

# Polarimetric retrievals of surface and aerosol parameters in polar regions from PACE multi-sensor observations



PI: Matteo Ottaviani<sup>1,2</sup>

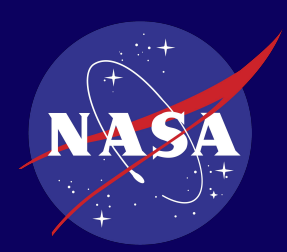
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SAT3 meeting, NASA GISS, New York, Feb 2025



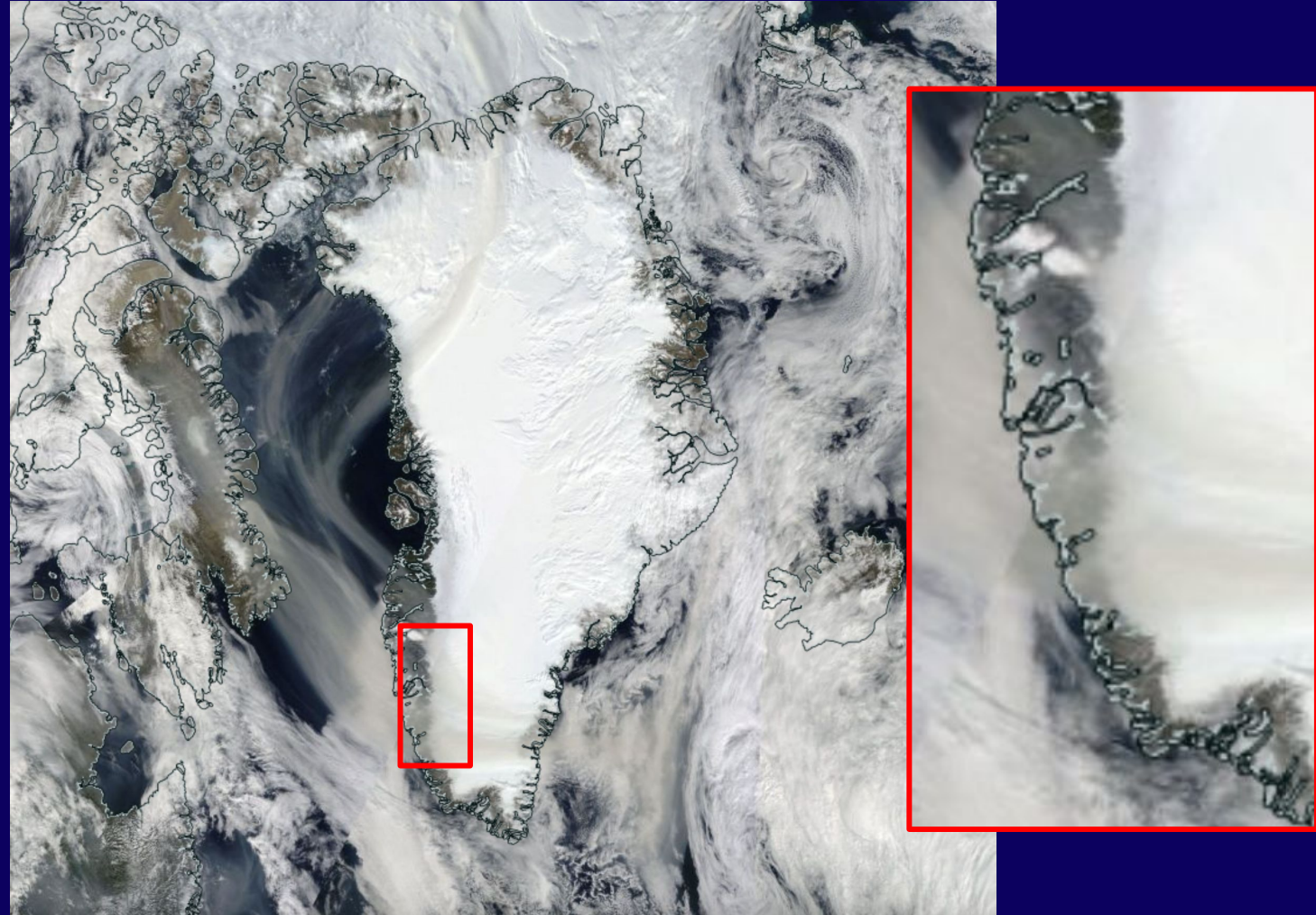
# Motivation

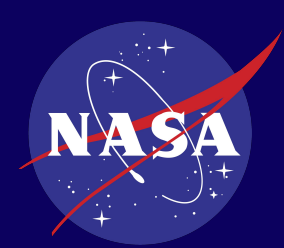


The **synergistic exploitation of the three sensors on PACE** allows to boost the measurements' information content.

We will perform advanced inversions to deliver improved estimates of the descriptive parameters for the snowpack and, in turn, of the albedo.

The inversions will simultaneously deliver aerosol properties of layers potentially present in the scene, focusing on absorbing plumes.



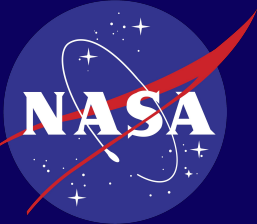


# Overview



We will exploit PACE data over Greenland, to retrieve a suite of relevant parameters.

DATA SOURCE	PRODUCT subproduct(s)	VALIDATION/EVALUATION DATASETS
OCI VIS/NIR/SWIR	<b>Cloud and Surf. Class. Mask</b> bare ice mask melt pond fraction	<ul style="list-style-type: none"><li>• NSIDC (Snow map)</li><li>• Sentinel-2/3 (MSI)</li><li>• IceSAT-2 (ATL13/22)</li><li>• ARCSIX (AVIRIS-NG, RSP, lidar)</li></ul>
OCI SWIR + HARP-2 VIS/NIR	<b>Snow albedo</b> snow grain size impurity concentration	<ul style="list-style-type: none"><li>• MODIS (MYD10A1, MCD43A3)</li><li>• Sentinel-3 (OLCI, GEUS-SICE)</li><li>• PROMICE (in-situ)</li><li>• ARCSIX + other campaigns of opportunity</li></ul>
OCI SWIR + HARP-2 VIS/NIR + SPEXone UV	<b>Aerosol Properties</b> optical depth size distribution complex refractive index	<ul style="list-style-type: none"><li>• AERONET (size distribution, refractive index)</li><li>• ARCSIX (RSP, lidar)</li><li>• IceSAT-2 (ATL09)</li></ul>



# Background



Polarimetric remote sensing has been demonstrated to boost retrievals of snow properties, and can partition impurities in the snow from those lofted above in form of atmospheric aerosols.

The project leverages the results of a previous ROSES grant (Remote Sensing Theory Program) which explored the information content of POLDER.

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**Iterative atmospheric correction scheme and the polarization color of alpine snow**

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The Cryosphere, 9, 1933–1942, 2015  
[www.the-cryosphere.net/9/1933/2015/](http://www.the-cryosphere.net/9/1933/2015/)  
 doi:10.5194/tc-9-1933-2015  
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The Cryosphere

**Photopolarimetric retrievals of snow properties**

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frontiers

**Polarization as a discriminator of light-absorbing impurities in or above snow**

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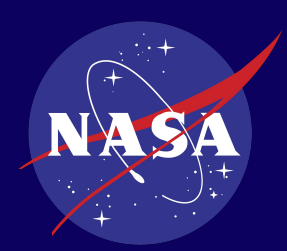
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Atmospheric Measurement Techniques

**Global sensitivity analysis of simulated remote sensing polarimetric observations over snow**

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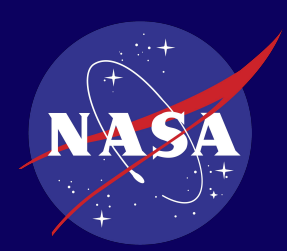
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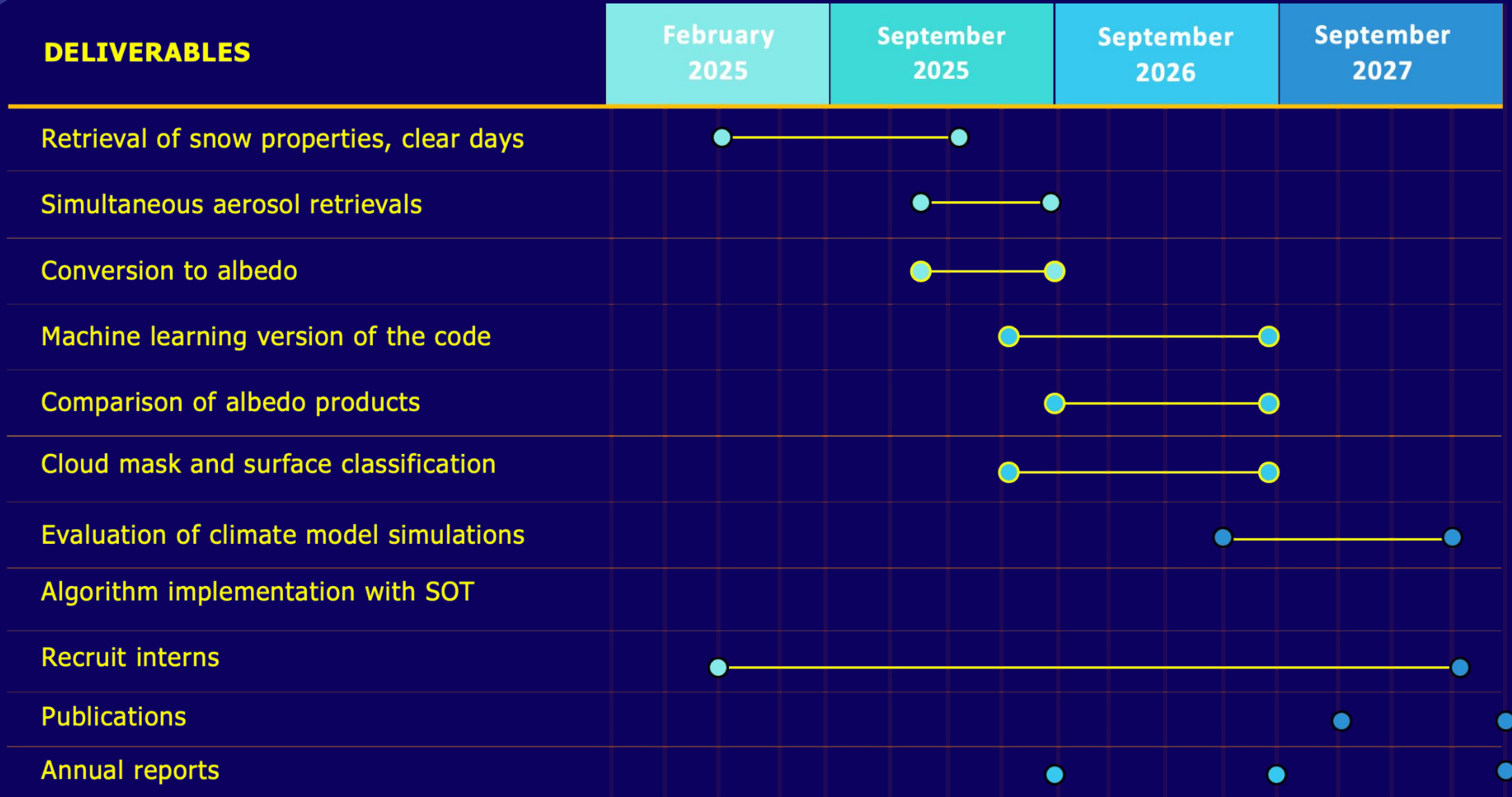
# Objectives / Deliverables

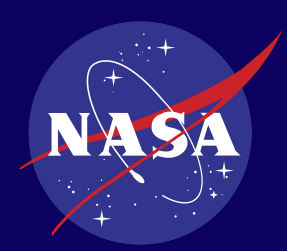


- 1) Cloud and surface classification mask for PACE observations
- 2) Simultaneous retrieval of surface and aerosol parameters, and maps of snow surface albedo
- 3) Evaluation of the albedo product with satellite retrievals, field measurements, and model maps of albedo



# Timeline





# Stakeholders / Users



- Modeling community (ModelE, CliC, SOLAS)
- European Space Agency
- Industry/agencies dedicated to hydrological and geological surveys
- STEM community

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