Demo of Aquatic/Ocean Color Tools

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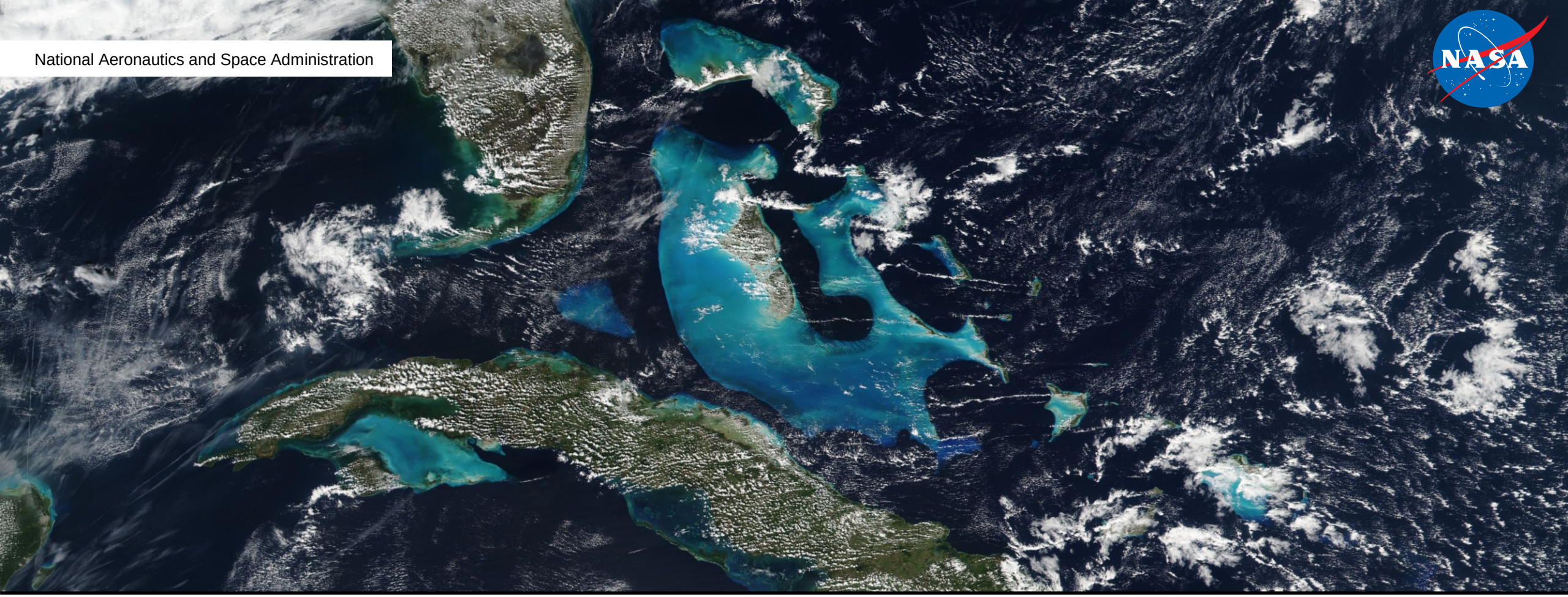


Overview of Ocean Color Data Access and Analysis Tools

Amita Mehta, NASA-UMBC-JCET;

Applied remote Sensing Training (ARSET) program

7 August 2018

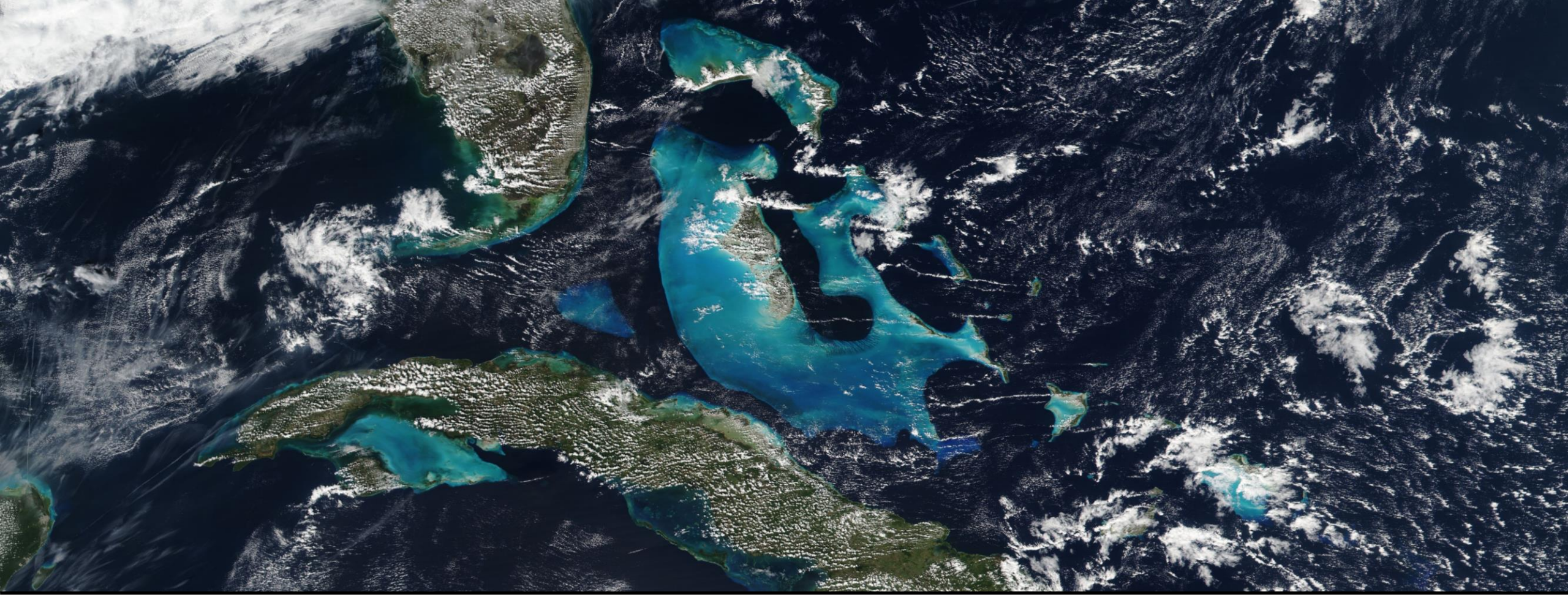
Objectives

Overview of:

- Monitor Ocean Color data
- Data search, spatial and temporal subsetting, analysis, and visualization:
  - OceanColor Web: https://oceancolor.gsfc.nasa.gov/
  - Giovanni: http://giovanni.gsfc.nasa.gov/giovanni/
- Image Processing and Visualization Software:
  - SeaDAS: http://seadas.gsfc.nasa.gov/

Outline

- About ARSET
- Overview of Current Remote Sensing Observations for Water Quality Monitoring
- Demonstration of Giovanni, OceaColor Web, SeaDAS
  [Focus: MODIS Ocean Color Data]



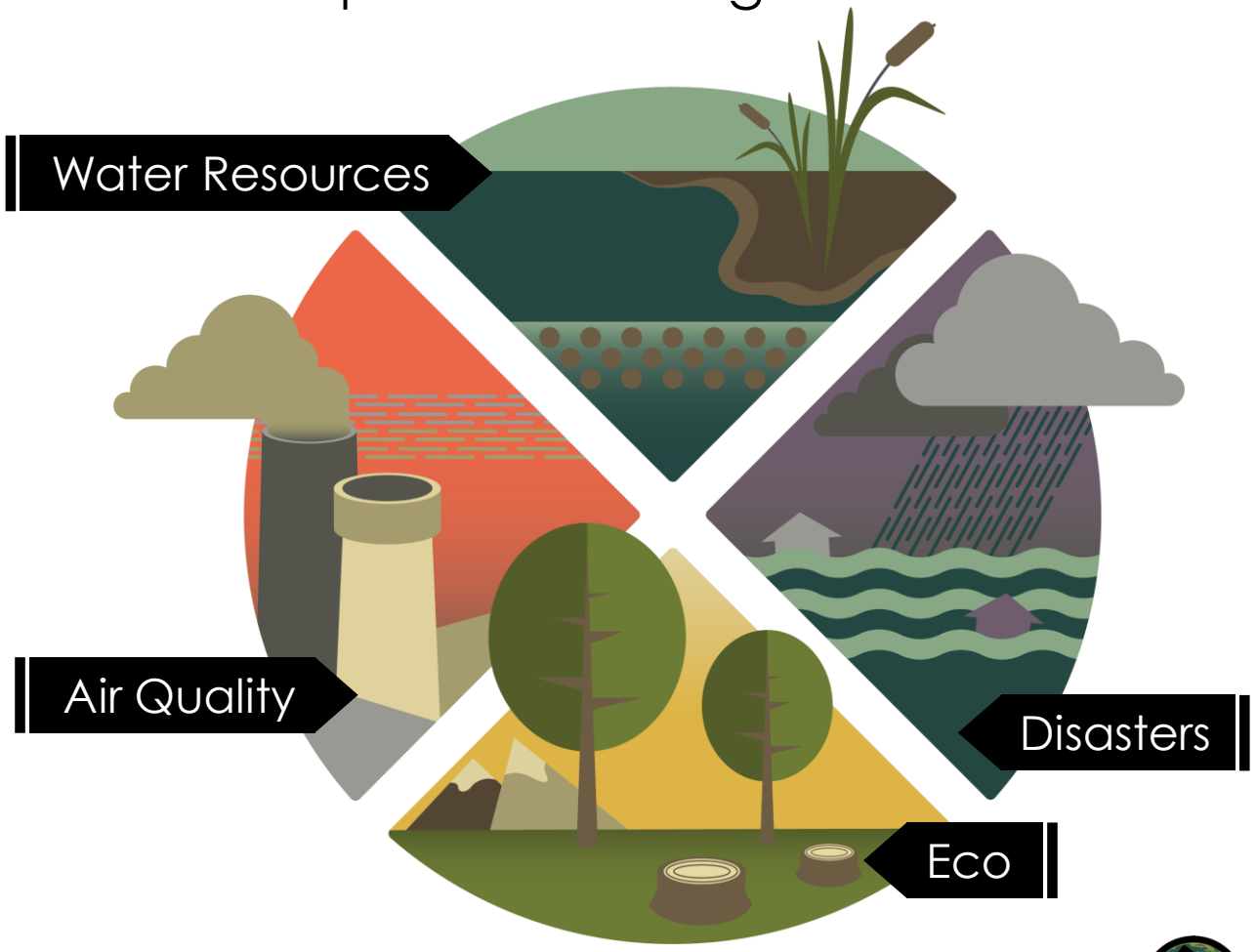
NASA's Applied Remote Sensing Training Program (ARSET)

NASA's Applied Remote Sensing Training Program (ARSET)

http://arset.gsfc.nasa.gov/

- Empowering the global community through remote sensing training
- Part of NASA's Applied Sciences Program
- Seeks to increase the use of Earth science in decision-making through training for:
  - policy makers
  - environmental managers
  - other professionals in the public and private sector

Topics for Trainings Include:



ARSET Team Members

Program Support

- Ana Prados, Program Manager (GSFC)
- Brock Blevins, Training Coordinator (GSFC)
- David Barbado, Spanish Translator (GSFC)
- Annelise Carleton-Hug, Program Evaluator (Consultant)
- Elizabeth Hook, Technical Writer/Editor (GSFC)
- Selwyn Hudson-Odoi, Training Coordinator (GSFC)
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- Stephanie Uz, Program Support (GSFC)

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- Amita Mehta, Instructor (GSFC)
- Erika Podest, Instructor (JPL)

Land & Wildfires

- Cynthia Schmidt, Lead (ARC)
- Amber Jean McCullum, Instructor (ARC)

Health & Air Quality

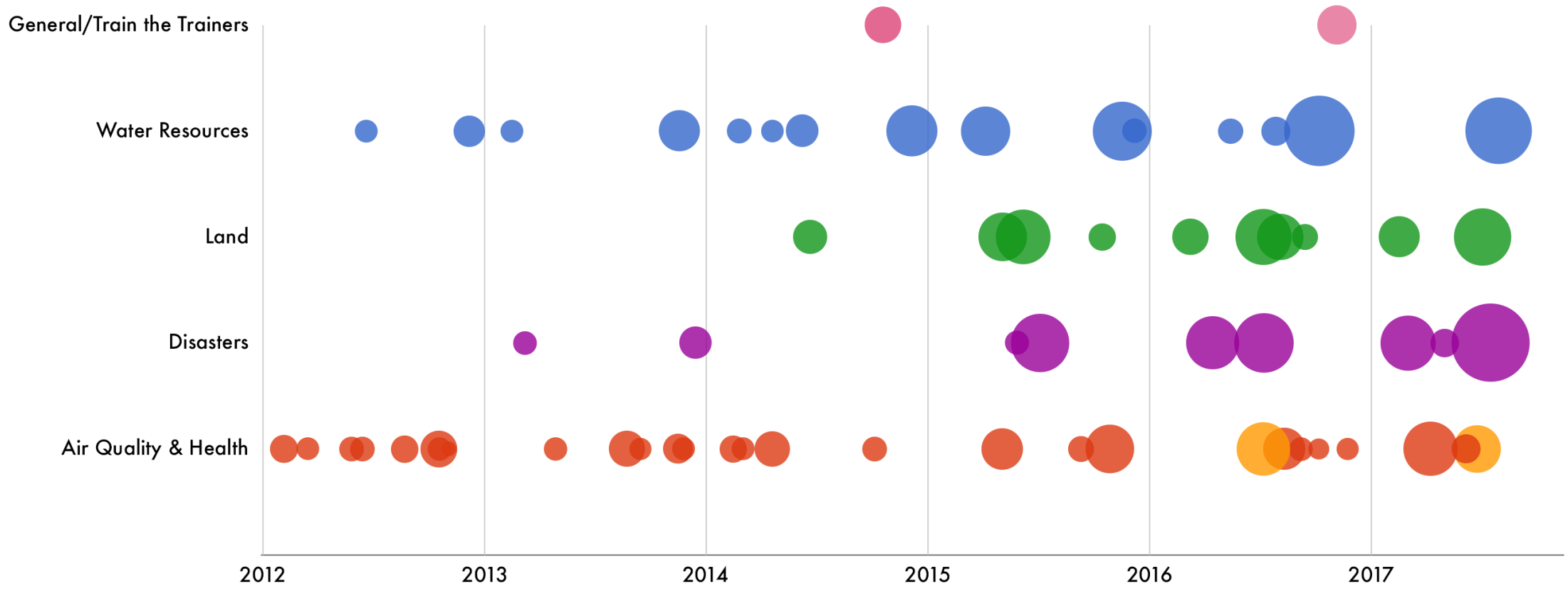
- Pawan Gupta, Lead (GSFC)
- Melanie Cook, Instructor (GSFC)

Acknowledgement:

- We wish to thank Nancy Searby for her continued support

ARSET Trainings

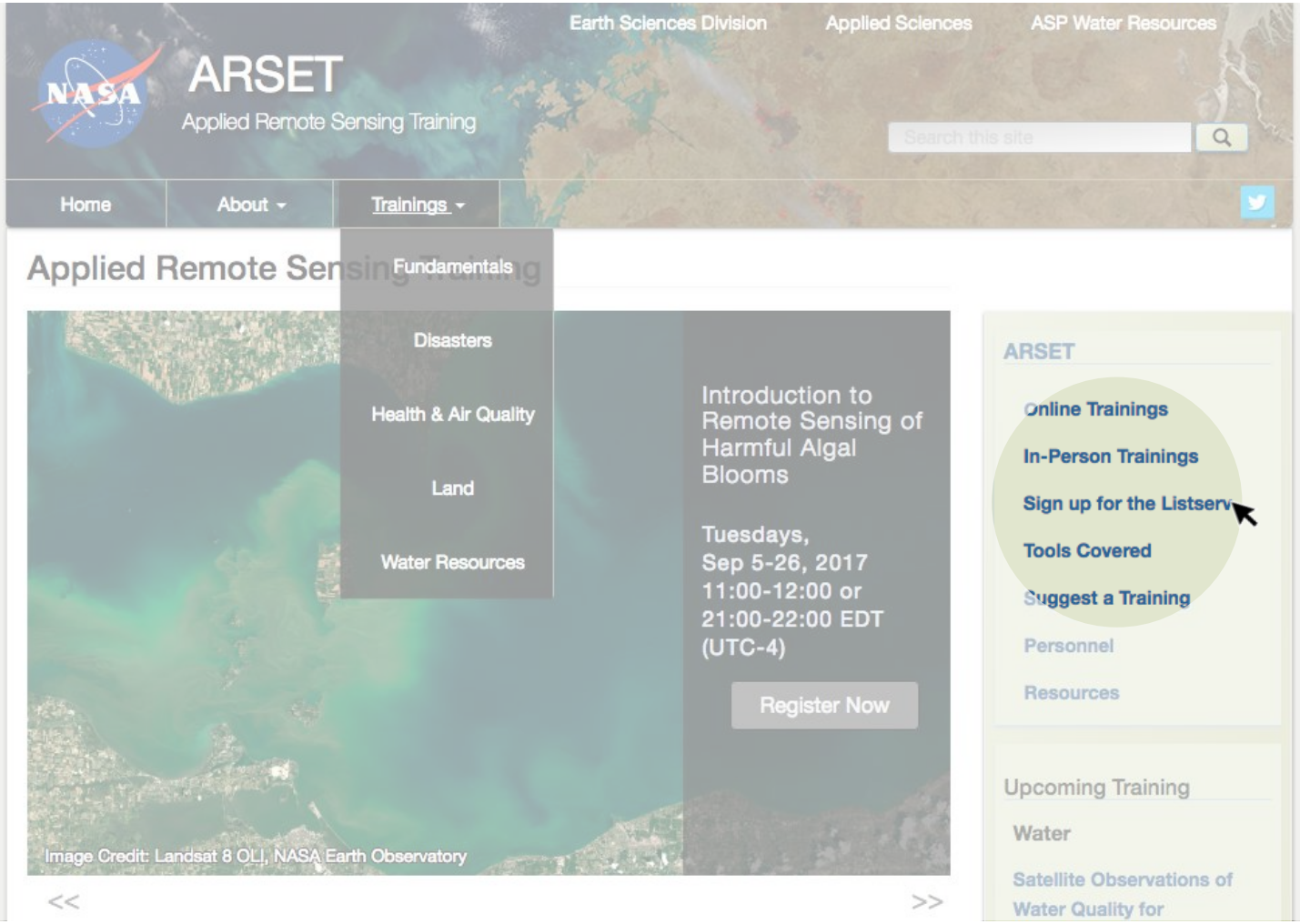
100 trainings | 13,000+ participants | 160+ countries | 3,700+ organizations



* size of bubble corresponds to number of attendees

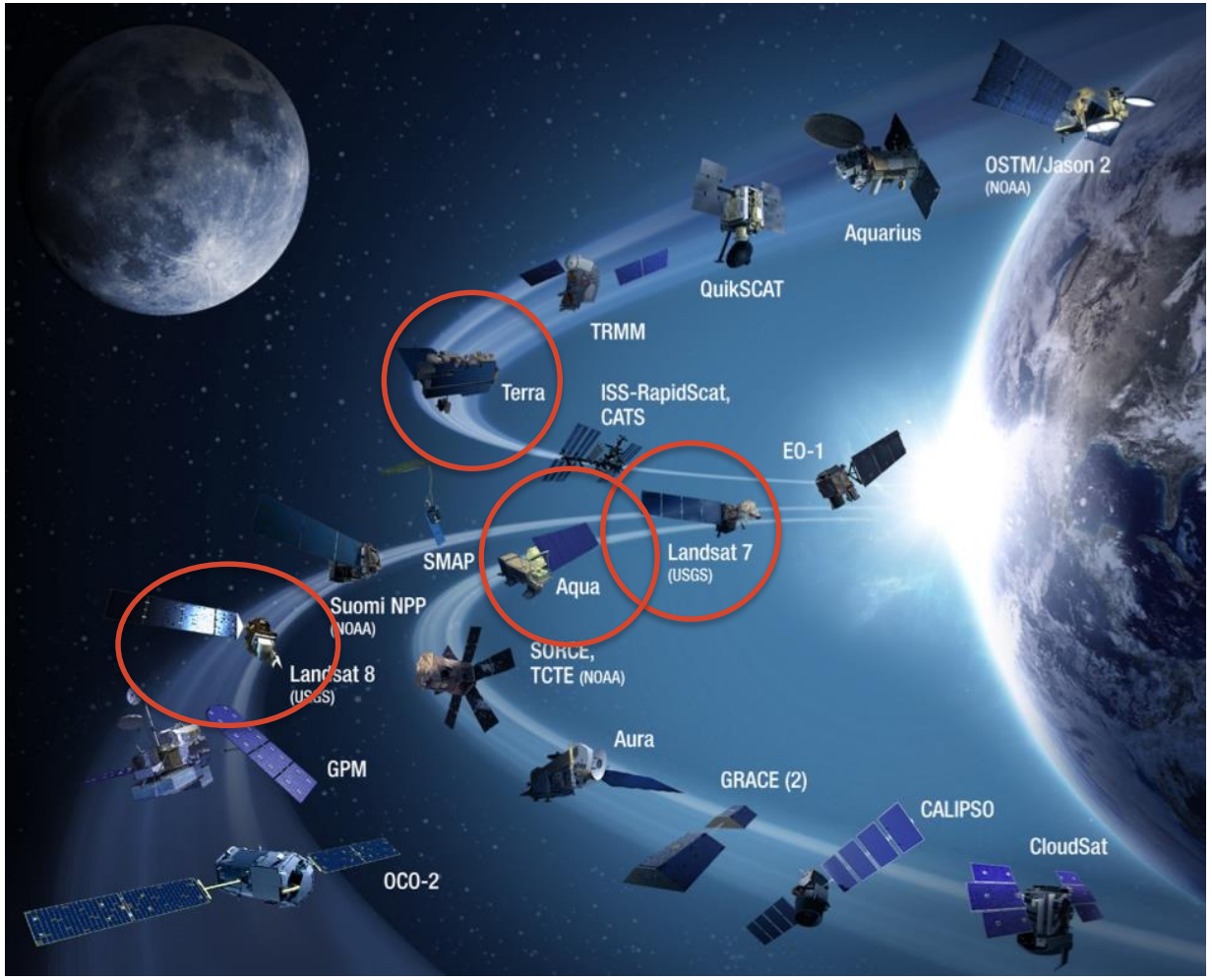
Learn More About ARSET

http://arset.gsfc.nasa.gov/



Satellites for Water Quality Monitoring

- Current Satellite Missions:
  - Landsat 7 [4/15, 1999 - present]
  - Landsat 8 [2/11, 2013 - present]
  - Terra [12/18, 1999 - present]
  - Aqua [5/4, 2002 - present]
  - Suomi National Polar Partnership (SNPP) [11/21, 2011 - present]
  - Sentinel-2A and 2B [6/23, 2015 & 3/7/2017 - present
  - Sentinel-3A [2/16, 2016 – present]



Satellites and Sensors for Monitoring Water Quality

Satellites	Sensors	Resolutions
Landsat 7 Landsat 8	Enhanced Thematic Mapper (ETM+) Operational Land Imager (OLI)	185 km Swath/15m, 30m, 60m 16-day
Terra & Aqua	MODerate Resolution Imaging Spectroradiometer (MODIS)	2330km Swath/250m, 500m, 1km 1-2 day
Soumi National Polar Partnership (SNPP)	Visible Infrared Imaging Radiometer Suite (VIIRS)	3040km Swath/375m – 750m 1-2 day
Sentinel 2A and 2B	Multi Spectral Imager (MSI)	290km Swath/10m, 20, 60m 5 -day
Sentinel 3	Ocean and Land Color Instrument (OLCI)	1270 Km Swath/300m 27-day

Optical, NIR, Mid-IR, Thermal IR, Shortwave Spectral Bands, Panchromaic (Landsat)

Relevant ARSET Water Trainings

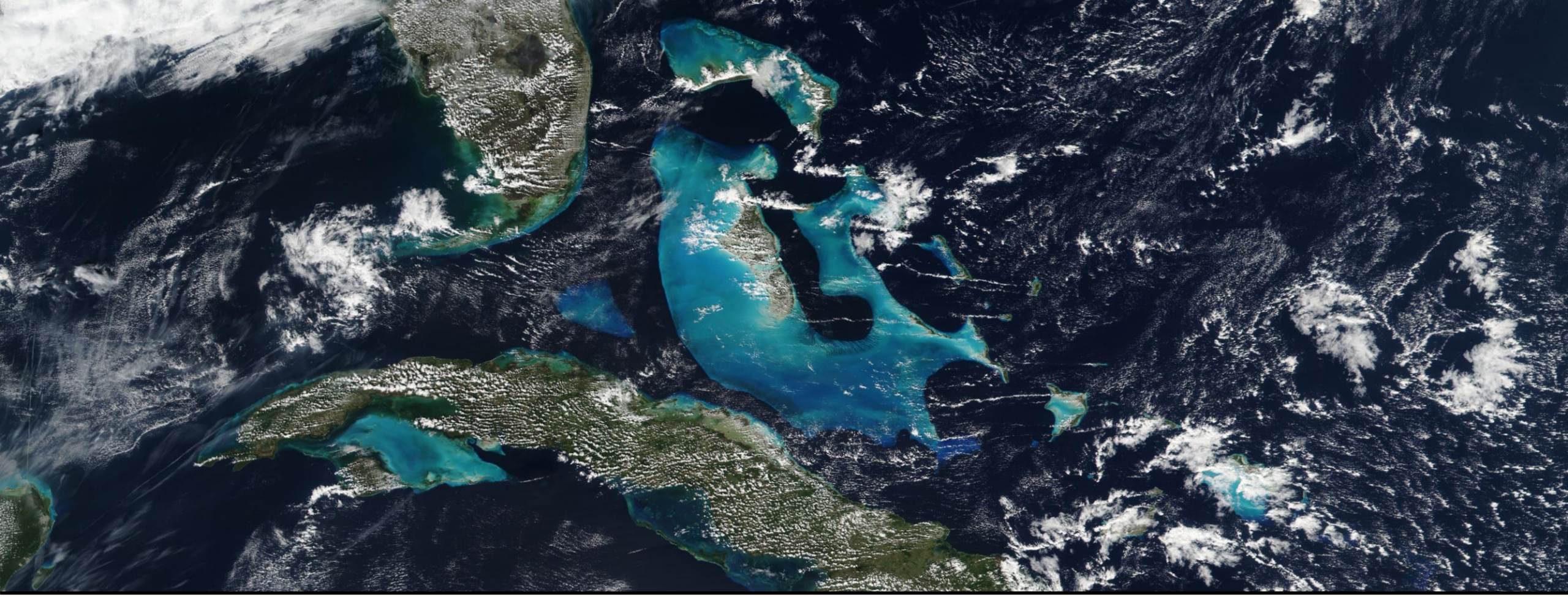
https://arset.gsfc.nasa.gov/

- **Advanced Webinar: Processing Satellite Imagery for Monitoring Water Quality;** https://arset.gsfc.nasa.gov/water/webinars/wq-image-processing (Sept 2018)
- **Introduction to Remote Sensing of Harmful Algal Blooms**

  https://arset.gsfc.nasa.gov/water/webinars/HABs17
- **Introduction to Remote Sensing for Coastal and Ocean Applications**

  https://arset.gsfc.nasa.gov/land/webinars/coastal-oceans-2016
- **Water Quality Monitoring Using Remote Sensing Measurements**

  https://arset.gsfc.nasa.gov/water/water-quality-2014



Ocean Color Data:
Chlorophyll-a Concentration and Water Surface Temperature
Demonstration of Web-Based Tools for Water Quality Data Access
Example: Chesapeake Bay

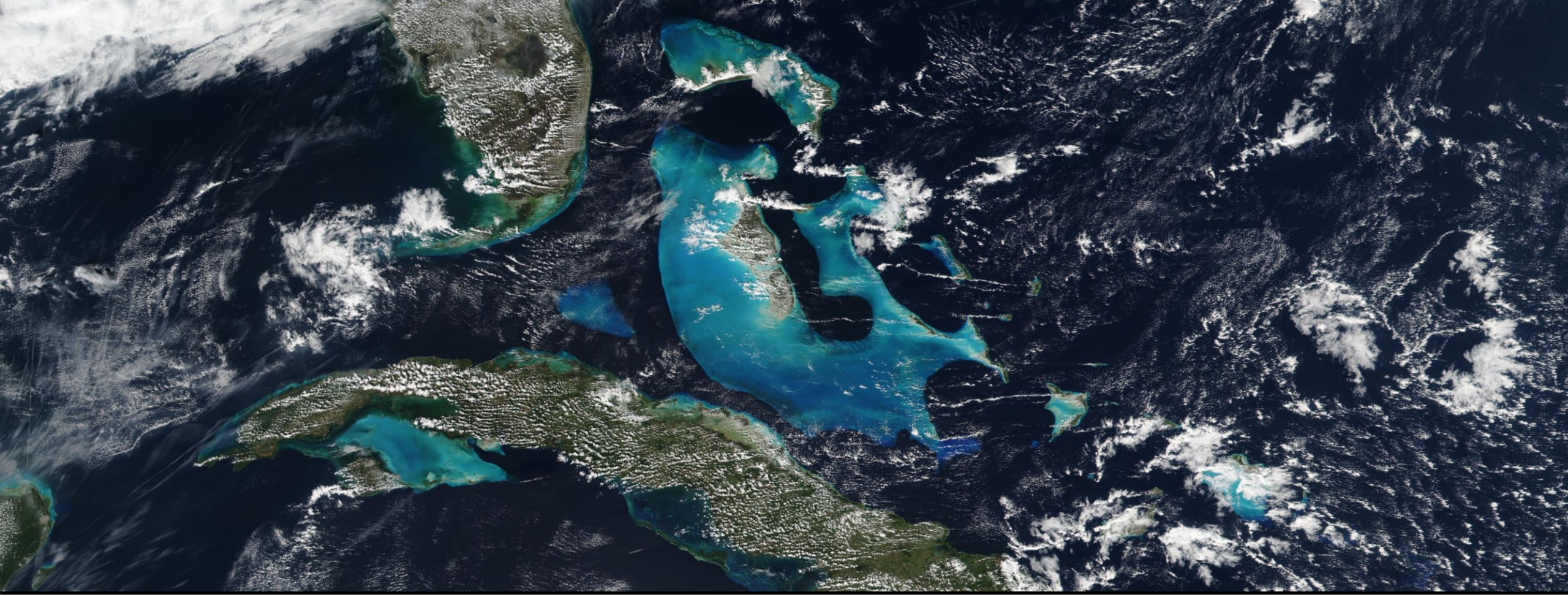
Data and Analysis Tools

- OceanColor Web: https://oceancolor.gsfc.nasa.gov/
- Giovanni: http://giovanni.gsfc.nasa.gov/giovanni/

- Image Processing and Visualization Software:
  - SeaDAS: http://seadas.gsfc.nasa.gov/

APPLIED REMOTE SENSING TRAINING PROGRAM
TRAIN - EMPOWER - ADVANCE

Thank You



Extra Slides

Landsat Bands

Landsat 7 ETM+

Band	Band Range (µm)	Spatial Resolution (m)
1	0.45 – 0.515	30
2	0.525 – 0.605	
3	0.63 – 0.69	
4	0.775 – 0.90	
5	1.55 – 1.75	
6	10.4 – 12.5	60
7	2.08 – 2.35	30
8	0.52 – 0.9	15

Landsat 8 OLI

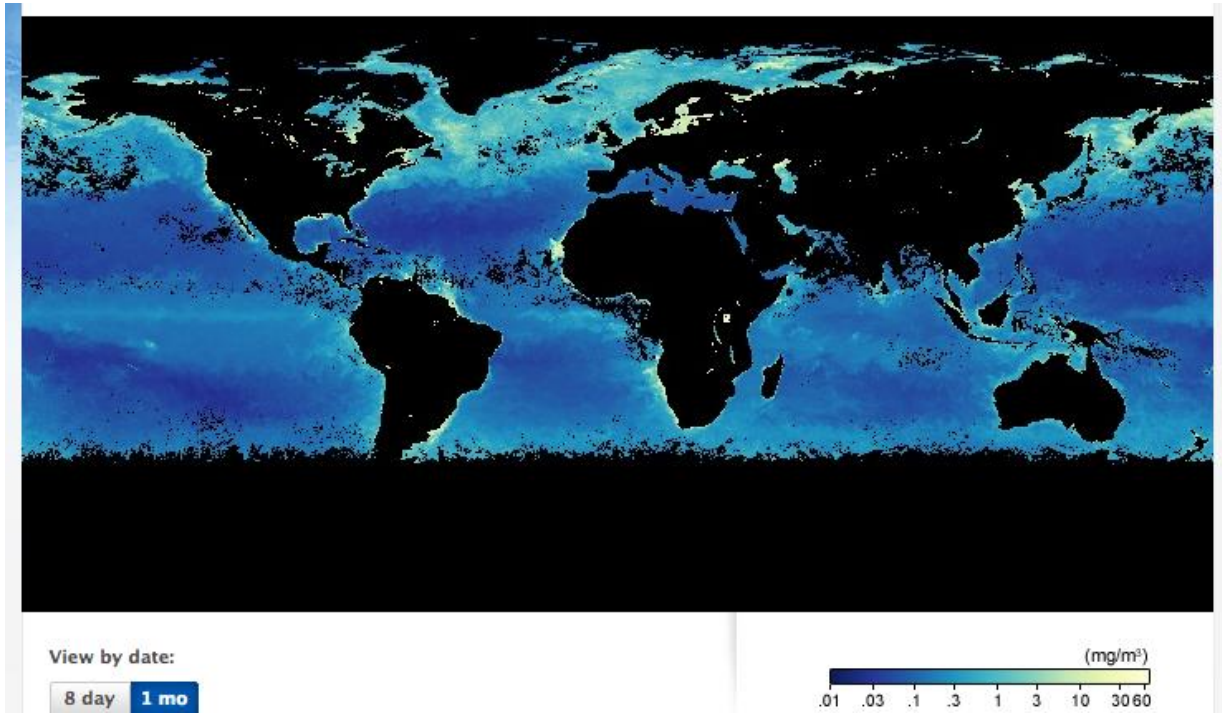
Band	Band Range (µm)	Spatial Resolution (m)
1	0.433 – 0.453	30
2	0.450 – 0.515	
3	0.525 – 0.60	
4	0.630 – 0.680	
5	0.845 – 0.885	
6	2.10 – 2.30	
7	0.500 – 0.680	
8	2.08 – 2.35	15
9	1.36 – 1.39	30

Relevant MODIS Bands

Band	Band Range µm
8	0.405-0.420
9	0.438-0.448
10	0.483-0.493
11	0.526-0.536
12	0.546-0.556
13	0.662-0.672
14	0.673-0.683
15	0.743-0.753

Spatial resolution: 1 km

Chlorophyll Concentration from Aqua MODIS, June 2017

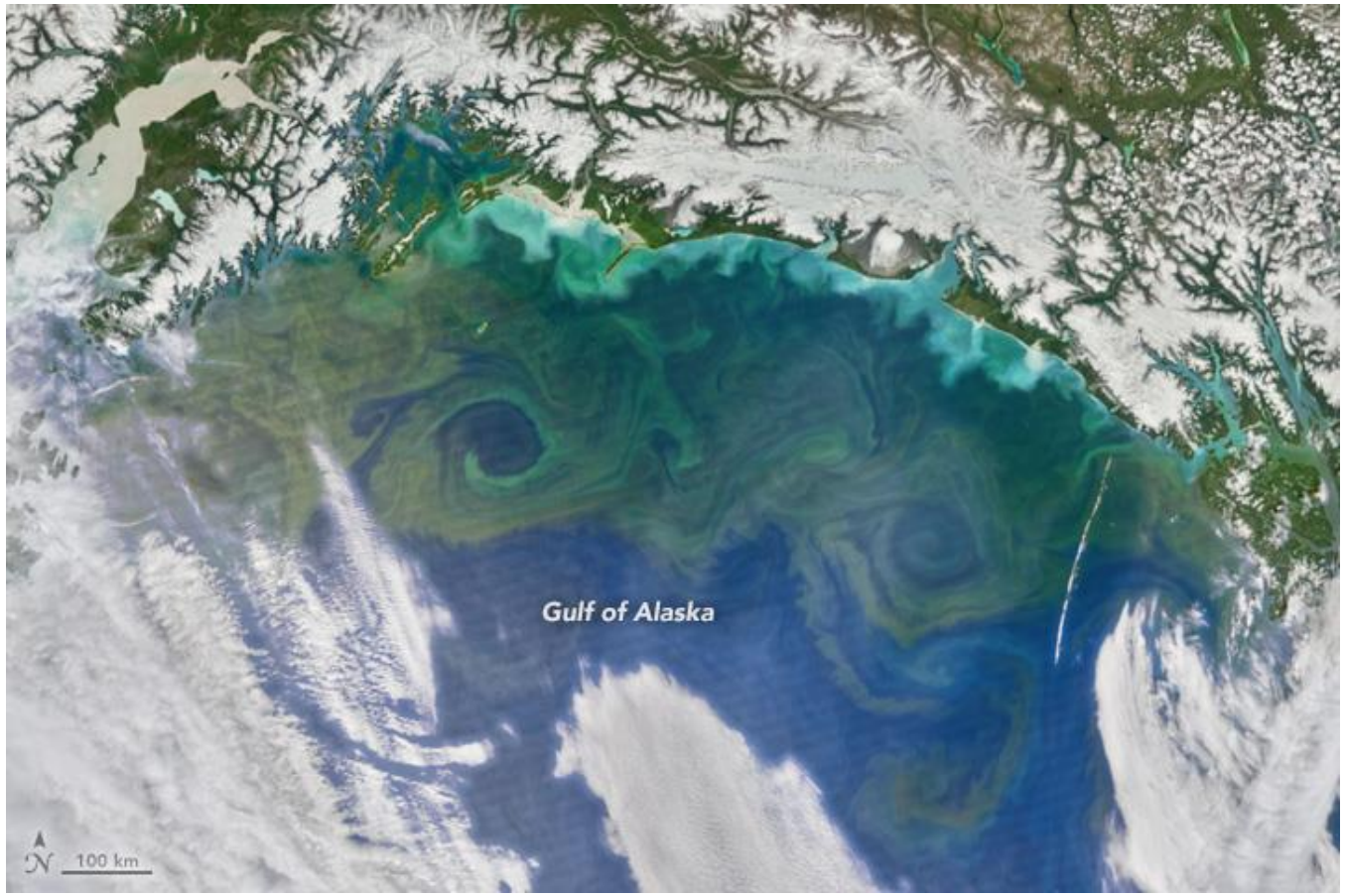


Relevant VIIRS Bands

Phytoplankton Bloom in the Gulf of Alaska, from VIIRS, June 9, 2016

Band	Band Range µm
M1	0.402-0.422
M2	0.436-0.454
M3	0.478-0.488
M4	0.545-0.565
M5	0.662-0.682
M6	0.739-0.745

Spatial Resolution: 750 m



MSI bands

https://earth.esa.int/web/sentinel/user-guides/sentinel-2-msi

	S2A		S2B		
Band Number	Central wavelength (nm)	Bandwidth (nm)	Central wavelength (nm)	Bandwidth (nm)	Spatial resolution (m)
1	443.9	27	442.3	45	60
2	496.6	98	492.1	98	10
3	560.0	45	559	46	10
4	664.5	38	665	39	10
5	703.9	19	703.8	20	20
6	740.2	18	739.1	18	20
7	782.5	28	779.7	28	20
8	835.1	145	833	133	10
8a	864.8	33	864	32	20
9	945.0	26	943.2	27	60
10	1373.5	75	1376.9	76	60
11	1613.7	143	1610.4	141	20
12	2202.4	242	2185.7	238	20

Algal Bloom in the Middle of the Baltic Sea, Sentinel-2 MSI, Aug 7, 2015

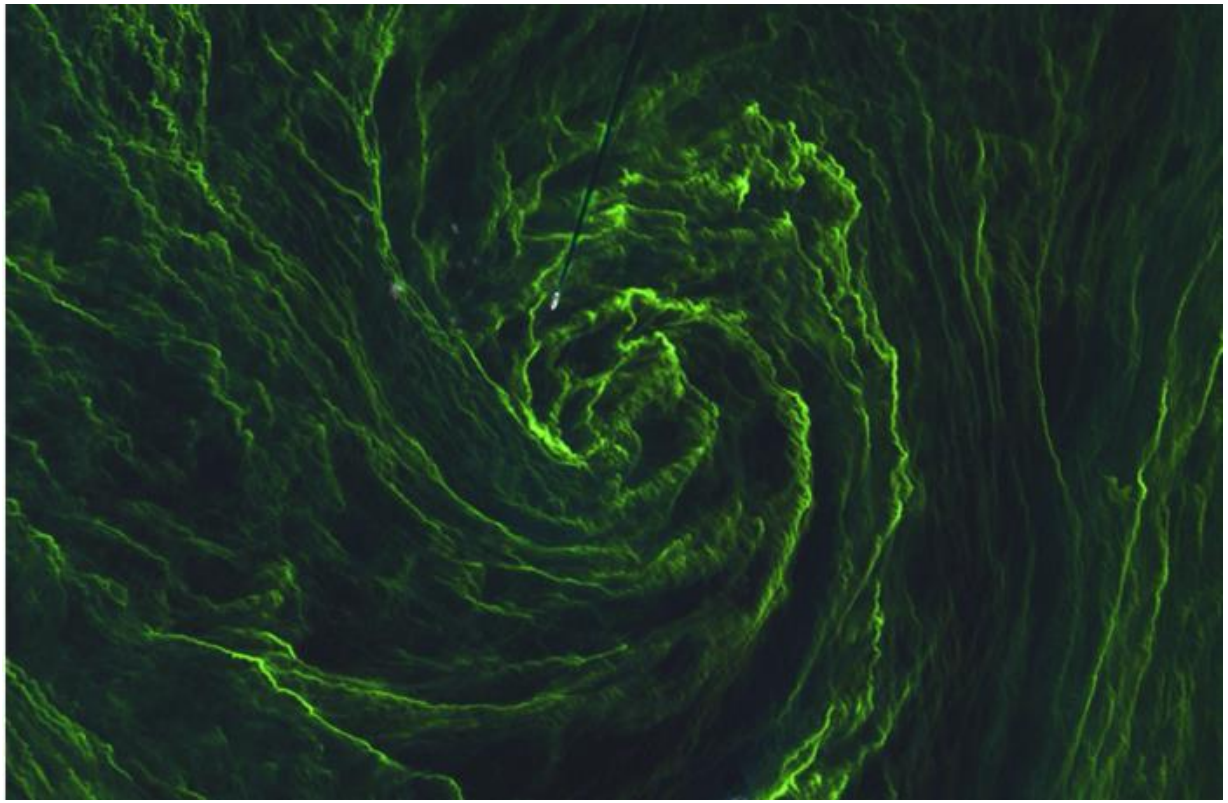


Image: Copernicus Sentinel data (2015)/ESA, CC BY-SA 3.0 IGO

OLCI Bands

https://sentinel.esa.int/web/sentinel/user-guides/sentinel-3-olci

Band	λ centre (nm)	Width (nm)
Oa1	400	15
Oa2	412.5	10
Oa3	442.5	10
Oa4	490	10
Oa5	510	10
Oa6	560	10
Oa7	620	10
Oa8	665	10
Oa9	673.75	7.5
Oa10	681.25	7.5
Oa11	708.75	10
Oa12	753.75	7.5

Band	λ centre (nm)	Width (nm)
Oa13	761.25	2.5
Oa14	764.375	3.75
Oa15	767.5	2.5
Oa16	778.75	15
Oa17	865	20
Oa18	885	10
Oa19	900	10
Oa20	940	20
Oa21	1 020	40

Sentinel-3 OCL-Based Chlorophyll Concentration

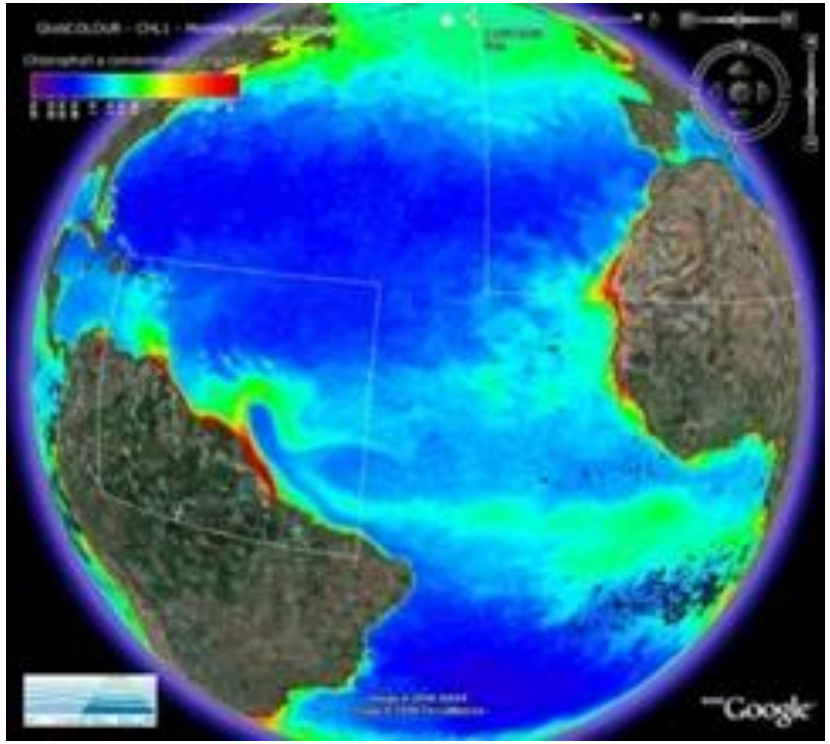


Image Credit: ESA/ACRI-ST