Preparing for GeoXO: Evaluating Pre-Convective Moisture Boundaries with Solar WV Absorption Bands

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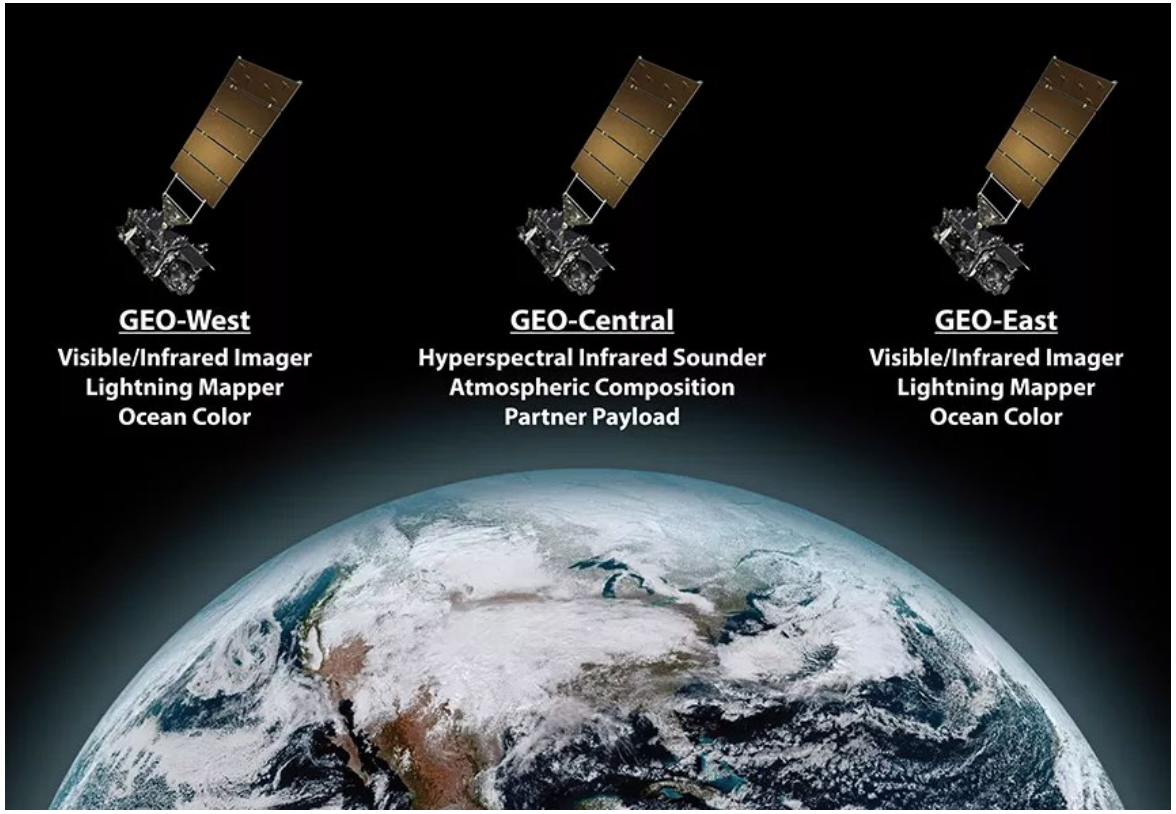
CIRA Connecting Models and Observations

GeoXO GEOSTATIONARY EXTENDED OBSERVATIONS

Geostationary Extended Observations (GeoXO)

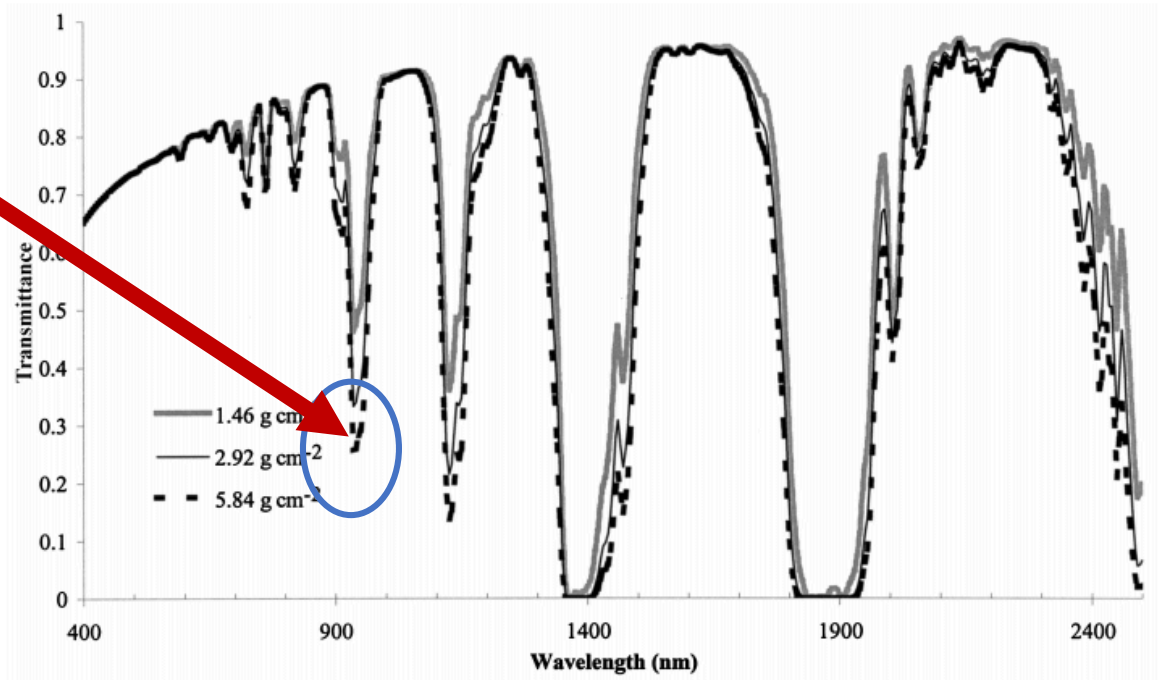
- GeoXO program represents NOAA's next generation of geostationary satellite sensors
- Will replace the current generation of GEOs, which will end with the launch of GOES-U in 2024
- Launch planned for 2032
- Planned instrumentation:
  - GeoXO Imager (GXI)
  - GeoXO Lightning Mapper (LMX)
  - GeoXO Sounder (GXS)
  - GeoXO Ocean Color Instrument (OCX)
  - GeoXO Atmos. Composition Instrument (ACX)



NOAA

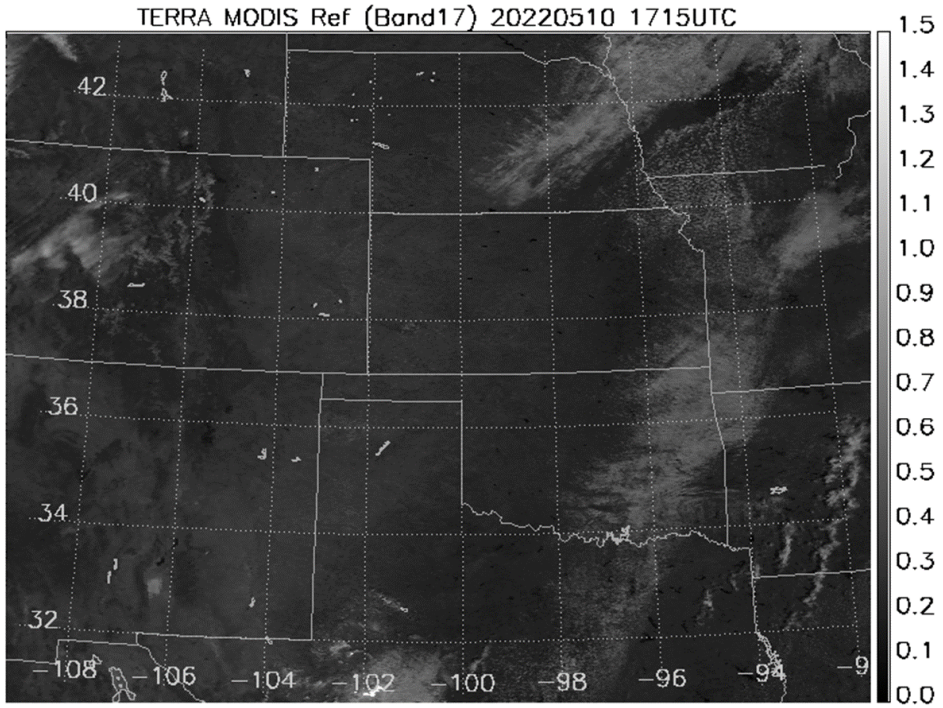
0.91 µm Water Vapor Channel

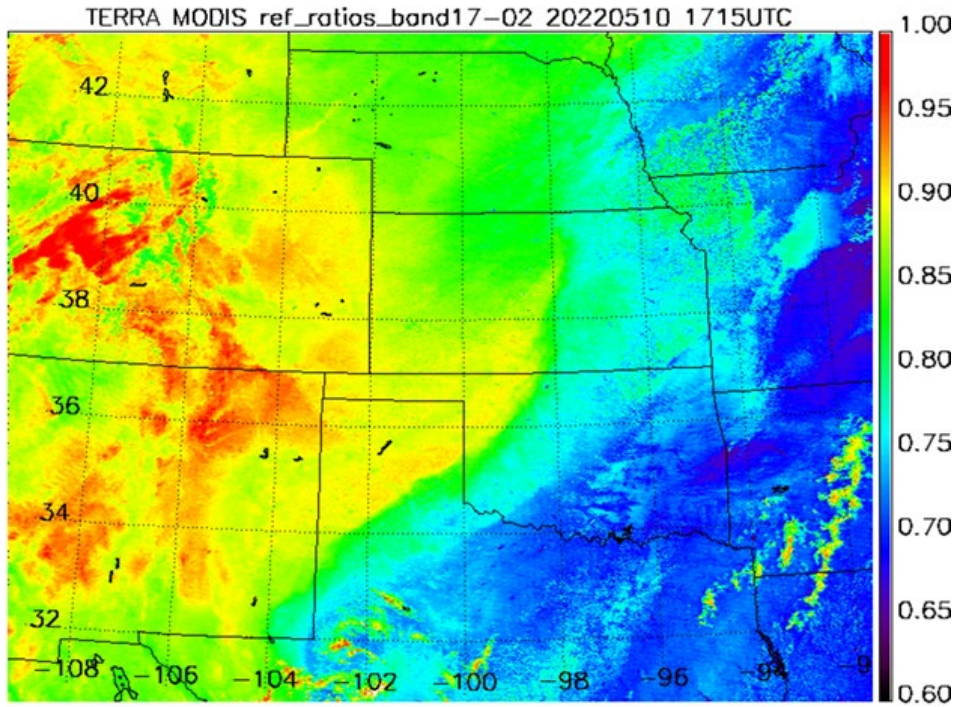
	Center Wavelength (µm)	50% Bandwidth (µm)	Nadir Pixel Size (km)	SNR/NEdT**
	0.47	0.04	0.5 (TBR)	250 (TBR)
	0.64	0.1	0.25***	125
	0.865	0.039	0.5 (TBR)	150 (TBR)
	0.91	0.02	1.0 (TBR)	300
	1.378	0.015	2.0	300
	1.61	0.06	1.0	300
	2.25	0.05	1.0 (TBR)	200 (TBR)
	3.9*	0.2	1.0	0.15 (TBR)
	5.15	0.2	1.0	0.15
	6.185	0.83	2.0	0.1
	6.95	0.4	1.0**** (TBR)	0.15 (TBR)
	7.34	0.2	2.0	0.1
	8.50	0.4	2.0	0.1
	9.61	0.38	2.0	0.1
	10.35	0.5	1.0**** (TBR)	0.1
	11.20	0.8	2.0	0.1
	12.30	1.0	2.0	0.1
	13.30	0.6	2.0	0.3



Atmospheric transmittance for varying amounts of TPW based on MODTRAN simulations – from Barducci et al. 2004

MODIS Imagery & Solar Moisture Transmittance (SMT)



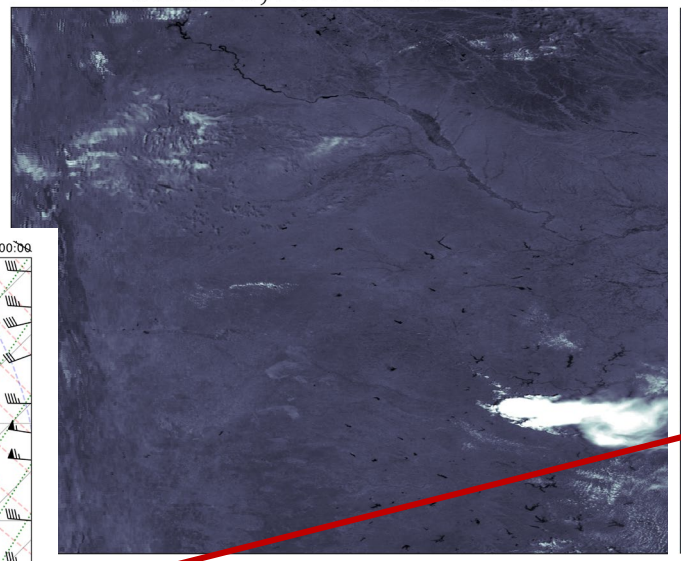


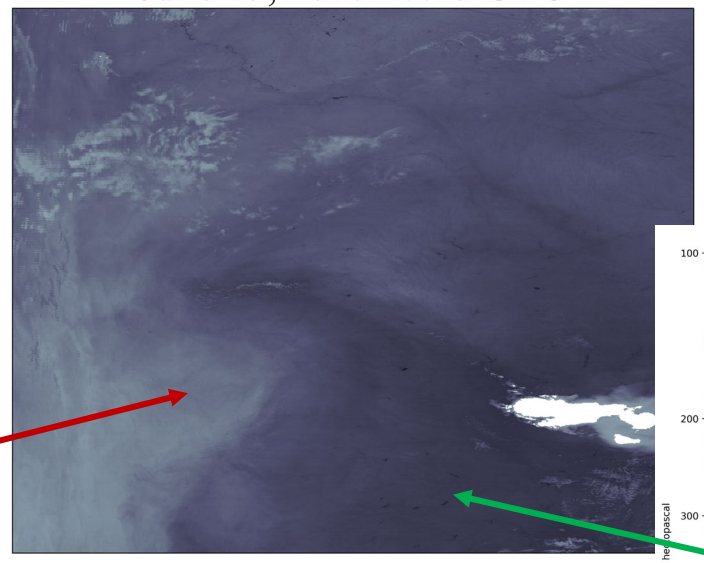
Courtesy of YJ Noh, Louie Grasso,and others (CIRA)

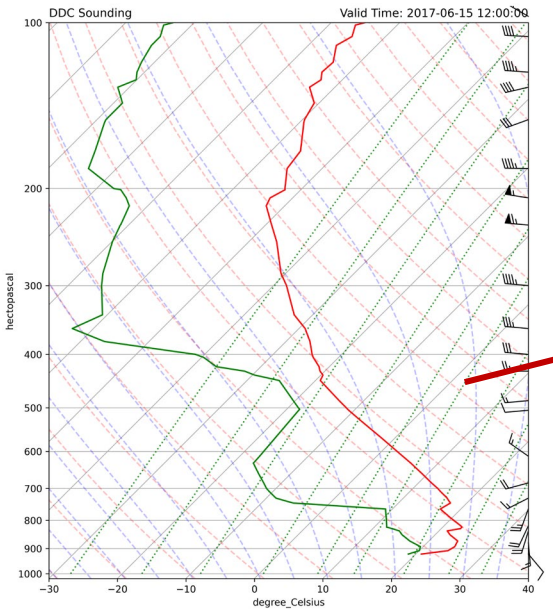
Moisture Convergence Case

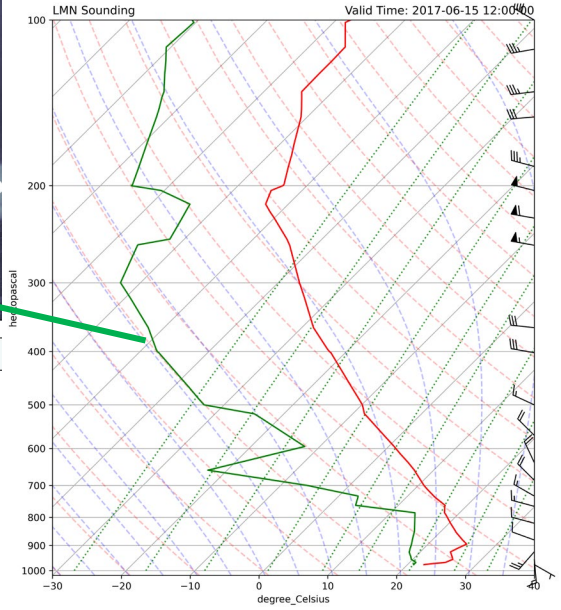
MODIS Channel 17 (0.905µm)
June 15, 2017 17:15 UTC

MODIS SMT Reflectance
(0.905µm/0.86µm)
June 15, 2017 17:15 UTC

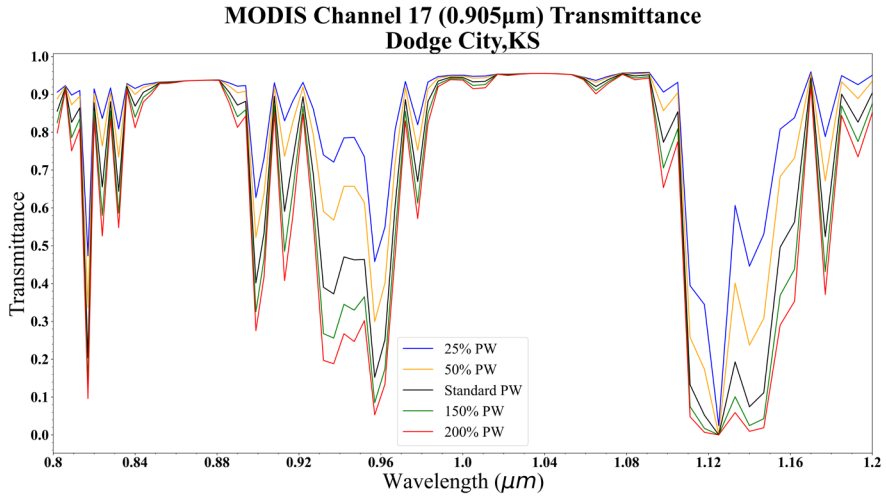


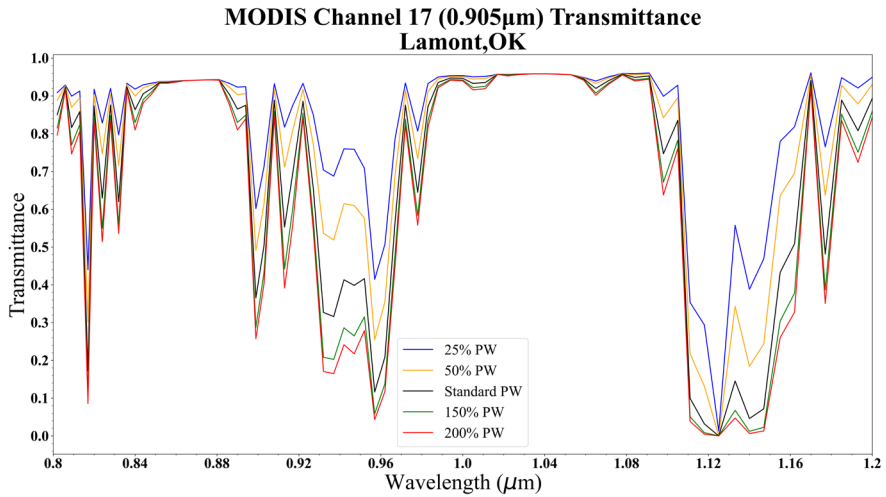


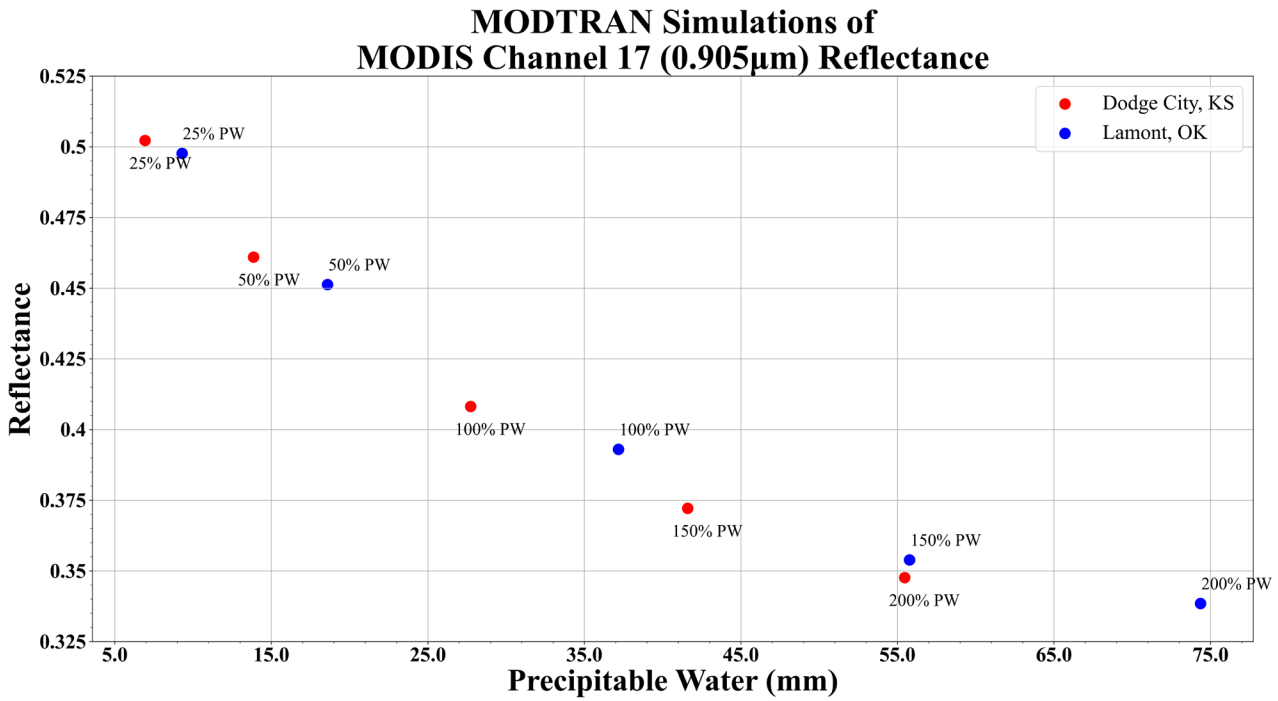




Moisture Convergence Case







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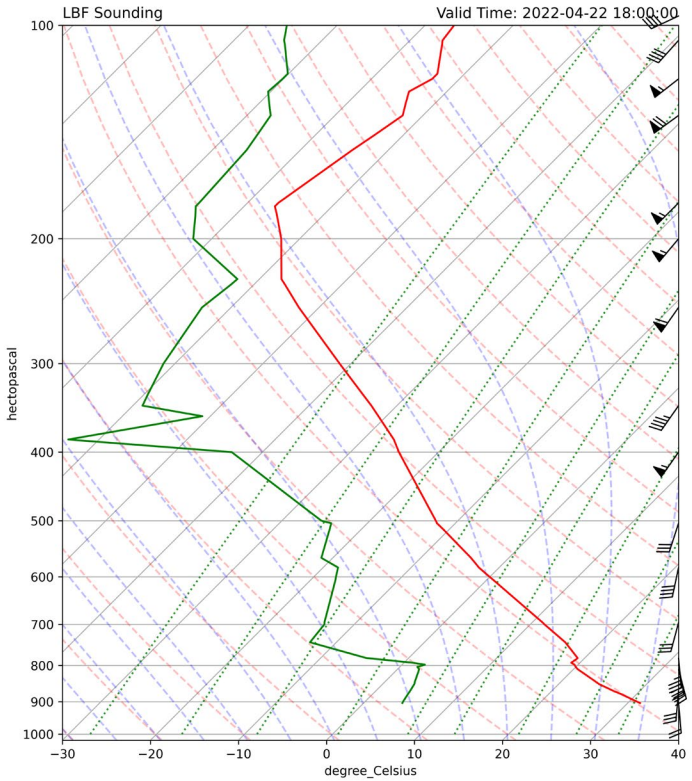
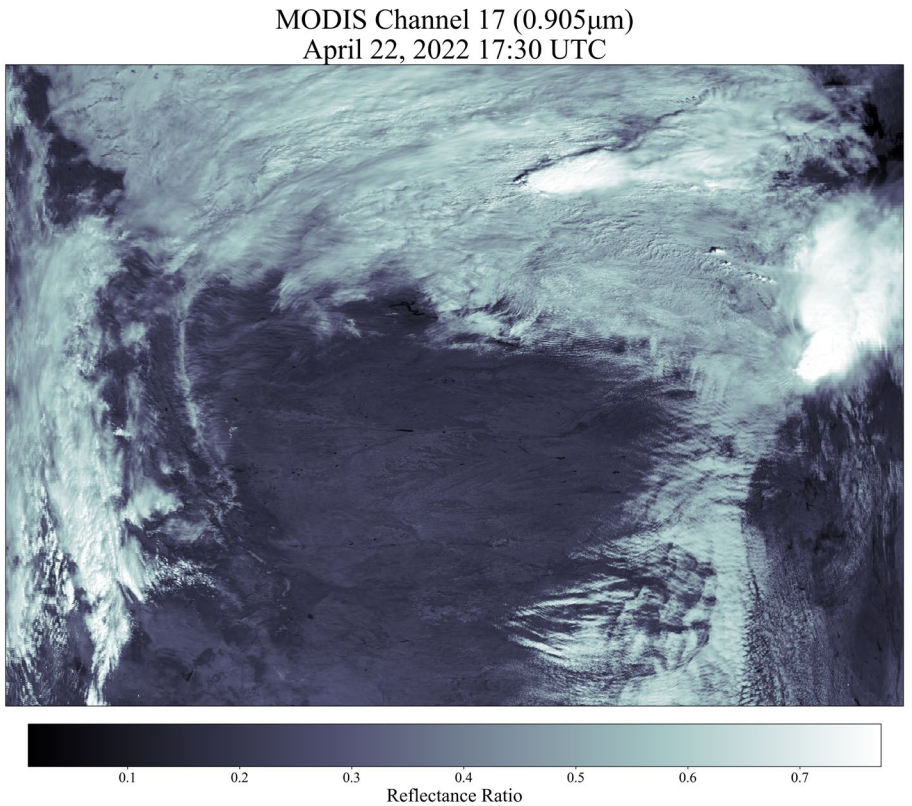
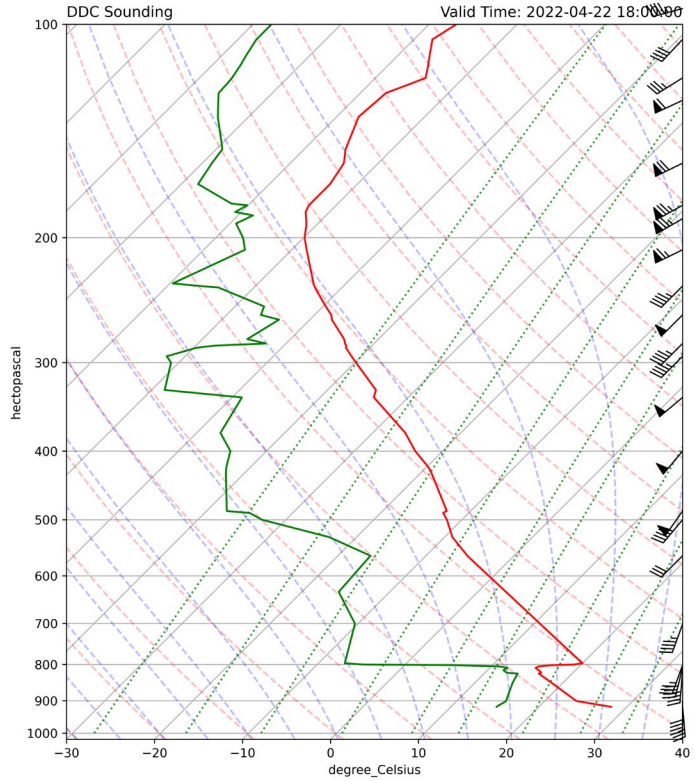
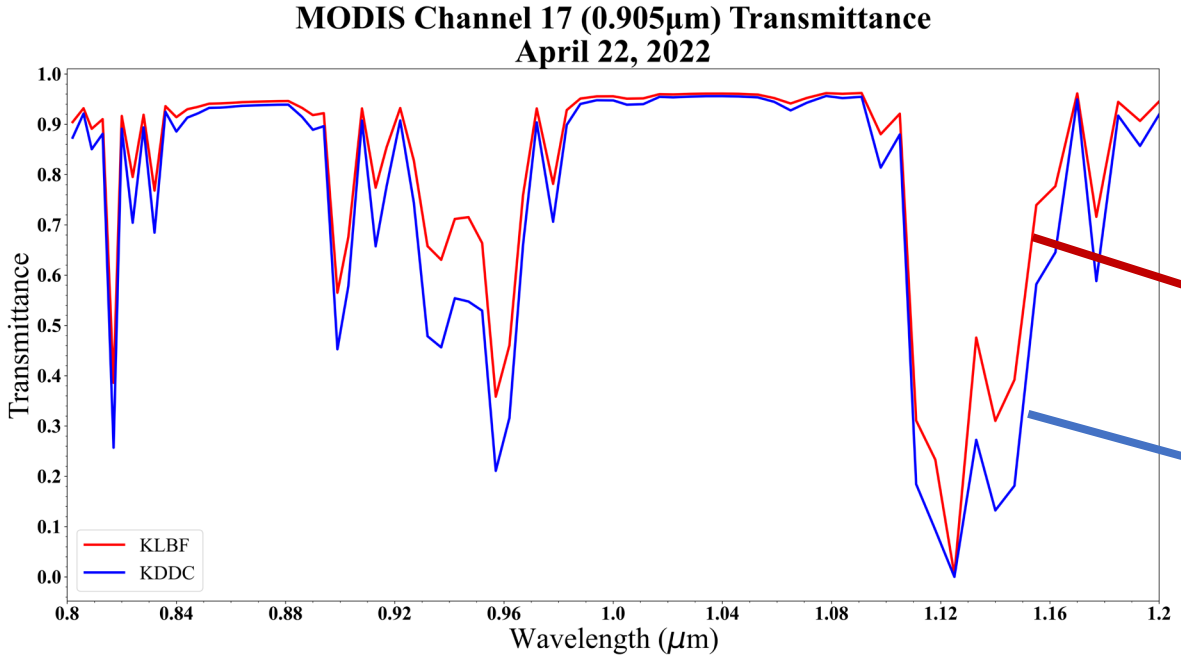
Dryline Case

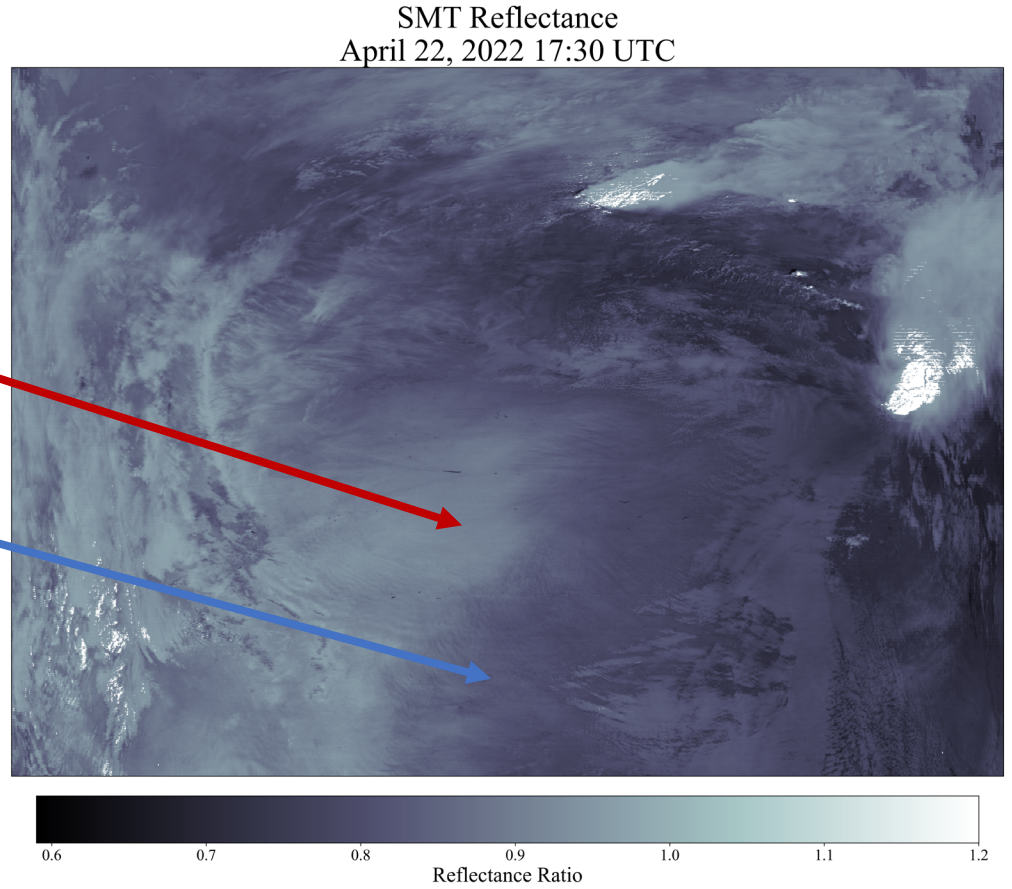






Dryline Case





Summary / Future Work

In Summary:

- Proposed 0.91 μm band can be utilized in various convective scenarios to gather information about boundary layer WV prior to convective initiation

- Solar Moisture Transmittance (SMT) appears to better highlight finer moisture features

Going Forward:

- Obtain and analyze imagery from MTG / FCI (launched Dec 2022)

- Run further radiative transfer simulations to resolve the degree of effect surface reflectance type has on the band and understand any other possible limitations

- Modelling convective scenarios and create synthetic 0.91 μm imagery to better understand the capabilities of the new band and how forecasters might utilize it in an operational setting