



Towards Operational Use of ESA FORUM Observations: From AI-Driven Retrievals to Data Assimilation

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The Far-infrared Outgoing Radiation Understanding and Monitoring (FORUM) mission, selected in 2019 as the ninth Earth Explorer by the European Space Agency, aims to provide spectrally resolved measurements of the longwave Earth's emitted radiance. FORUM will also cover the far-infrared region of the spectrum, which represents approximately 50% of the Earth's outgoing longwave radiation and, until recently, has never been systematically observed from space. FORUM is scheduled for launch in 2027 and, utilizing a Fourier transform spectrometer, will provide valuable insights into atmospheric parameters such as surface emissivity, water vapor distribution, and ice cloud properties. Once operational, FORUM is expected to generate more than 10,000 spectra per day, resulting in a substantial data volume that will require efficient processing and analysis. To handle this, accelerated radiative transfer and inversion techniques are essential. This is particularly important for near-real-time applications, such as weather and climate modeling. The first part of this seminar will focus on the inverse and forward modeling challenges. In particular, I will discuss how retrieving atmospheric properties from FORUM radiances involves solving a highly ill-posed inverse problem, traditionally addressed through Bayesian and regularization-based approaches. I will present recent developments toward hybrid and AI-driven solutions for both the forward radiative transfer operator and the inverse retrieval mapping, designed to accelerate computations while maintaining physical consistency. In the second part, I will shift the perspective toward data assimilation readiness by addressing the problem of spectral dimension reduction. I will illustrate recent efforts on optimal channel selection for FORUM, aimed at identifying the most informative spectral channels for numerical weather prediction models, enabling future operational exploitation of FORUM observations within next-generation assimilation systems.

Thursday, 30 October 2025, 2:00PM

Refreshments 1:45PM

Please also join colleagues for refreshments and informal discussion after the seminar until 3:30PM

NCAR-Foothills Laboratory, 3450 Mitchell Lane

FL2-1022, Large Seminar

Seminar will also be live webcast

<https://sundog.ucar.edu/public/page/MMM>

Participants may ask questions during the seminar via Slido.