MODIS Atmosphere Discipline Breakout

Steve Platnick
MODIS Atmosphere Discipline Lead, NASA GSFC

NASA's Terra, Aqua, and Aura Drifting Orbits Workshop
Nov. 1, 2022

- Q/A input can be seen by all *panelists*. *Attendees* can see the question <u>if</u> it's answered by a *panelist* or *host*.

- When posting to the Q/A: Type "@MODIS" before your question so it's easier to track questions for our breakout.

MODIS Atmosphere Discipline Team Breakout Agenda

- Received 21 RFI submissions relevant to MODIS Atmospheres + additional information from 6 other teams. Far too many to summarize in detail. Will provide broad overview.
- Presentations serve as examples across the range of submissions.

Time	Topic	Presenter
4:36 PM	Overview: Atmosphere Products and RFI Summary	Steve Platnick
4:48	CLARREO Pathfinder Response to NASA's Terra, Aqua, and Aura Drifting Orbits RFI	Yolanda Shea
5:00	Exploiting local time distributions to understand sensitivities of MODIS cloud retrievals to pixel size/solar geometry	Kerry Meyer
5:12	Science and applications for clouds and aerosols supported by the continuation of the morning Terra orbit	Bob Holz (VIIRS Atmo. Disc. Lead)
5:24	Synergistic Observations from AIRS and MODIS in a Drifting Aqua Orbit	Eric Fetzer
5:36-6:00 PM	Breakout 2 Discussion	

MODIS Atmosphere Team: Principal Products

Aerosol Level-2

- Dark Target (*Levy*), Deep Blue (*Hsu*) algorithms
- Optical depth, etc.
- 10km, 3km

Cloud Level-2

- Cloud mask (1km, with 250/500m info.): *Holz, Ackerman*
- Cloud properties
  - Cloud Top: Pressure, Temp., Height (5km, 1km): *Holz, Menzel*
  - Optical/Microphysical: Phase, Optical Thickness, Particle Effective Radius, derived Water Path, uncertainties, etc. (1km, with partly cloudy filtering, sub-pixel heterogeneity info.): *Platnick, Meyer*

Clear Sky Level-2

- Profiles/TPW: IR-based (5km) (*Borbas, Menzel, Ackerman*)

Temporal/Spatial Statistics Level-3

(*Platnick, Meyer, Holz*)

- Aerosol, cloud, clear sky: hundreds of scalar and histogram datasets
- 1° equal angle grid; daily, 8-day, monthly
- MODIS Terra and Aqua separately
- Special L3 products: COSP (combined Terra & Aqua), GEWEX
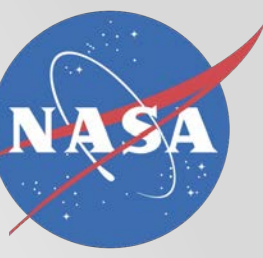
MODIS Atmosphere Team: Additional Context

- All L2 algorithms rely on absolute radiometric calibration

- All products in Collection 6.1 production (2017/18); teams working on Collection 7 (Senior Review maintenance funding)

- All teams also works on SNPP/JPSS continuity products in production since late 2018 to early 2020); aerosol and cloud teams working on GEO algorithms (ROSES MEaSUREs, ESROGSS).

MODIS Atmosphere Team: Further Information

atmosphere-imager.gsfc.nasa.gov or search on *MODIS + Atmosphere*

MODIS Atmosphere-Relevant RFI Submissions

21 relevant RFI submissions

+ 6 post-RFI inputs with primary input on:

- aerosol data assimilation (ECMWF [Garrigue], GMAO [da Silva], DLR [Popp])
- uniqueness of MODIS AOD [Terra] (NASA/UMBC [Sayer], DLR [Popp], AeroCom/U. Oslo [Schultz])
- Atmosphere Motion Vectors (U. Wisc./CIMSS [Santek, Key])

| RFI ID	Title	Submitter (First name)	Submitter (Last name)	Country	Instruments
12	CERES Response to NASA's Terra, Aqua, and Aura Drifting Orbits RFI	Norman	Loeb	US	CERES, MODIS
14	NOI from European Centre for Medium-Range Weather Forecasts (ECMWF)	Richard	Engelen	GB	AIRS/AMSU, MODIS, MLS, OMI, MOPITT
16	Response to Request for Information for NASAs Terra, Aqua, and Aura Drifting Orbits	Joel	Norris	US	CERES, MODIS
25	Response to NASA's Terra, Aqua, and Aura Drifting Orbits RFI	Wenying	Zu	US	CERES, MODIS
26	CERES Clouds Working Group Response to NASAs Terra, Aqua, and Aura Drifting Orbits RFI	Bill	Smith, Jr	US	MODIS, CERES
34	CERES Surface Atmosphere Radiation Budget (SARB) working group response	Seigi	Kato	US	MODIS, CERES
41	Unique elements of application and science enabled by the orbit drifting	Tianle	Yuan	US	MODIS
44	Benefits of Aqua / Terra Continued Operation for the Climate Record of Global Water Vapor	John	Forsythe	US	AIRS/AMSU, MODIS
50	The role of the diurnal cycle for clouds in the extratropics	Catherine	Naud	US	MODIS, AIRS, MISR
64	Request for Information: Opportunity for different CALIPSO-CloudSat-Aqua/MODIS collocation	Zhibo	Zhang	US	MODIS [A-Train]
65	WMO and GCOS response to NASA RFI NNH22ZDA018L	Caterina	Tassone	CH	AIRS/AMSU, CERES, MODIS, MLS
69	Science objectives that can be achieved with Terra and Aqua data during the period of orbital drift.	Eva	Borbas	US	AIRS/AMSU, MODIS
77	**Science and applications for clouds and aerosols supported by the continuation of the morning Terra orbit**	**Robert**	**Holz**	US	MODIS
79	**Exploiting local time distributions to understand sensitivities of MODIS cloud retrievals to pixel size/solar geometry: Implications for multi-sensor CDR continuity**	**Kerry**	**Meyer**	US	MODIS
86	Ongoing MODIS Contributions to GeoXO Risk Reduction and Vertical Cloud Structure Operational Products	John	Haynes	US	MODIS [A-Train]
88	**CLARREO Pathfinder Response to NASAs Terra, Aqua, and Aura Drifting Orbits RFI (NNH22ZDA018L)**	**Yolanda**	**Shea**	US	CERES, MODIS
100	Scientific investigations and applications facilitated by acquisitions from Terra and Aqua satellites after departure from nominal orbit	Edward	Hyer	US	AIRS/AMSU, MODIS, MISR
103	Enabling new microphysics retrievals	Daniel	McCoy	US	MODIS
106	**Synergistic Observations from AIRS and MODIS in a Drifting Aqua Orbit**	**Eric**	**Fetzer**	US	AIRS/AMSU, MODIS
110	Response to RFI concerning NASA's Terra Drifting Orbit	Larry	Di Girolamo	US	MODIS, MISR, ASTER, CERES
111	Unique science made possible with Terra, Aqua, and Aura observations	Mian	Chin	US	MODIS, MISR, MLS, OMI

Summary of MODIS Atmosphere-Relevant RFI Submissions

21 RFI submissions with relevant statements addressing MODIS atmosphere discipline science and/or products + 6 post-RFI inputs => 9 U.S. academic, 12 NASA, 1 U.S. gov't (non-NASA), 5 International

<u>Common categories</u>:

I. **Enable reduced uncertainties in existing data records:** Theme 1 and/or 2

- Improved Reflective Solar Bands (RSB) radiometric calibration with CLARREO-Pathfinder overlap

- Improve understanding of cloud/aerosol RSB retrieval sensitivities to solar/view geometry

    - Drifting Local Time (LT) distributions => filter sampling populations with similar LT but different solar/view geometry (retrievals sensitivity)

    - Drifting Mean Local Time (MLT) equatorial crossing => different geometric sampling (retrieval sensitivity, evaluation with GEO, informing historical AVHRR drifting orbits for longer term CDRs)
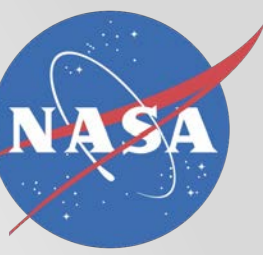
Summary of MODIS Atmosphere-Relevant RFI Submissions

Common categories (cont.):

II. **Enable new data records/science:** Theme 1

- Novel diurnal sampling observations and diurnal synergy with other Aqua/Terra instruments (deep convective clouds, shallow marine clouds, extratropical clouds, cloud Nd, aerosol AOD). *Closely linked with Category I.*

III. **Continue unique data records:** Theme 1 and/or 2

- Terra morning orbit (cloud and aerosol), Aerosol Data Assimilation (CAMS [ECMWF], GMAO, NRL), MODIS Polar Winds (Atmospheric Motion Vectors)

IV. **Enabling continuity through overlapping data records:** Theme 1 and/or 2

- Terra v. Metop SG A1 (NET Dec. 2024). *Closely linked with Category III.* "Enabling" does not ensure continuity, requires algorithm continuity (Level-2,-3), etc. lesson-learned in EOS=>SNPP/JPSS and ESA's Climate Change Initiative (CCI).

- EarthCARE ("expected to be launched in 2023", earth.esa.int/eogateway/missions/earthcare)

V. **Other**

- Field campaigns, GeoXO GXI design (MODIS NIR water vapor channel in drifting orbit)

Summary of MODIS Atmosphere-Relevant RFI Submissions

Category	RFI Count
I. Enable reduced uncertainties in existing data records	8
II. Enable new data records/science	7
III. Continue unique data records	13
IV. Enabling continuity through overlapping data records	7
V. Other	2

For the 27 inputs (21 RFI + 6 post-RFI), 8 were assigned to two categories, 1 to three categories (total count = 37).

RFI submission presentations

- **Enable reduced uncertainties: Radiometric Continuity (I)**
  Overlap with CLARREO Pathfinder, *Yolanda Shea (LaRC)*

- **Enable reduced uncertainties: Exploiting Local Time distributions (I)**
  Exploiting local time distributions to understand MODIS cloud retrieval sensitivity to pixel size view/solar geometry, *Kerry Meyer (GSFC)*

- **Enabling Unique Data Record and Continuity Overlap (III, IV)**
  Science and applications for clouds and aerosols supported by the continuation of the morning Terra orbit, *Bob Holz (U. Wisc., Madison)*

- **Enable new data records: Sampling Diurnal Cycle (II)**
  Synergistic Observations from AIRS and MODIS in a Drifting Aqua Orbit, *Eric Fetzer (JPL)*