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# The CLIMCAPS Ozone Retrieval Product

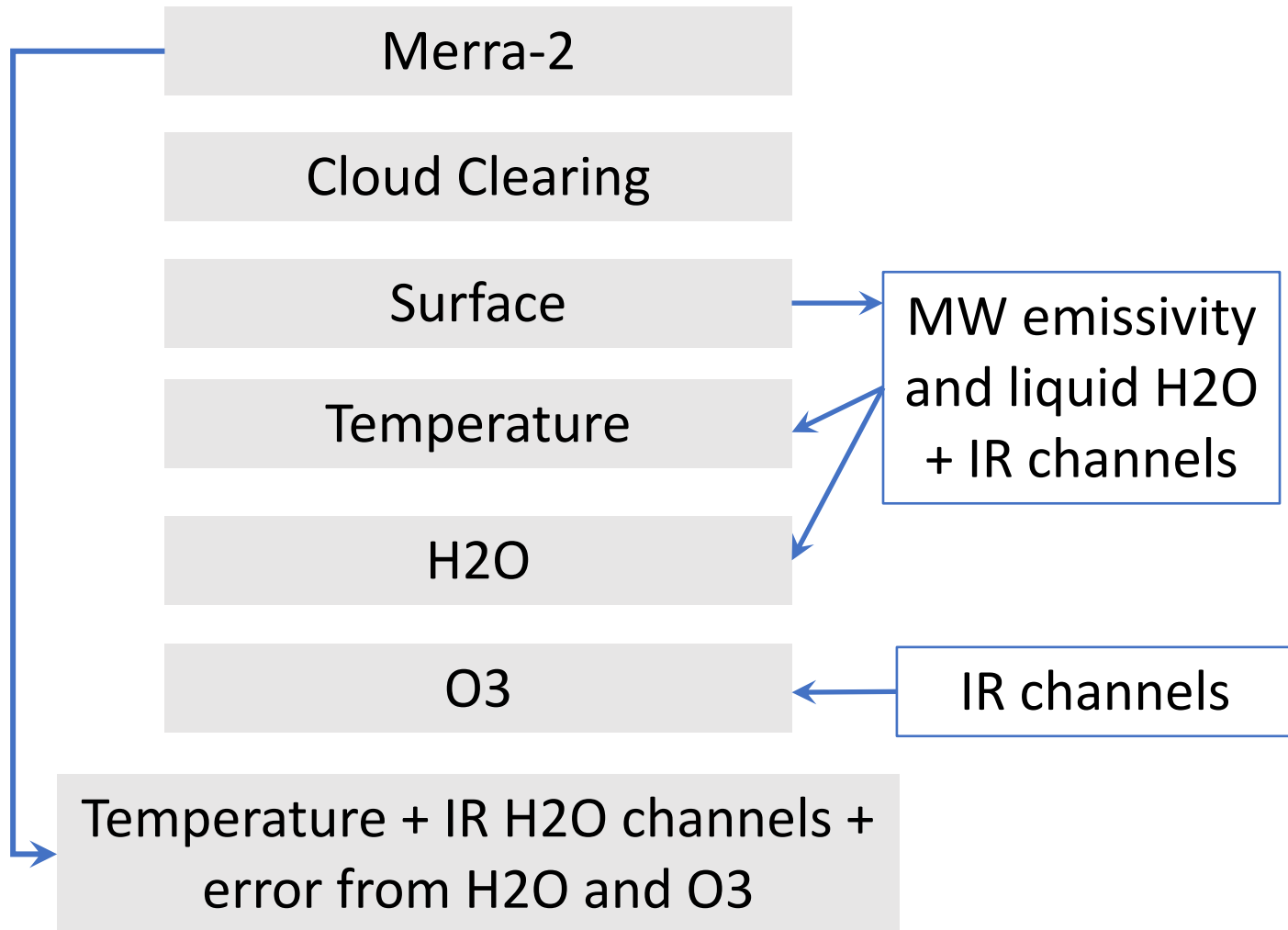
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## design considerations for climate applications

Nadia Smith & Chris Barnet



# CLIMCAPS\* O<sub>3</sub> retrieval methodology



\*Barnet, "Status and results from CLIMCAPS-SNPP and CLIMCAPS-Aqua", Oct 4 @ 11:30am

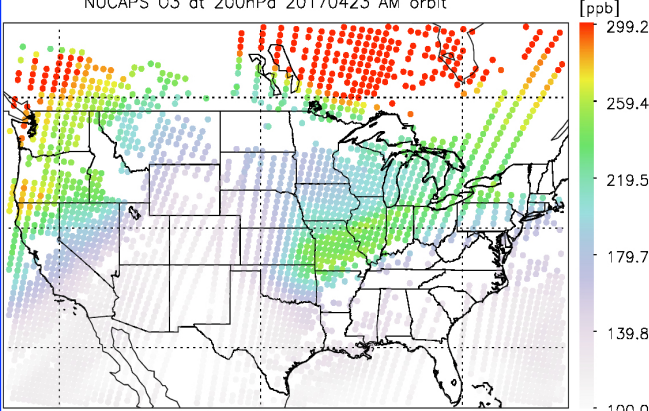


# NUCAPS O<sub>3</sub> retrieval product in thermodynamic context and diagnostic mode

night

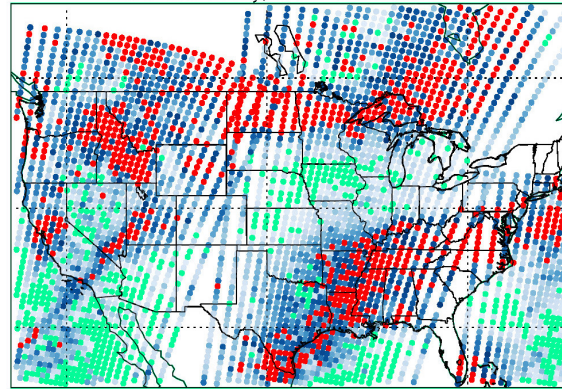
## O<sub>3</sub> at 200 hPa

NUCAPS O<sub>3</sub> at 200hPa 20170423 AM orbit



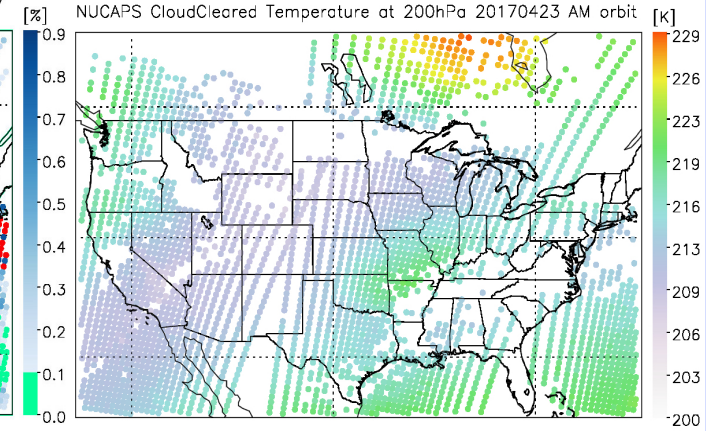
## % Cloud Fraction

NUCAPS cloud fraction 20170423 AM orbit, With QC (max=\*\*\*\*)  
Red > 90% cloudy, Green is CLEARSKY



## T at 200 hPa

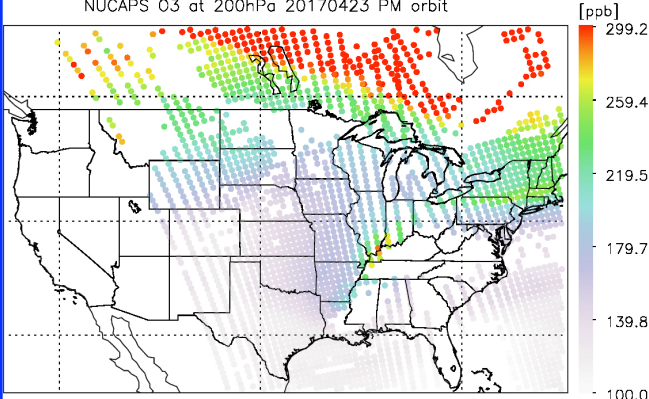
NUCAPS CloudCleared Temperature at 200hPa 20170423 AM orbit



day

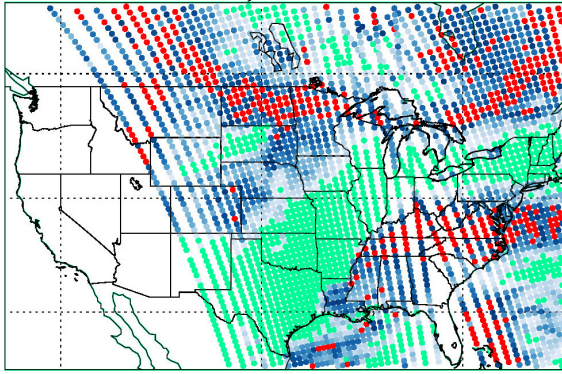
## O<sub>3</sub> at 200 hPa

NUCAPS O<sub>3</sub> at 200hPa 20170423 PM orbit



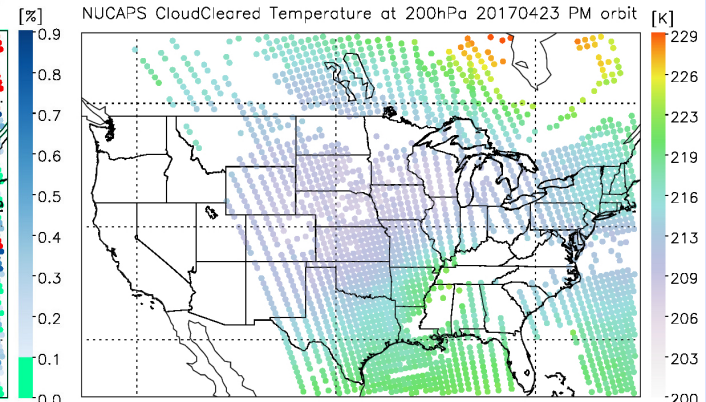
## % Cloud Fraction

NUCAPS cloud fraction 20170423 PM orbit, With QC (max=\*\*\*\*)  
Red > 90% cloudy, Green is CLEARSKY

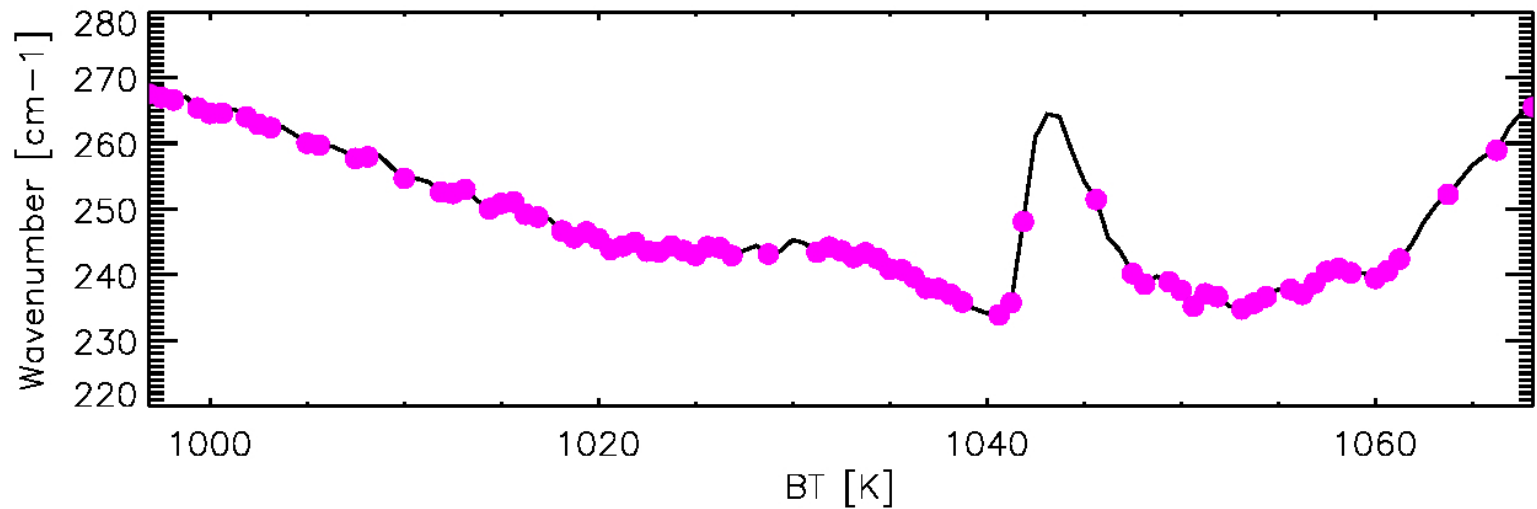
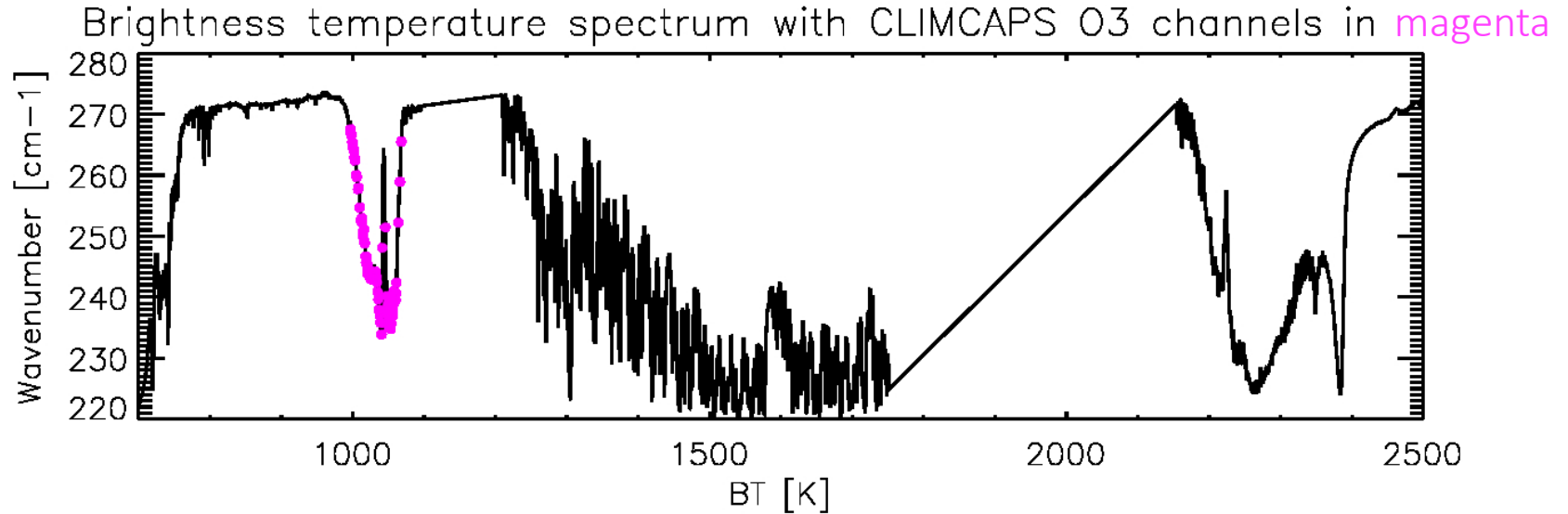


## T at 200 hPa

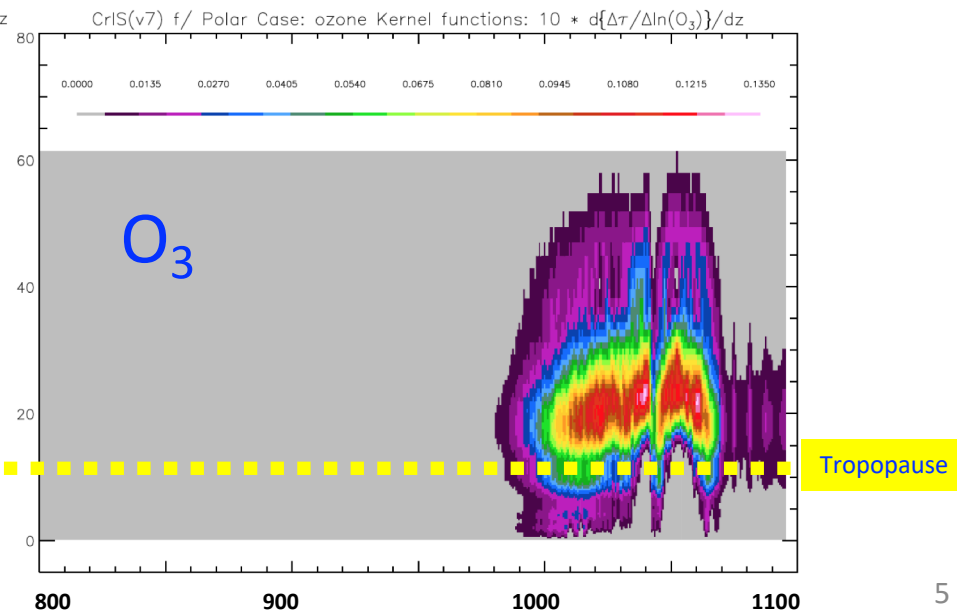
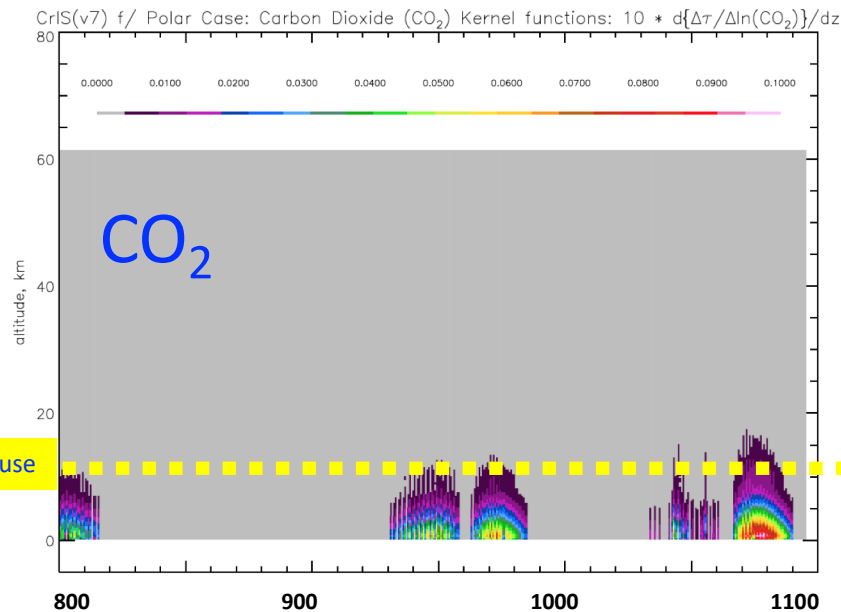
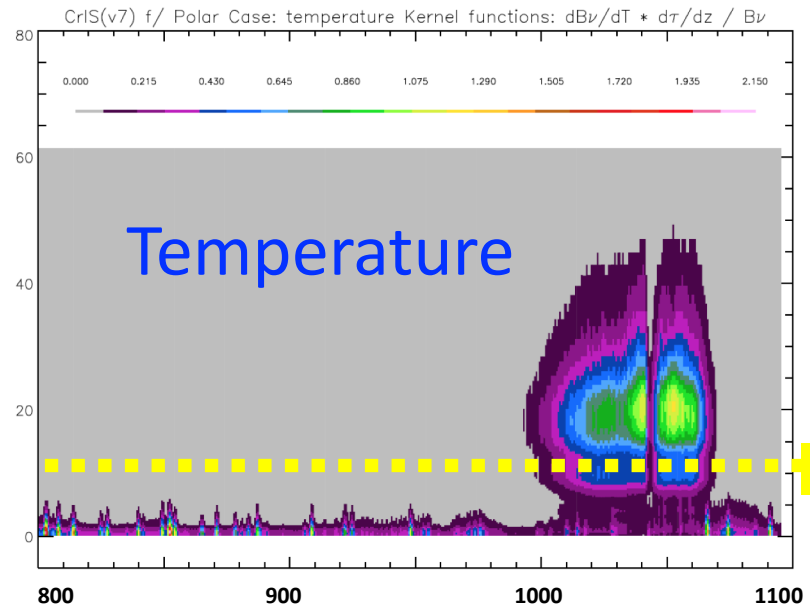
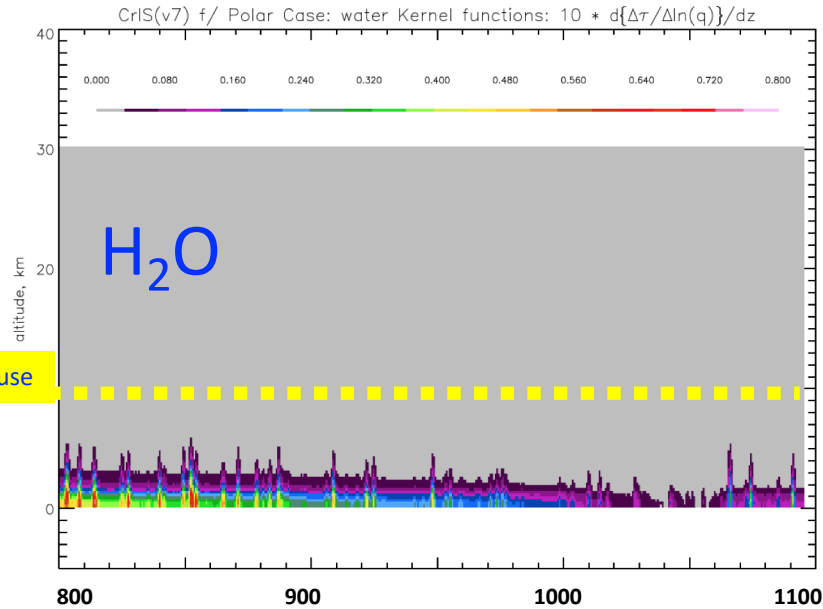
NUCAPS CloudCleared Temperature at 200hPa 20170423 PM orbit



# NUCAPS O<sub>3</sub> retrieval channels



# CrIS kernel functions in Ozone absorption band

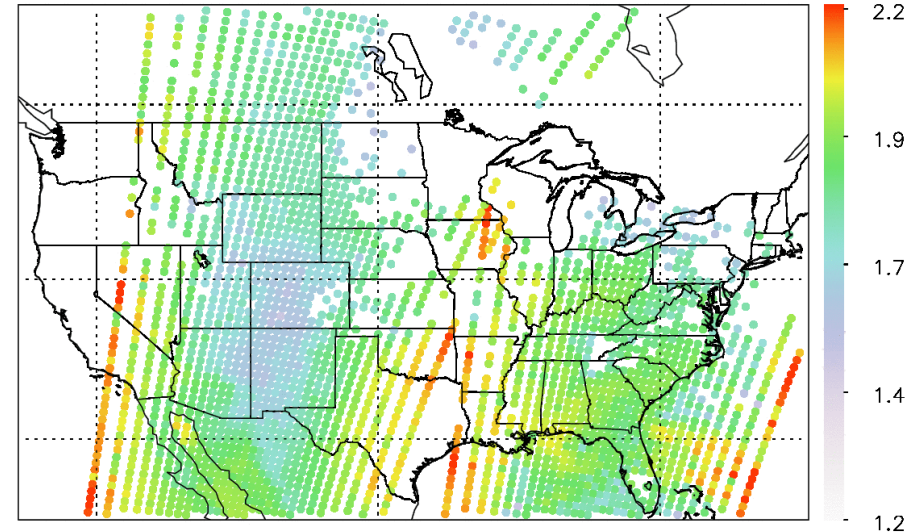
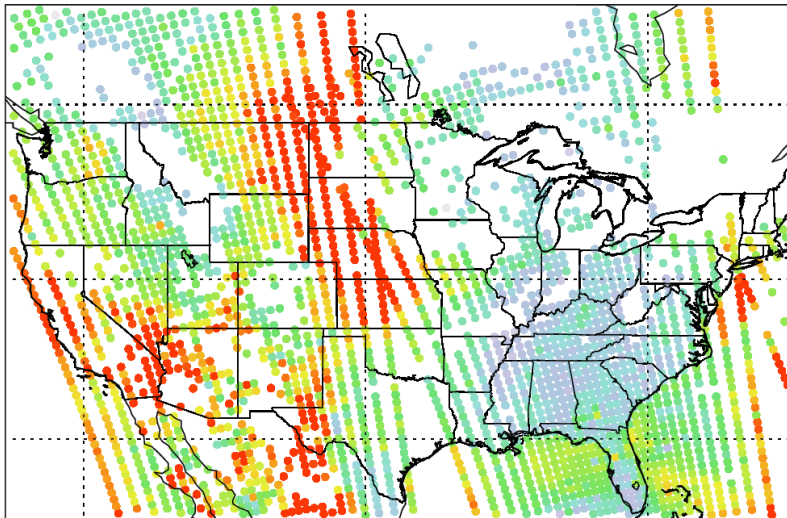


# NUCAPS-SNPP O<sub>3</sub> Degrees of Freedom

April, 20-28 2017

Day time – 1:30pm

Night time – 1:30pm



Mean DOF: ~2.0  
STD DOF: ~0.2

Statistically, am/pm DOF is the same

- Information content varies spatially with thermodynamic state – spatially + temporally – what does this mean for science and applications?
- We must be able to make sense of differences on a scene-by-scene basis as well as statistically. We need to evaluate/verify/understand the signal and the noise



# Designing a CLIMCAPS O<sub>3</sub> product for the scientific community

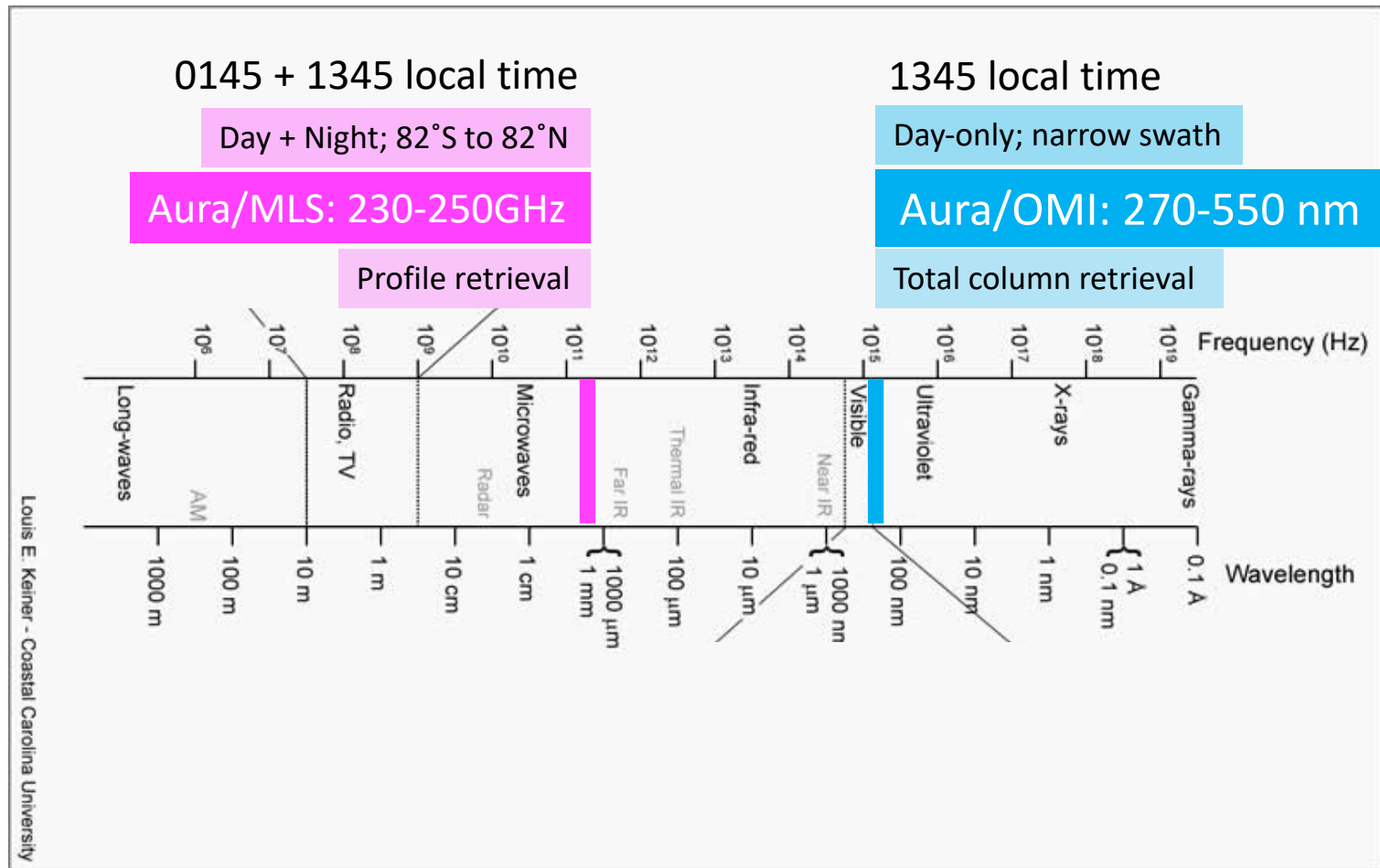
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Plan: Test the sensitivity of CLIMCAPS O<sub>3</sub> retrieval to different a-priori's, error covariance, channels, and evaluate the quality of observed spatio-temporal patterns in addressing target questions/applications

## Goals:

- Quantify and verify signal + noise
- Evaluate and demonstrate product quality in science applications

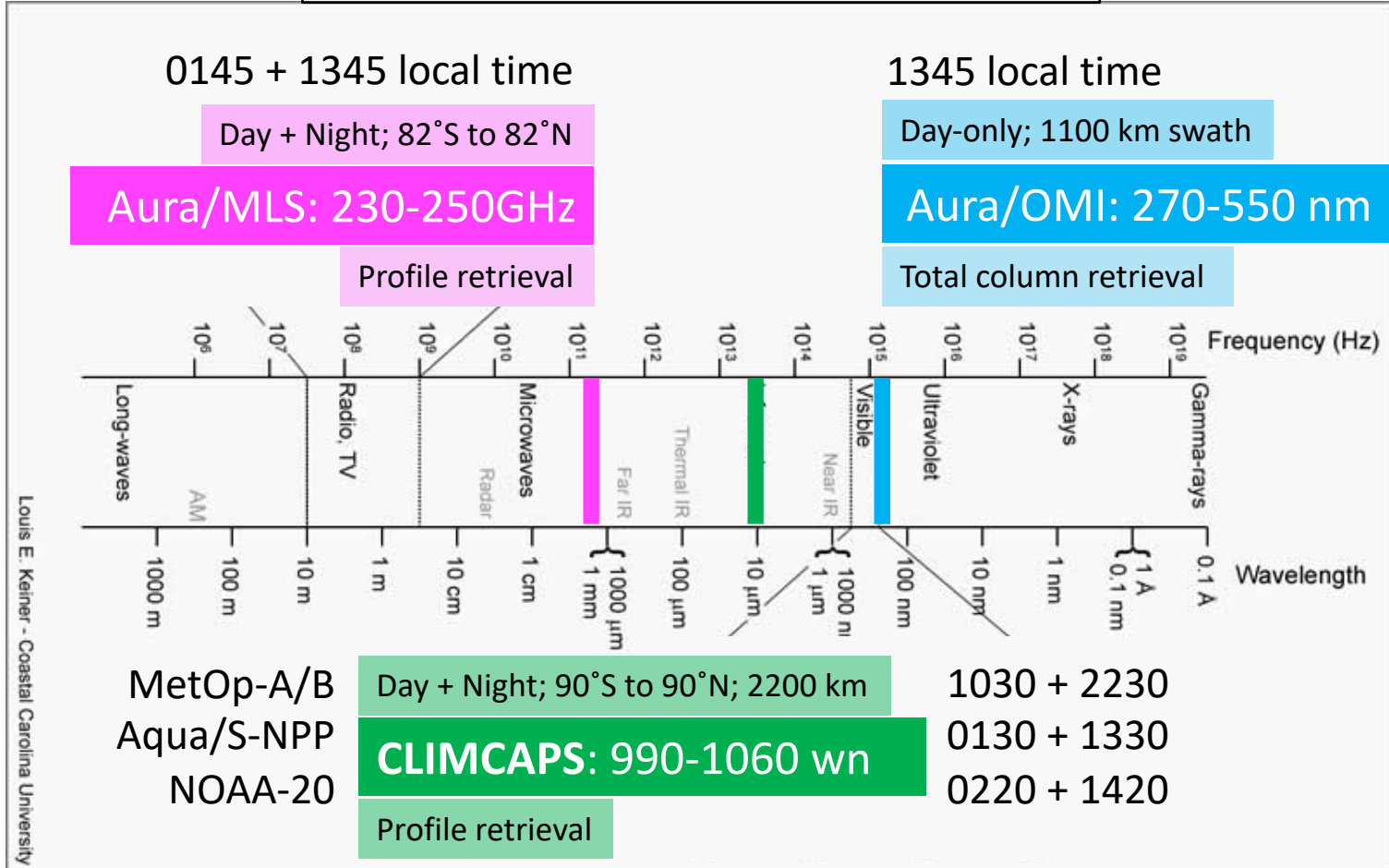
# MERRA-2 assimilated observations



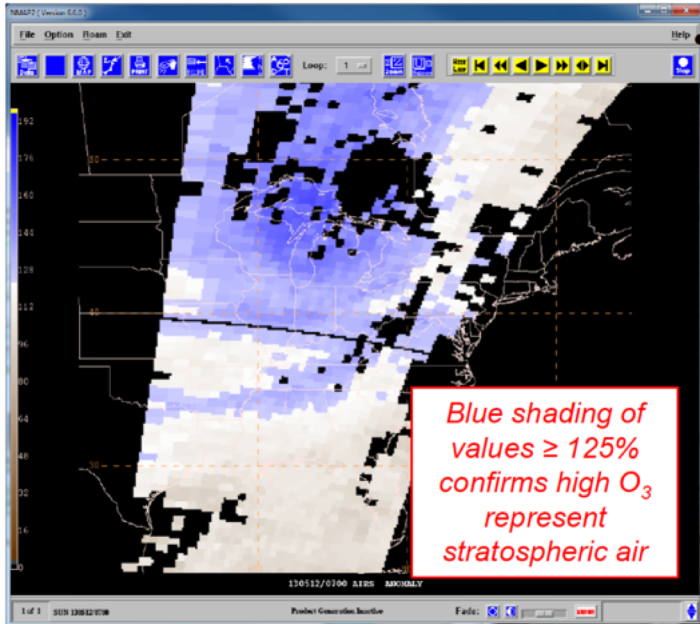


# CLIMCAPS with MERRA-2 a-priori

**CLIMCAPS = [theory + MW + UV] + IR**



# What are the science questions we aim to support with the CLIMCAPS ozone product?



Berndt et al. 2016 IEEE TGRS 54(2):958-967

- Global change/seasonality (O<sub>3</sub> depletion/recovery/healing)
- Stratosphere-Troposphere Exchange: Link to wildfires and extreme weather
- Hurricane Extratropical Transition: O<sub>3</sub> Anomalies
- Polar stratospheric clouds: Temperature < -78°C + nitric acid
- For the first time weather forecasters will have real-time operational access to an O<sub>3</sub> product: Level-3 (data cube) NUCAPS O<sub>3</sub> product in AWIPS-II\* – Spring 2019 release

\*Smith, “NOAA proving ground efforts in developing weather applications”, Oct 4 @ 5:40pm

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CLIMCAPS O<sub>3</sub> is *NOT* another Level-2 product  
for the archives

CLIMCAPS O<sub>3</sub> product is designed *with* and *for*  
scientific community

Focus on delivering high quality scientific information that  
goes beyond a single quantity to include quantitative  
information on the background thermodynamic & chemical  
state as well as full error budget

Questions?

