## **EE439D S’24 Project Resource**

## **Visual ML | Cloud Analysis & Tracking using GeoStat Satellite Imagery**

<https://piazza.com/umd/spring2024/enee439d/resources> Scroll down to “Project S’24”

[UMD Access link to IEEE Xplore Digital Library](https://proxy-um.researchport.umd.edu/login?url=https://ieeexplore.ieee.org/Xplore/home.jsp) for journal and conference articles.

**Google Project ID:** examplegeostat

Personal Links:

[A Guide to Understanding Satellite Images of Hurricanes | NESDIS (noaa.gov)](https://www.nesdis.noaa.gov/news/guide-understanding-satellite-images-of-hurricanes#:~:text=Strong%20storms%20with%20a%20well,and%20infrared%20imagery%20at%20night.)

ABI Band 11 Cloud Top (Temperature) - [PowerPoint Presentation (noaa.gov)](https://www.star.nesdis.noaa.gov/goes/documents/ABIQuickGuide_Band11.pdf)

[Improve Sentinel 2 satellite images cloud detection with machine learning in Google Earth Engine | by Minh Nguyen | AREA Lab | Medium](https://medium.com/eelab/improve-cloud-detection-and-removal-with-machine-learning-in-google-earth-engine-ac0a2f759022)

* Script: <https://code.earthengine.google.com/aa71a59518fbe942c96570f1a572b1cc>

Working with Google Maps API in Colaboratory: <https://colab.research.google.com/github/google/earthengine-community/blob/master/tutorials/sentinel-2-s2cloudless/index.ipynb?authuser=0#scrollTo=hMObmv_tdLaX>

**Tutorials**

[**NASA ARSET: Introduction to Geostationary Satellite Remote Sensing of Air Quality, Session 1/4**](https://www.youtube.com/watch?v=BlMnNNcCmrw)

Video tutorials (4 sessions) on Geostat satellite remote sensing (for air-quality observ.)

**Geostationary satellite: Highest sampling every 1-5min; typically every 10min.**

**Sample dataset(s) as a starting point:**

* Real-time image from NOAA web

<https://www.star.nesdis.noaa.gov/GOES/fulldisk.php?sat=G16>

* GEOS Data Archive: <https://www.ssec.wisc.edu/datacenter/goes-archive/>
* More general GEOS data and portal: <https://www.goes-r.gov/>

**Dataset 1:** MODIS data : <https://ladsweb.modaps.eosdis.nasa.gov/>

**Dataset 2 :** Sentinel-2 Data: <https://sentinel.esa.int/web/sentinel/toolboxes/sentinel-2>

Some sample code at : <https://custom-scripts.sentinel-hub.com/custom-scripts/sentinel-2/cby_cloud_detection/> , <https://developers.google.com/earth-engine/tutorials/community/sentinel-2-s2cloudless#build_a_sentinel-2_collection>

**Dataset 3:** Landsat-8 Data

<https://landsat.usgs.gov/landsat-8-cloud-cover-assessment-validation-data>

**Related references/readings as a starting point:**

1. Survey Papers and Tools related to cloud analysis:

<https://tobac.readthedocs.io/en/latest/> TOBAC cloud detection system.

Heikenfeld, M., Marinescu, P. J., Christensen, M., Watson-Parris, D., Senf, F., van den Heever, S. C., and Stier, P.:TOBAC 1.2: towards a flexible framework for tracking and analysis of clouds in diverse datasets, Geosci. Model Dev., 12, 4551–4570, https://doi.org/10.5194/gmd-12-4551-2019, 2019 .

Mahajan, S., Fataniya, B. Cloud detection methodologies: variants and development—a review. *Complex Intell. Syst.* **6**, 251–261 (2020). <https://doi.org/10.1007/s40747-019-00128-0>

1. Introduction to Remote Sensing:

* 1. <https://earthobservatory.nasa.gov/features/tracking>
  2. <https://appliedsciences.nasa.gov/get-involved/training/english/arset-introduction-satellite-remote-sensing-air-quality-applications>
  3. <https://weather.ndc.nasa.gov/sport/journal/pdfs/2009_GRS_Jedlovec.pdf>
  4. <https://airbornescience.nasa.gov/content/Cloud_detection_algorithm_for_multi-modal_satellite_imagery_using_T_convolutional_neural>

1. Dataset Documentation:
   1. Dataset 1: <https://cimss.ssec.wisc.edu/modis/CMUSERSGUIDE.PDF>
   2. Dataset 2: <https://sentinels.copernicus.eu/web/sentinel/technical-guides/sentinel-2-msi/level-1c/cloud-masks>
2. Some additional (advanced) literature
   1. <https://www.sciencedirect.com/science/article/abs/pii/S0034425720303758>
   2. <https://www.mdpi.com/2072-4292/15/6/1706>
   3. <https://ui.adsabs.harvard.edu/abs/2016JGRD..121.7172S/abstract>

Links from Report:

Literature:

* <https://medium.com/eelab/improve-cloud-detection-and-removal-with-machine-learning-in-google-earth-engine-ac0a2f759022>
* <https://www.nesdis.noaa.gov/news/guide-understanding-satellite-images-of-hurricanes#:~:text=Strong%20storms%20with%20a%20well,and%20infrared%20imagery%20at%20night>.
* <https://www.star.nesdis.noaa.gov/goes/documents/ABIQuickGuide_Band11.pdf>
* <https://www.techtarget.com/searchmobilecomputing/definition/geostationary-satellite>

Datasets:

Sentinel-2 Data: <https://sentinel.esa.int/web/sentinel/toolboxes/sentinel-2>

Landsat-8 Data: <https://landsat.usgs.gov/landsat-8-cloud-cover-assessment-validation-data>

Sample Codes:

Sentinel-2 Data:

* <https://custom-scripts.sentinel-hub.com/custom-scripts/sentinel-2/cby_cloud_detection/>

Cloud Masking:

* <https://developers.google.com/earth-engine/tutorials/community/sentinel-2-s2cloudless#build_a_sentinel-2_collection>
* <https://code.earthengine.google.com/aa71a59518fbe942c96570f1a572b1cc>