

D3D Project Newsletter — Months 1–6

Period: Months 1–6

Project: *Deep 3D Scattering of Solar Radiation in the Atmosphere due to Clouds* (D3D)

Supported by: Hellenic Foundation for Research and Innovation (H.F.R.I.)

1. Project Overview

The D3D project investigates how clouds affect the propagation of solar radiation in the atmosphere by combining 3D cloud reconstructions from all-sky imager (ASI) networks with advanced radiative transfer models and deep learning methods. The goal is to improve the accuracy and efficiency of estimating solar radiative fluxes in complex atmospheric conditions.

During the first six months, the team focused on establishing foundational methods, calibration workflows, and early methodological outputs that will support subsequent phases of research.

2. News Highlights (Months 1–6)

- The D3D team began with visualization of early 3D cloud reconstruction methodologies using synchronized ASI imaging. This included transforming RGB imagery into radiances and building preliminary reconstruction workflows.
 - Initial methodological components were formalized, including workflows for constructing an artificial dataset and RGB-to-radiance conversion steps foundational to cloud field analyses.
 - Demonstrations of early results showed the effects of cloud coverage conditions on radiance estimates, which will inform later deep learning model training and validation.
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3. Research Progress by Work Package

WP1 — Instrument Calibration and Network Setup

The ASI network was calibrated early in the project, including geometric and radiometric calibration of sky imagers with reference instruments. This ensured accurate radiance measurements critical for 3D reconstructions.

WP2 — Parameter Extraction & 3D Reconstruction

Early algorithms were developed to extract atmospheric parameters (e.g., cloud optical depth, aerosol optical depth) and reconstruct 3D cloud fields using synchronized ASI imagery and stereoscopic techniques.

4. Scientific Milestones Achieved

- **Validation of initial reconstruction workflows:** Cloud field estimations began to align with measurement data.
 - **Machine learning groundwork:** Established foundational ML approaches for aerosol retrieval and radiance estimation.
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