Future Satellite Capabilities for Air Quality Applications

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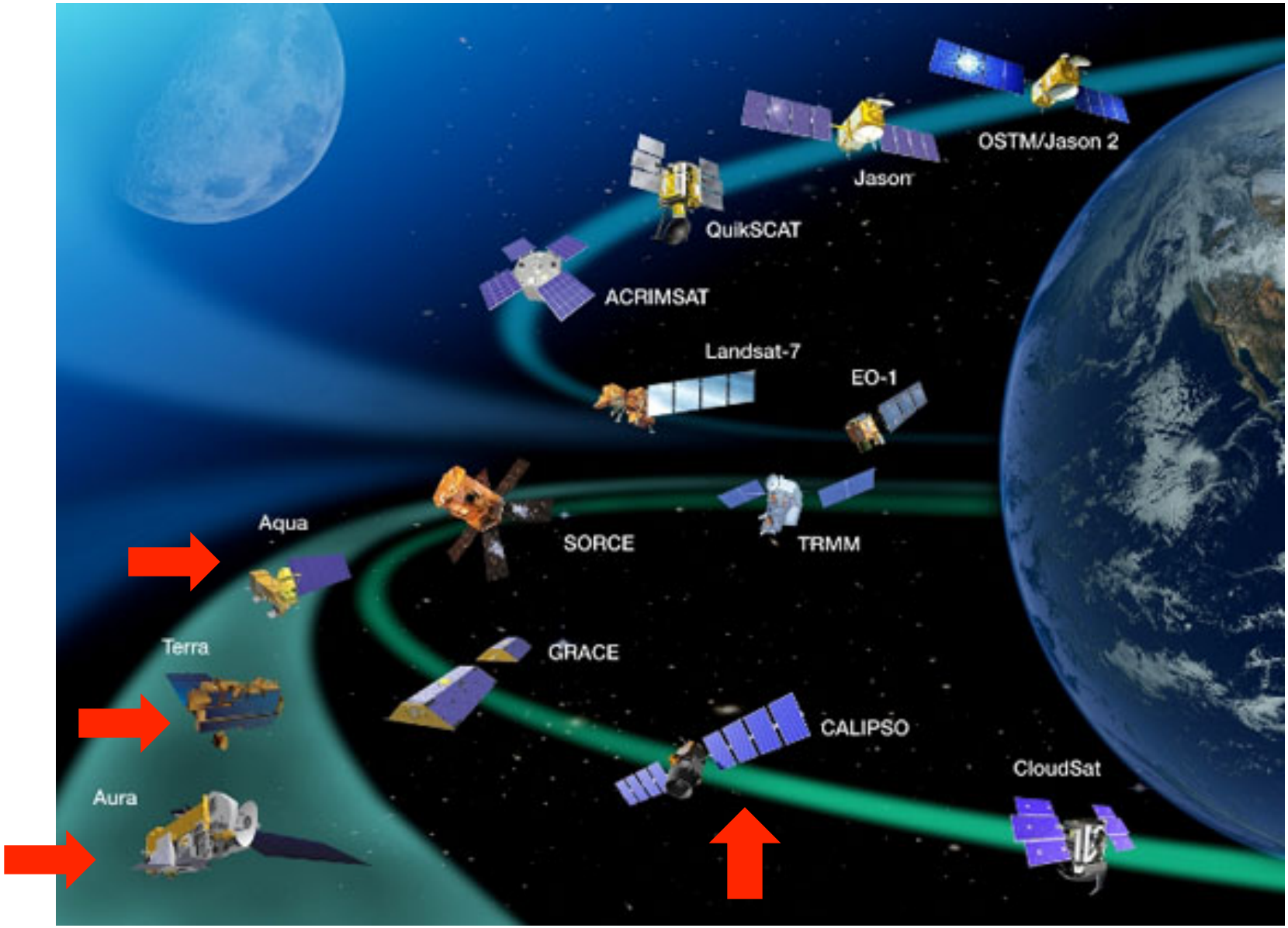
EPA Training
September 29 – October 1, 2014

ARSET - AQ

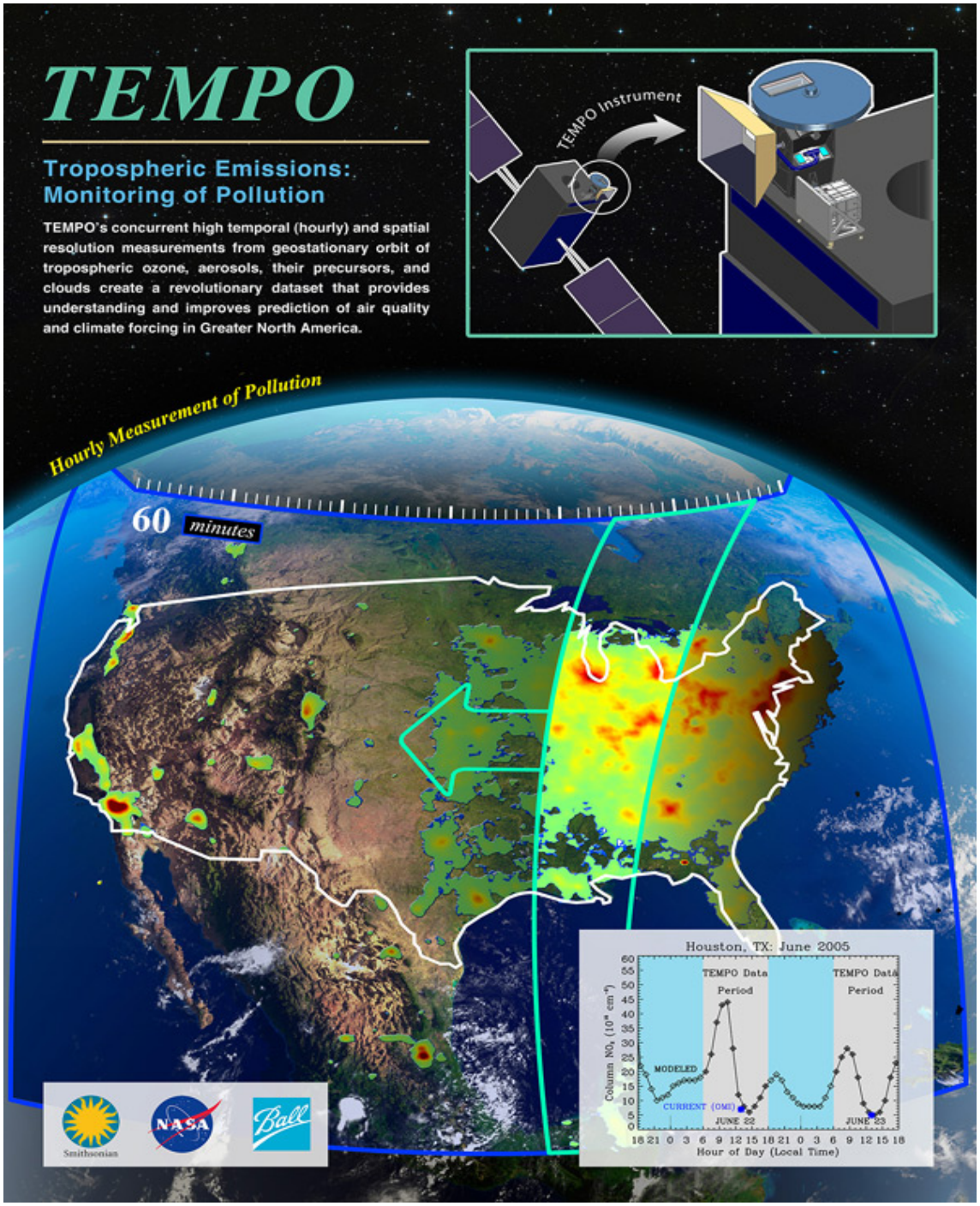
Applied Remote SEnsing Training – Air Quality

A project of NASA Applied Sciences

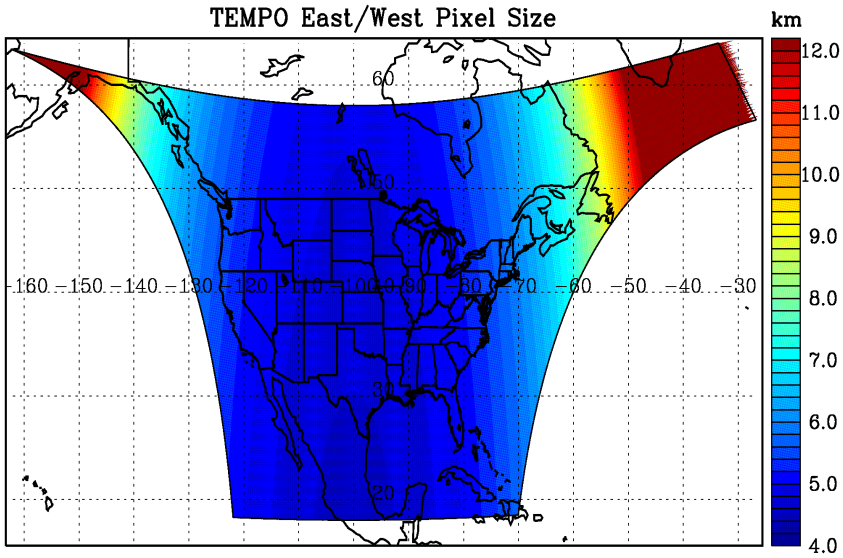
Current Sensors & Air Quality Capabilities

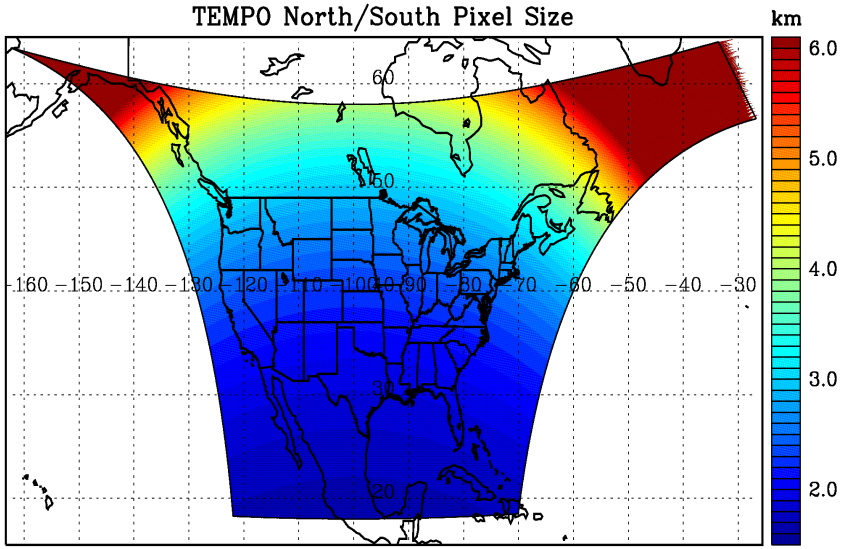


- Geostationary over Northern America
- High Temporal Resolution - 1 hour
- High Spatial Resolution – 2.2x4.7 km
- Spectral Range 290-740 nm
- Data Products:O3, NO2, SO2, H2CO, C2H2O2, aerosols, cloud parameters, and UVB radiation.
- Expected Launch 11/2018



TEMPO footprint (GEO at 100° W)





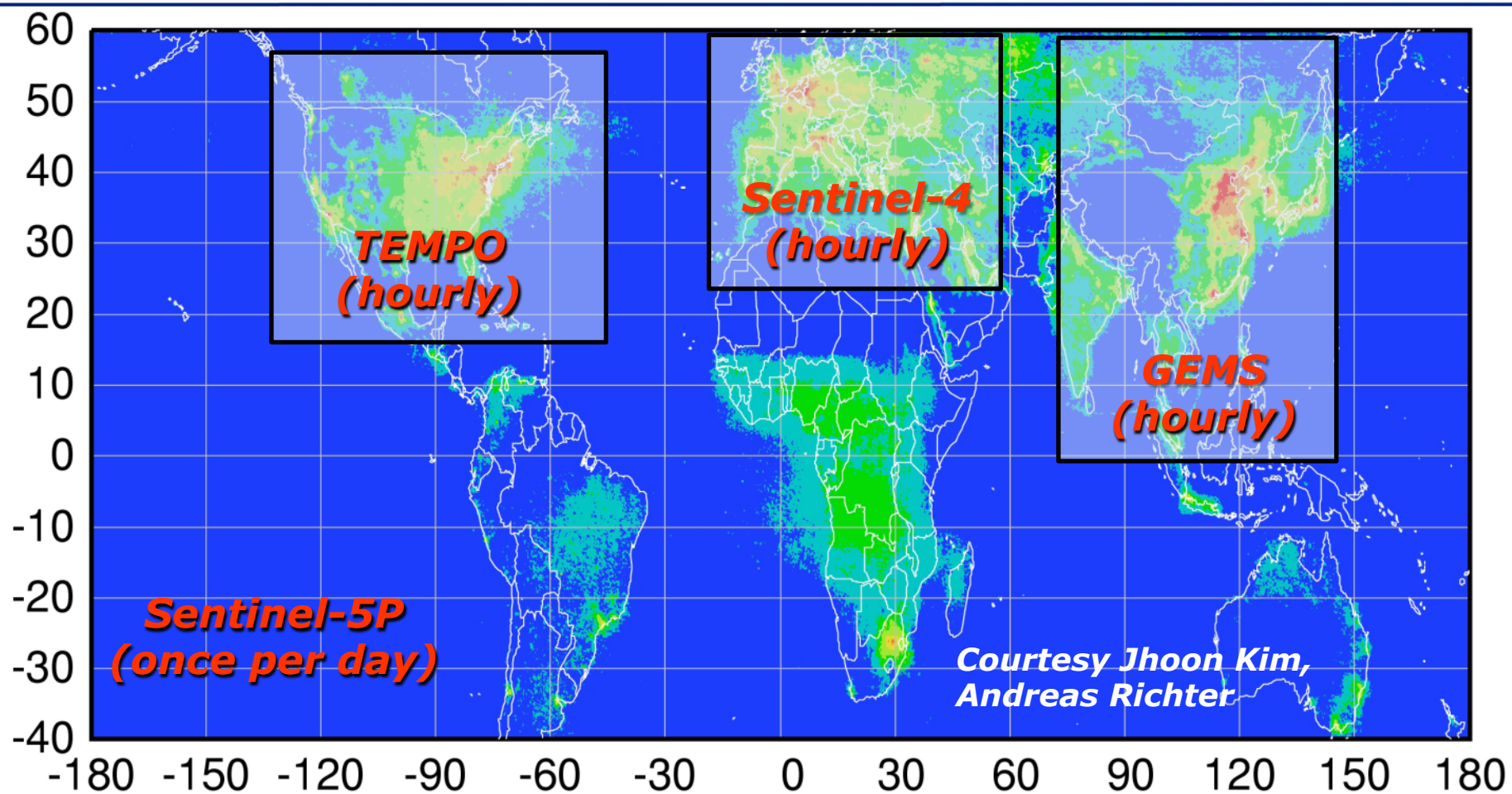
Location	N/S (km)	E/W (km)	GSA (km^2)
36.5°N, 100°W	2.11	4.65	9.8
Washington, DC	2.37	5.36	11.9
Seattle	2.99	5.46	14.9
Los Angeles	2.09	5.04	10.2
Boston	2.71	5.90	14.1
Miami	1.83	5.04	9.0
Mexico City	1.65	4.54	7.5
Canadian tar sands	3.94	5.05	19.2

Assumes 2000 N/S pixels

For GEO at 80°W, pixel size at 36.5°N, 100°W is 2.2 km × 5.2 km.

Slide from KChance

Global pollution monitoring constellation (2018-2020)



Policy-relevant science and environmental services enabled by common observations

- Improved emissions, at common confidence levels, over industrialized Northern Hemisphere
- Improved air quality forecasts and assimilation systems
- Improved assessment, e.g., observations to support United Nations Convention on Long Range Transboundary Air Pollution

Slide from KChance

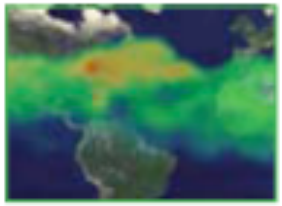
The GEOstationary Coastal and Air Pollution Events (GEO-CAPE)

NASA Earth Science Decadal Survey Mission

Expected Launch - 2020

GEOSTATIONARY COASTAL AND AIR POLLUTION EVENTS (GEO-CAPE)

Launch: 2013-2016 **Mission Size: Medium**



Identification of human versus natural sources of aerosols and ozone precursors

Dynamics of coastal ecosystems, river plumes, and tidal fronts

Observation of air pollution transport in North, Central, and South America

Prediction of track of oil spills, fires, and releases from natural disasters

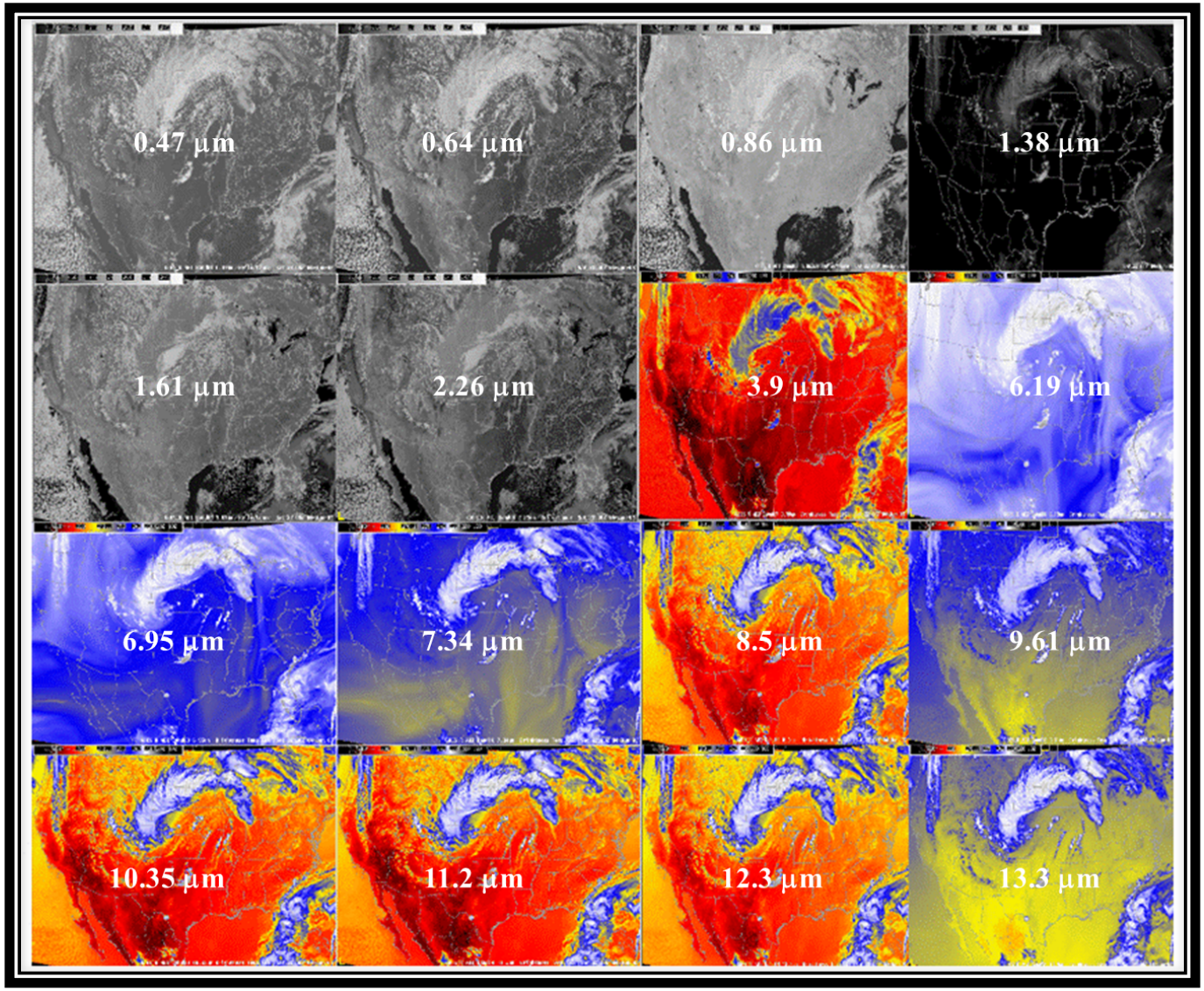
Detection and tracking of waterborne hazardous materials

Coastal health

Forecasts of air quality

Expected Launch:	**2016**
Advance Baseline Imager (ABI):	**16 Spectral bands**
Very High Temporal Resolution:	**15 min to 30 seconds**

GOES-R Spectral Coverage



	ABI	Current GOES Imager
Spectral Coverage	16 bands	5 bands
Spatial Resolution		
0.64 µm Visible	0.5 km	~ 1 km
Other visible/near-IR	1.0 km	n/a
Bands (>2 µm)	2 km	~ 4 km
Spatial Coverage		
Full Disk	4 per hour	Scheduled (3 hrly)
CONUS	12 per hour	~4 per hour
Mesoscale	Every 30 sec	n/a
Visible (reflective bands)		
On-orbit calibration	Yes	No

Remote Sensing Capabilities - Current Missions

Sensor	Launch Date	Design Length	Resolution	End Date/Problems
Terra - MODIS	1999	5 Years	10/3/(1) KM	2015 -2016
Terra – MISR	1999	5 Years	17.6 KM	2015 -2016
Aqua - MODIS	2001	5 Years	10/3/(1) KM	2018
Aura – OMI	2004	6 Years	13 x 27 KM	Loss of data
Parasol - POLDER	2004	2 Years	18 KM	Out of A-Train
Calipso - CALIOP	2006	3 Years	5 Km x .2 KM	
NPP - VIIRS	2011	5 Years	6 KM	
NPP - OMPS	2011	5 Years	6 KM	
TES				
MOPITT				
Geostationary				
MSG - SEVIRI	2005		10 KM	
GOES - GASP	2006	5 Years	4 KM/30 Min	

Remote Sensing of Aerosol Capabilities - Upcoming Missions

Sensor	Launch Date	Measurements	Notes
EarthCARE	2015	Aerosols/Clouds	LIDAR Narrow swath
OCO-2	2014	CO2/Aerosols	7 KM Resolution/7 Yr.
TROPOMI	2014	Aerosols/Gases	Few bands
Sentinel-3	2014 - 2020	Aerosols	Improve A-Train Capabilities
Geostationary			
GOES-R	2015	Aerosols	North America
TEMPO	2018-2019	Aerosol & Trace Gases	Cluster
Sentinel-4	2019	Aerosol & Trace Gases	Cluster
MP-GEOSat	2018	Aerosol & Trace Gases	Cluster
GEO-CAPE	2020	Aerosols	North America May be preempted by TEMPO