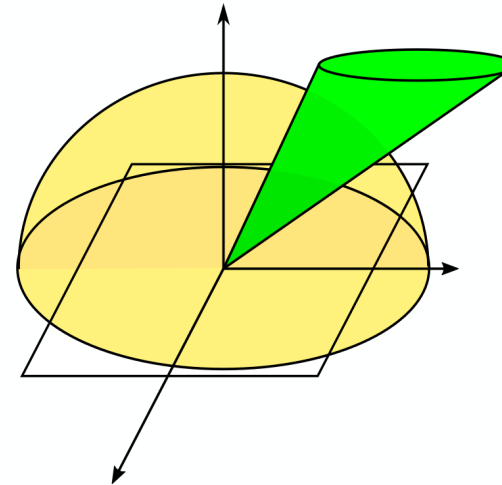### (**b**idirectional **r**eflectance **f**actor)

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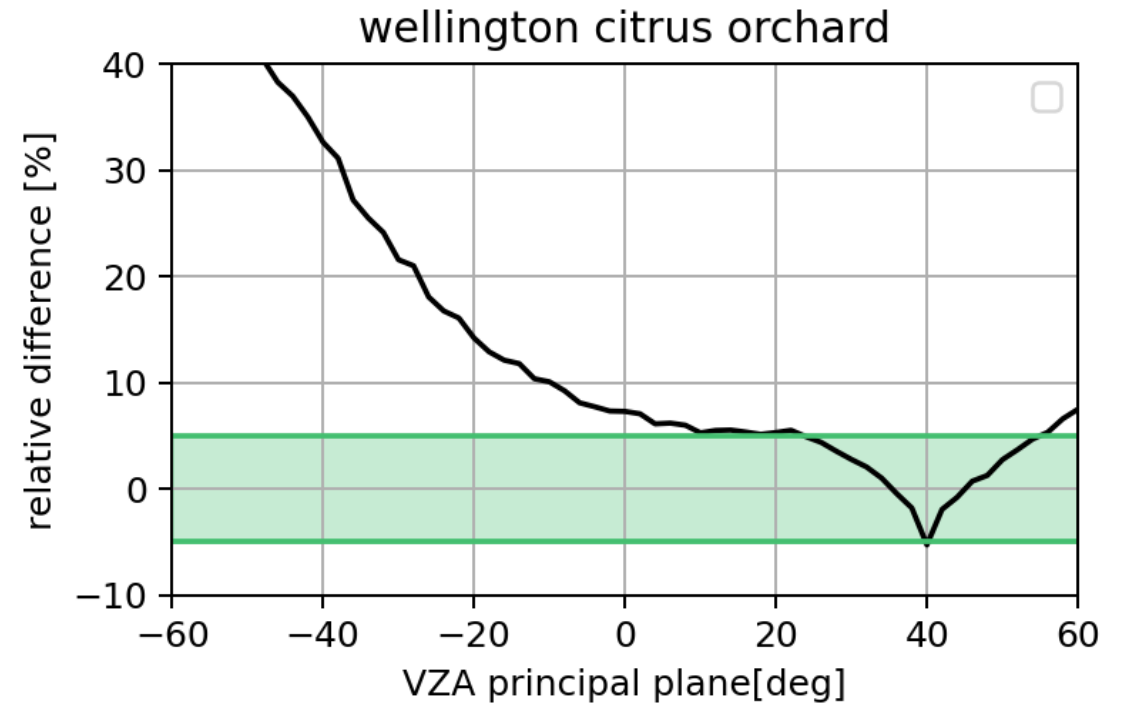- Black-sky reflectance
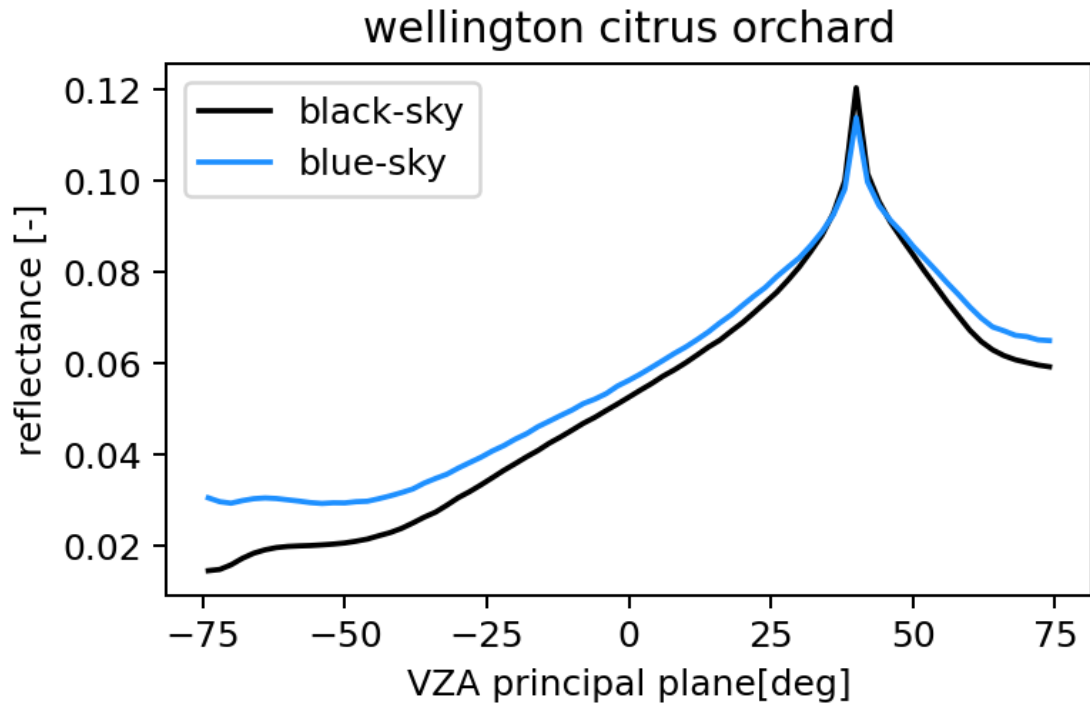
HDRF
(**h**emispherical-**d**irectional **r**eflectance **f**actor)

- Depends on surface and atmosphere
- Experimentally accessible in the field
- Blue-sky reflectance

Scene source: Stuckens et al. (2009)

Terminology

rendered at 550nm

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8

How do we derive the BRF from HDRF?

→ Need to develop standard protocols

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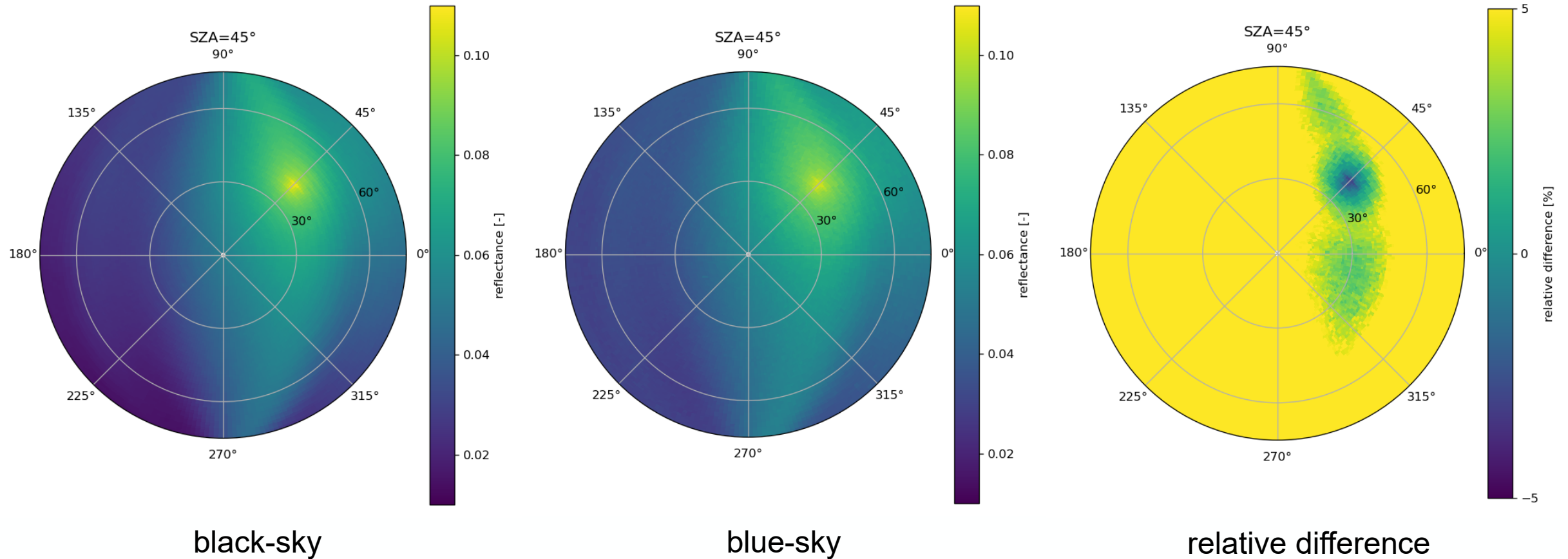→ THE EUROPEAN SPACE AGENCY

Blue-sky reflectance retrieval

Unmanned aerial vehicles are a flexible platform
Lots of work is being done on UAV measurements

Image credit:
Latini et.al. 2021 DOI:
10.1109/IGARSS47720.2021.9554496

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Blue-sky reflectance retrieval

black-sky

blue-sky

relative difference

11

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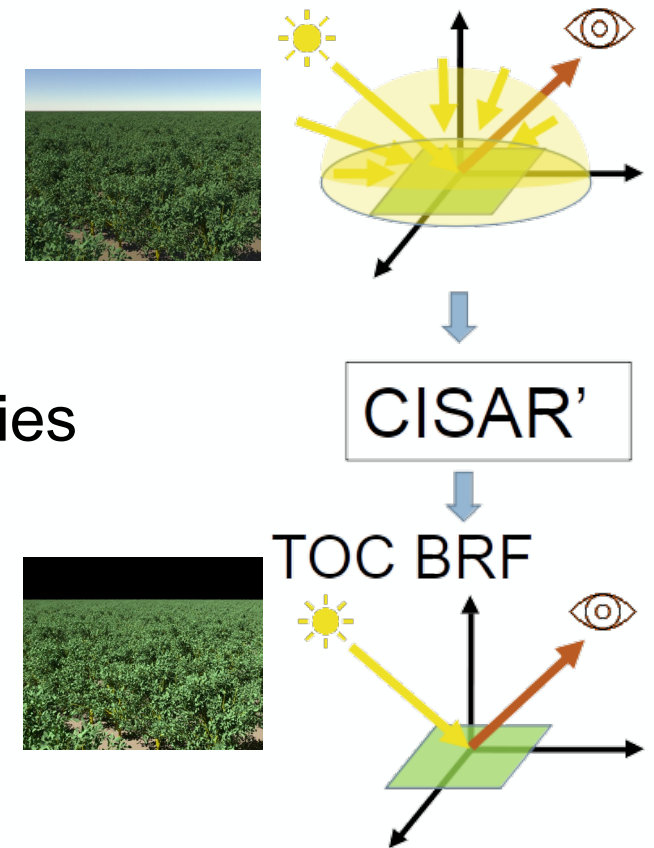
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How do we derive the BRF from HDRF and validate the result?
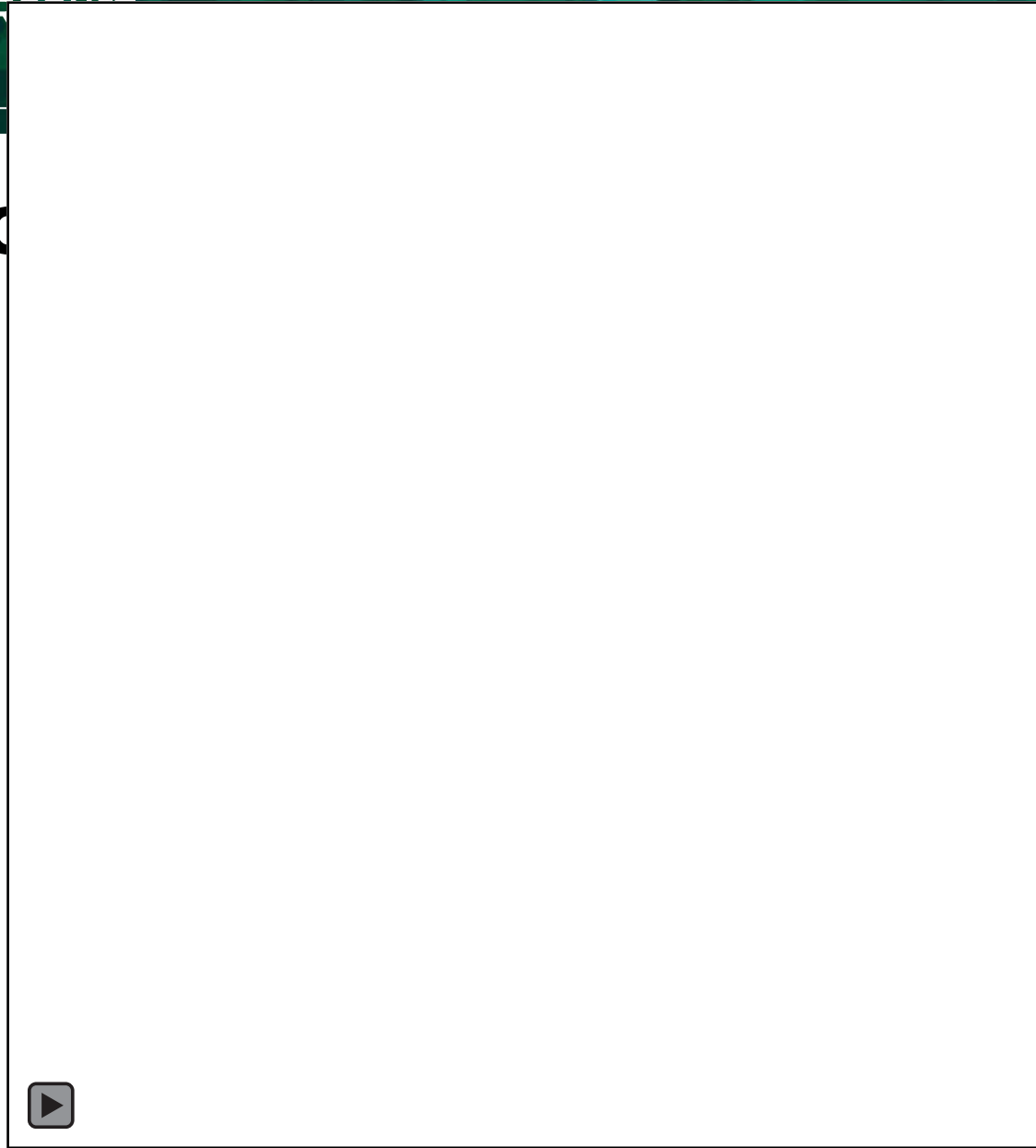
Validating black-sky reflectance estimation

Problem: Black-sky reflectance of real-world scenes is experimentally inaccessible.

Solution: Design an artificial target with all desired properties whose black-sky reflectance can be computed!
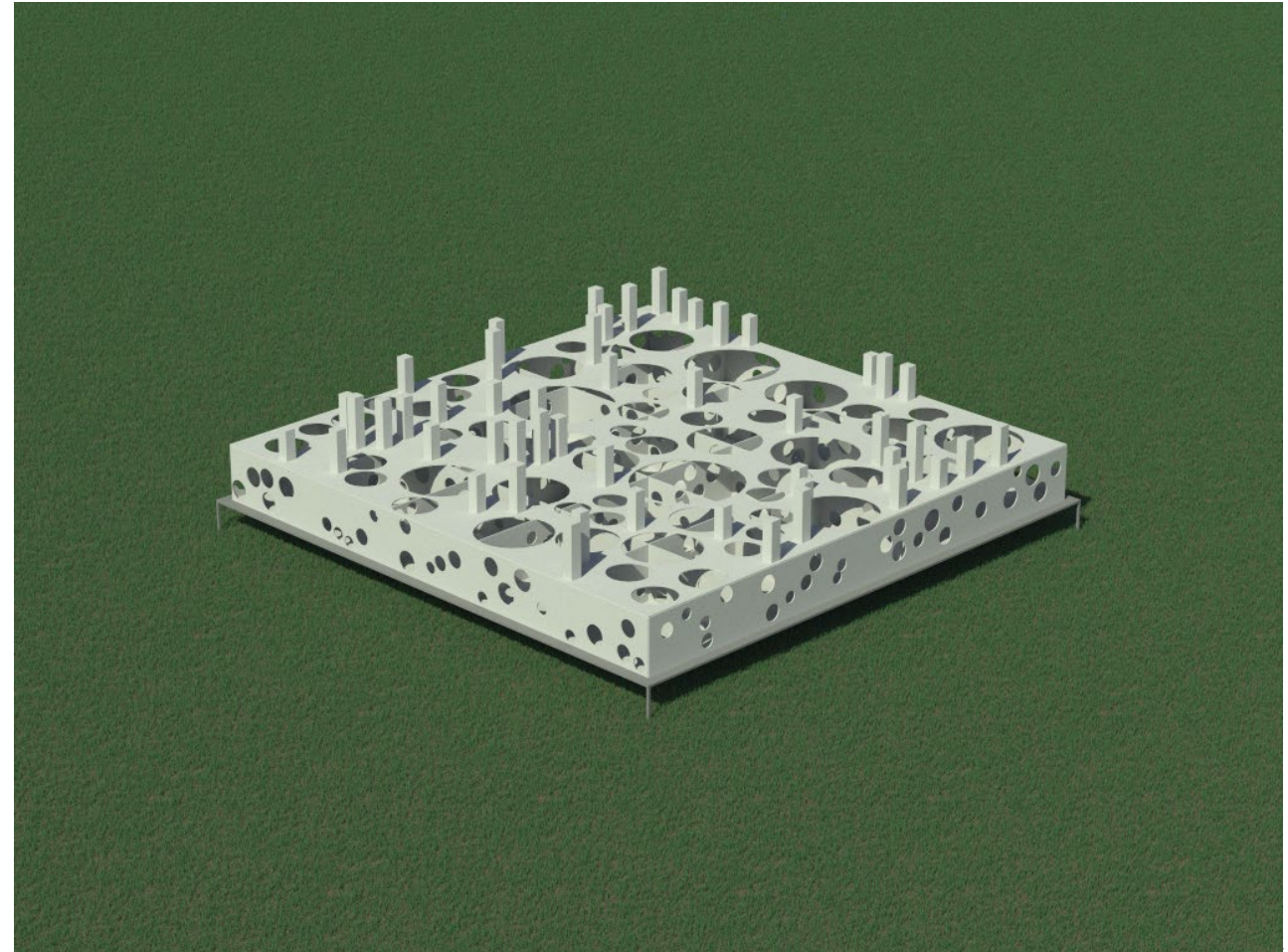
13

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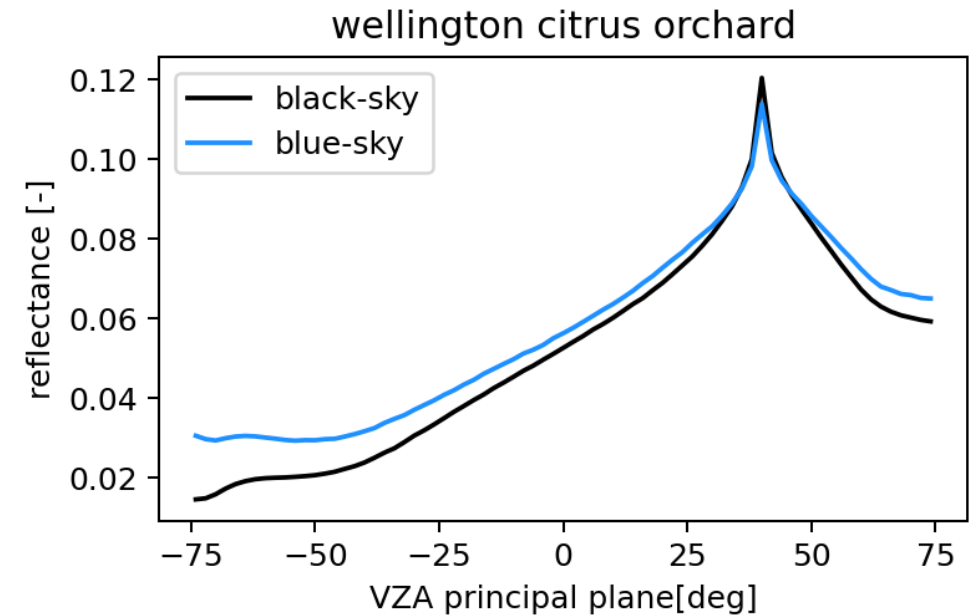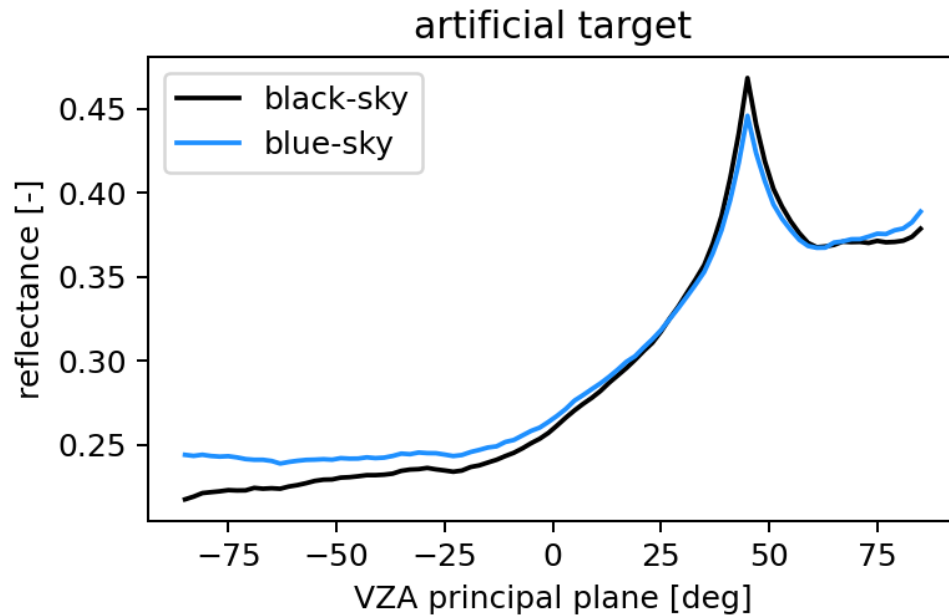
Validating blac...ation

Validating black-sky reflectance estimation
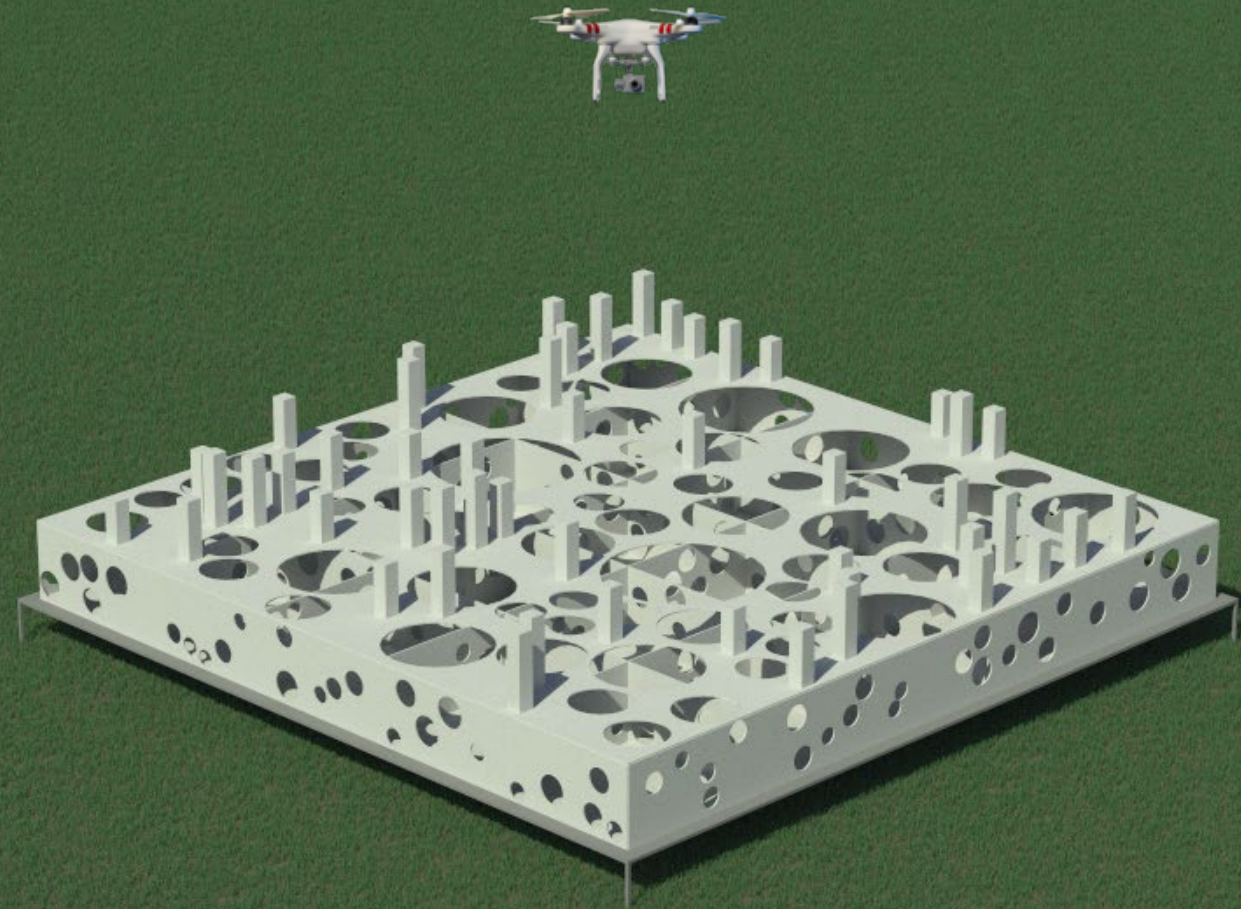
- BRF designed to emulate vegetation

- Physical size ~5m x 5m x 1m

- Feature size ~10cm

- Controlled shape allows production

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Validating black-sky reflectance estimation

Validati

Proposed protocol

18

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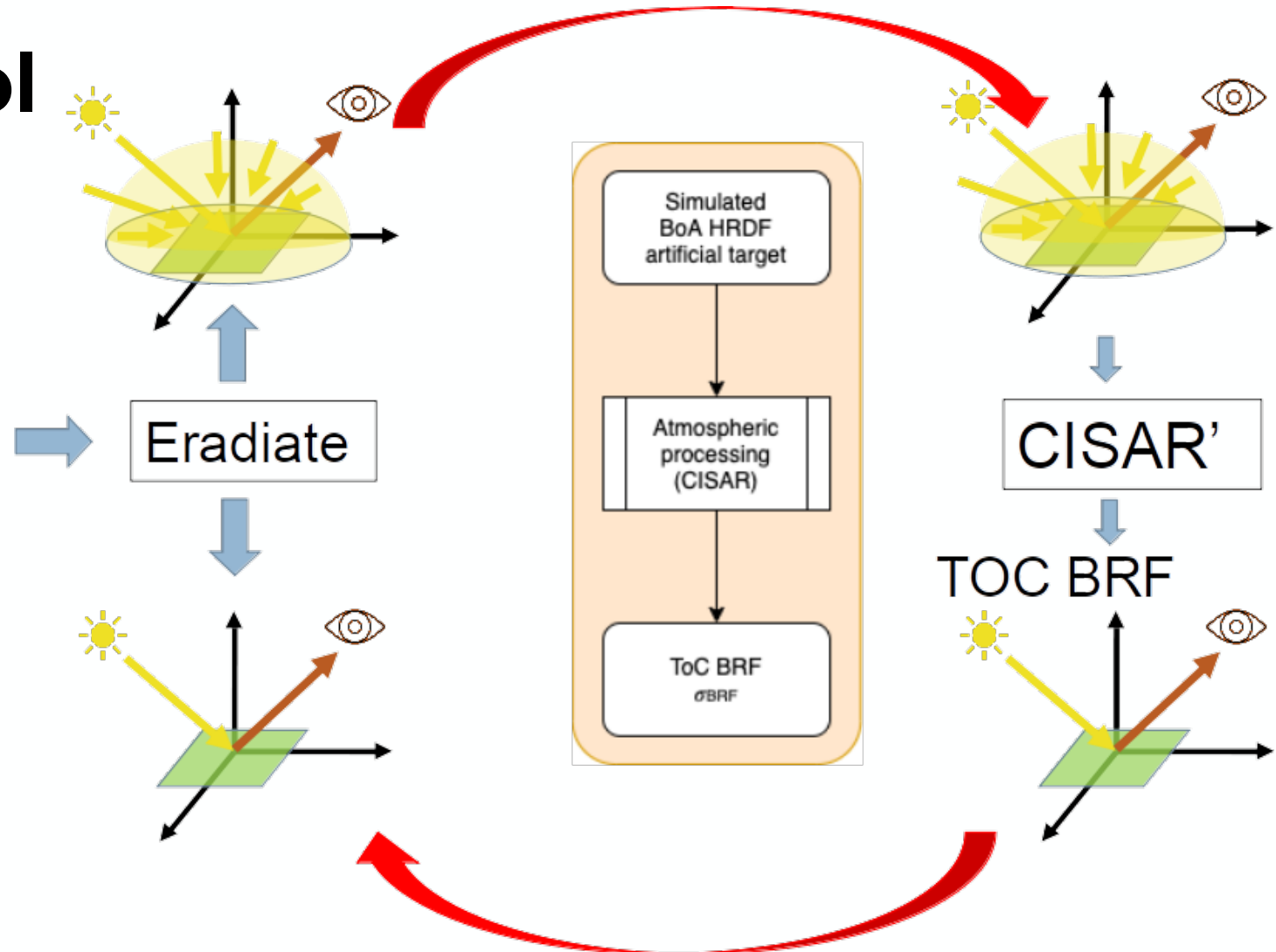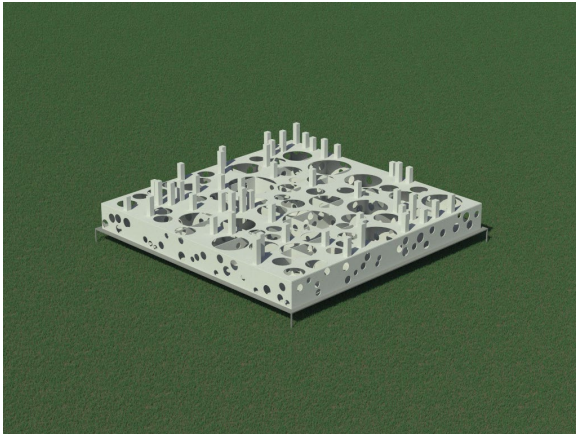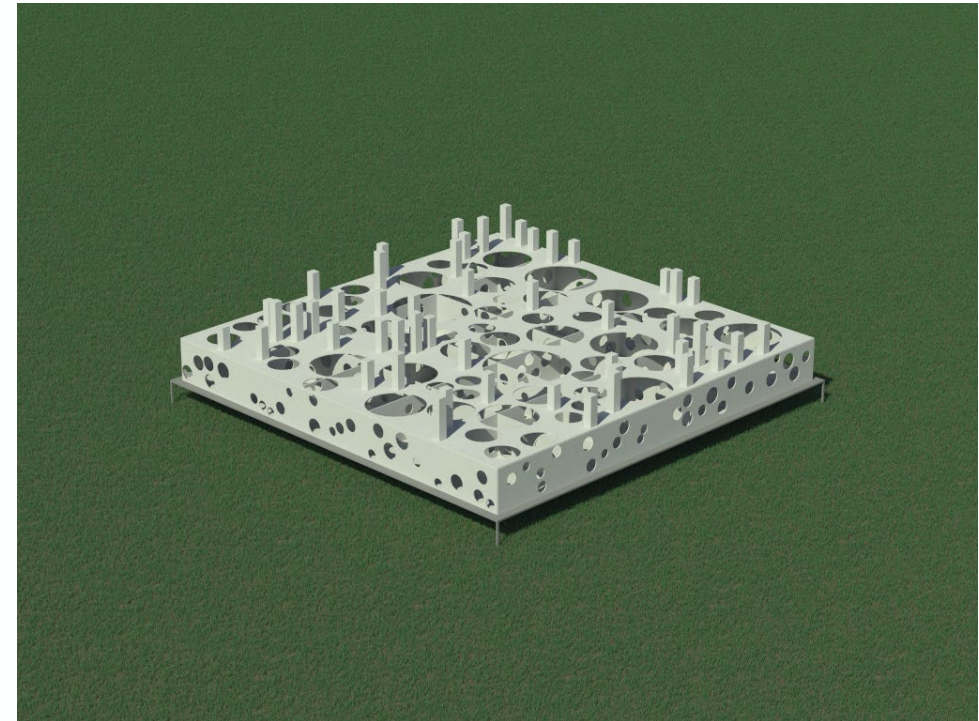
Wrap-up

A **novel approach** to validating the retrieval of surface BRF from in-situ HDRF measurements using an **artificial target** and state-of-the-art radiative transfer models like **Eradiate**

19

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Join me for an interactive Eradiate demo session on Tuesday 18:00!

Questions?

All simulations and images in this presentation were created with Eradiate.
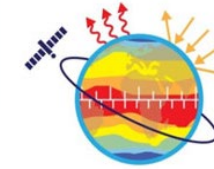To check it out, go to **eradiate.eu** or scan the QR code

It supports:
- Heterogeneous atmospheres with particle layers
- Explicit 3D canopies
- 3D elevation models
- Plane parallel and spherical atmosphere geometries

eradiate.eu

20

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Validating Eradiate

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