Synergy of LEO and GEO observations for observing global AOD (and other aerosol properties)

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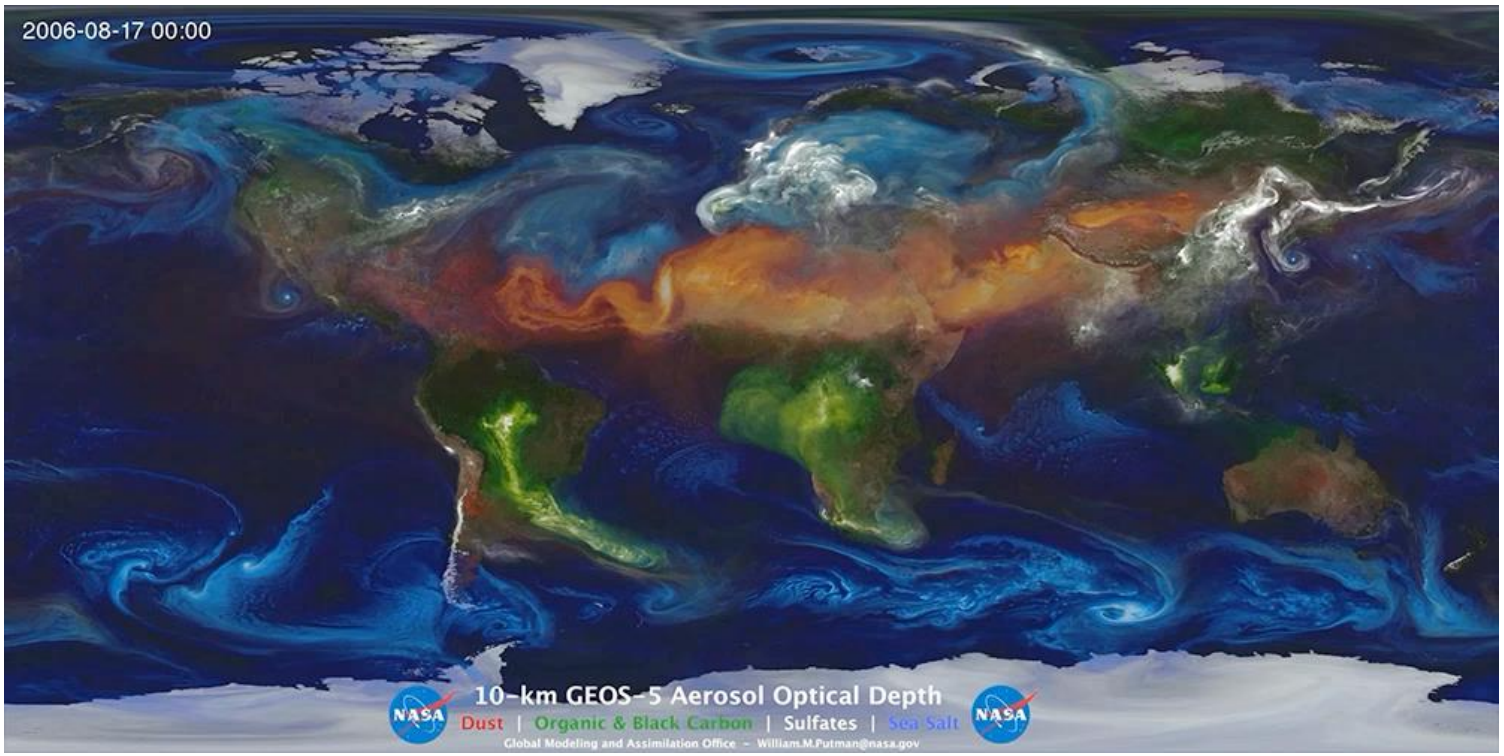
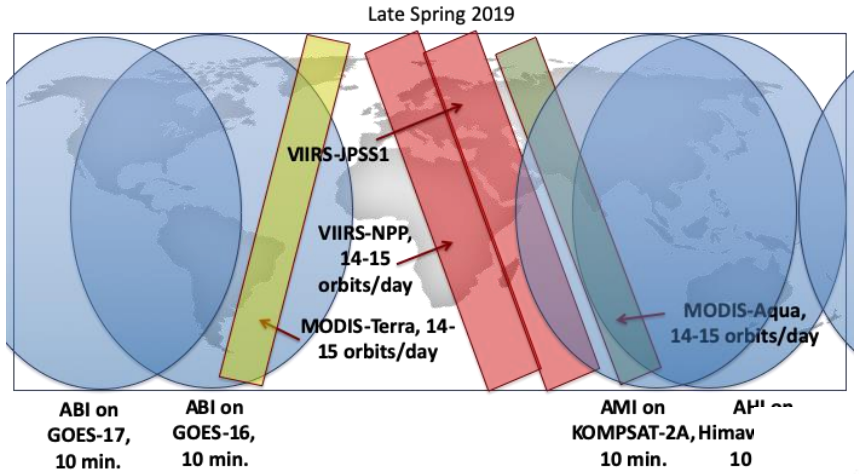


How can we “observe” (and validate) this GOES-5 Nature Run animation?

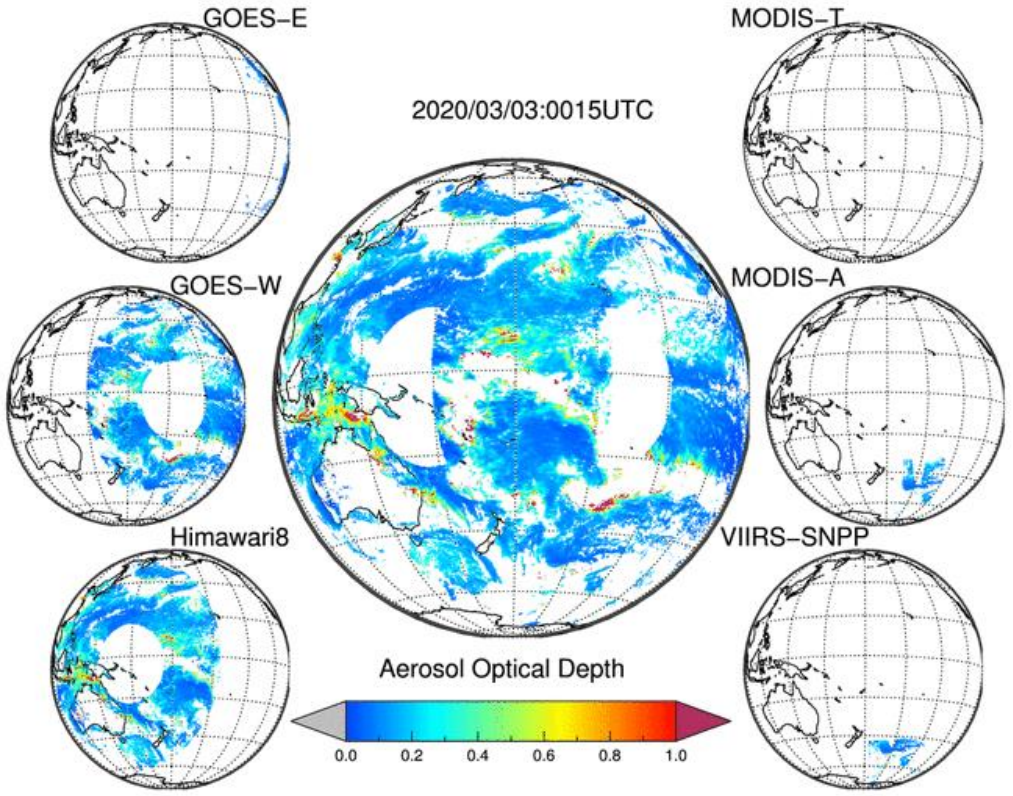
Need a constellation of observations!



And a strategy for merging!

Example:

Dark Target retrieval algorithm on constellation of VIS/NIR/SWIR providing AOD every ½ hour.



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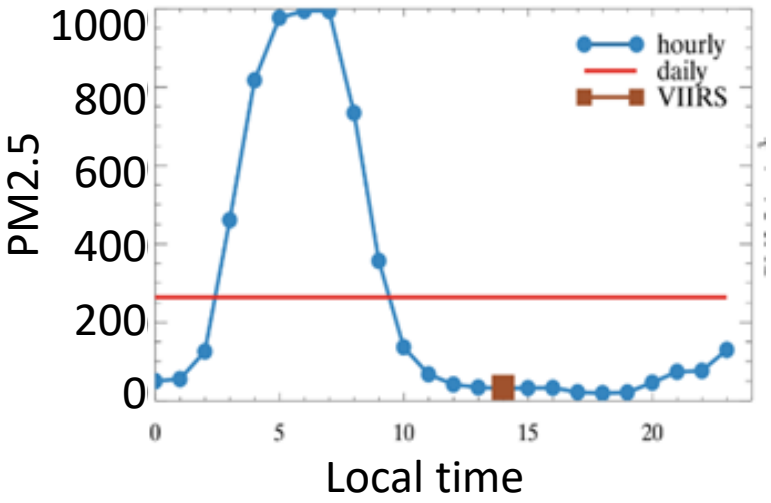
GEO: Temporal view of air quality (merge with LEO)

Diurnal variation of PM2.5.
Seely Lake, Montana
1 Sep 2017



Estimating daily average PM2.5 is not enough. Estimating from polar orbit is also not enough.

Multiple exposures (even for only 2 hours) to high levels of PM2.5 can increase risk to cardiovascular disease by 40%.

Predicting hourly/sub-hourly PM2.5 using satellite aerosol products is critical.

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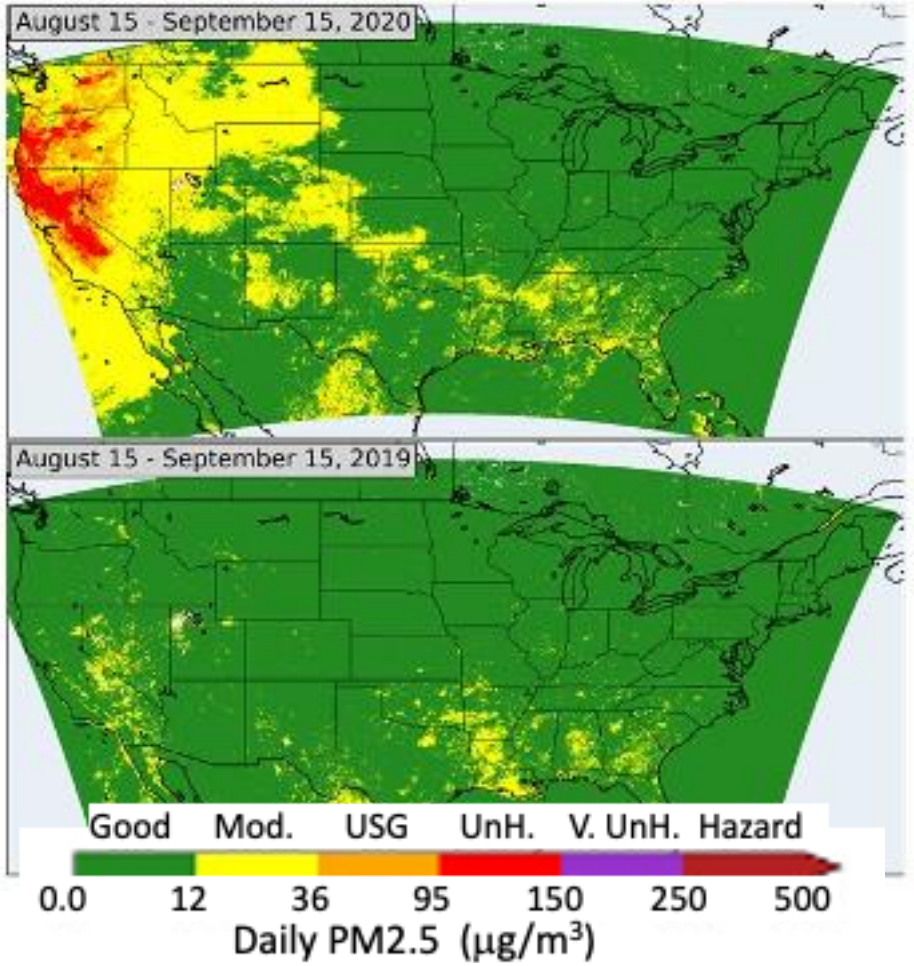
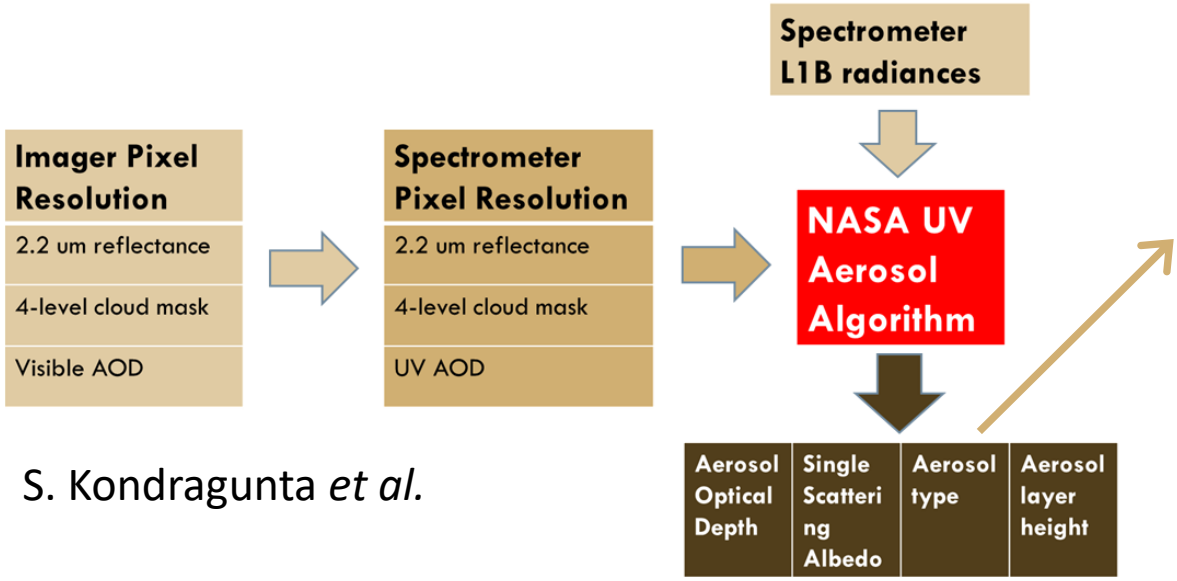
Impact of CA/OR/WA Wildfires: Surface PM2.5 Estimated from SNPP+NOAA-20 VIIRS AOD, 2020 vs 2019

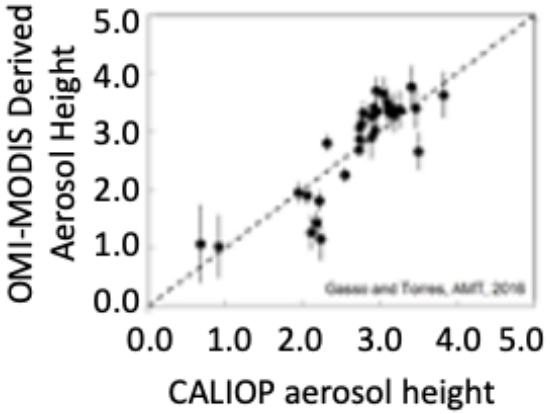


Air quality impact of smoke from fires. Daily PM2.5: 2020 vs. 2019

VIS/NIR/SWIR Imager + Ocean color Imager + UV/VIS Spectrometer, LEO+GEO

→ Aerosol "Type", "Height", SSA, etc.





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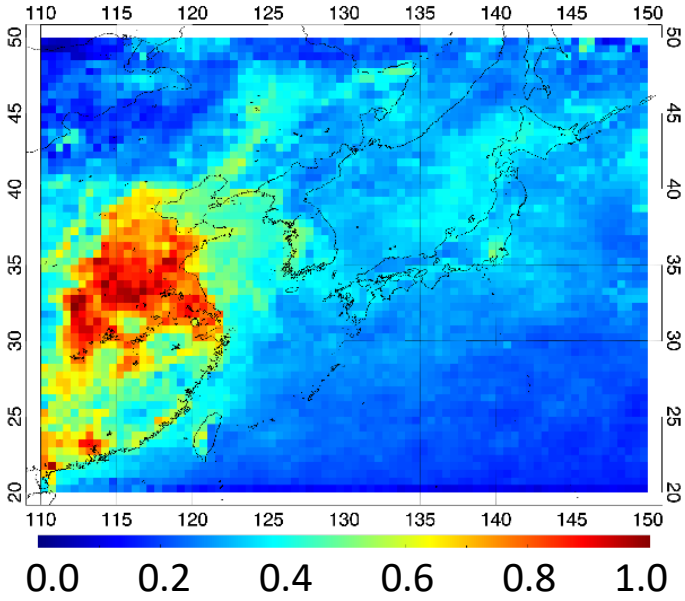
GOCI	AHI MRM	AHI ESR	VIIRS EDR
11.3%	31.1%	33.3%	10.3%
MODIS DT	MODIS DB	MISR	
8.3%	3.7%	2.1%	

% of retrievals going into map (based on validation with sunphotomter and other factors)

Fused AOD during KORUS-AQ



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Lots of work to do!

- Calibration (are all sensors “consistent”?)
- Funky geometry (GEO different than LEO, account in RT?)
- Canceling biases in LEO may not occur in GEO (scattering phase functions versus observing geometry, over-sampling sites within disk)
- GEO Imager data are HUGE! (2.75 GB native disk imagery), so reprocessing with consistent algorithms needs thought, CPUs and storage
- Requires new algorithms, that make use of time-dependence and multi-observation synergy
- Effective and useful imagery
- Communication of uncertainties when you have multiple kinds of sensors in different kinds of orbits.