SATELLITE DATA PROCESSING MAPPING & VISUALIZATION: HURRICANE SANDY

Niemah Brooks [1]   **Paul Alabi** [2,3]   **Aye Phyu** [2]

Midwood High school [1]   *The City College Of New York* [2]   *NOAA CREST Center* [3]

Abstract

The Earth has several satellites around it that provide a wide range of information about its biosphere, atmosphere, hydrosphere and other environment impacts. Satellites are also used for telecommunication and defense. There are two major types of environmental (weather) satellites that help us observe and protect the earths systems: Geosynchronous and Polar orbiting satellites. These satellites provide global and regional coverage of the earth and collects data about the earth's surface temperature, ocean color, water vapor, pressure, snow cover, ice, and clouds.

Suomi NPP is an Environmental satellite that was first launched in 2011 and was named after meteorologist Verner E. Suomi. It is part of a constellation of satellites in the Joint Polar Satellite System (JPSS). Suomi carries the Visible Infrared Imaging Radiometer Suite(VIIRS) Instrument. VIIRS is an instrument capable of multi-spectral imaging of the earth for different purposes. It has 22 spectral bands which consist of 5 high resolution Imagery channels(I-bands) and 16 Moderate resolution channels(M-bands).

In this project the data collected by VIIRS Instrument is used to map and visualize severe weather events in particular Hurricane Sandy which caused a great deal of damage to the North-East of United States.
VIIRS (SDR) "Sensor Data Records": I-band and M-band data files which are used for ocean color and visible imagery at 0.640 to 0.865 μm is retrieved, reprojected and mapped to generate images of the hurricane and the regions around it.

Procedure

Within Earth's orbit satellites collect data.

The data is then sent here to a satellite dish here on earth.

The data is retrieved and processed on the computer through our server.

Images are then produced that are plotted on the globe.
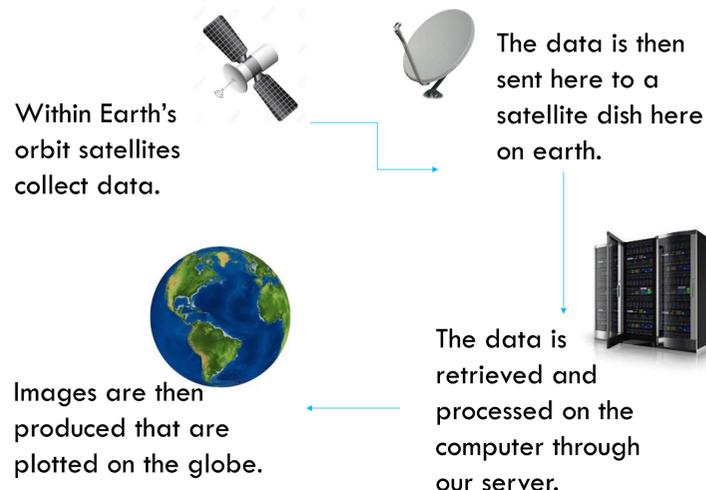
Methodology

Systems Applications
Suomi NPP VIIRS Data, Satellite Antenna, Server, Linux OS
Software Application
Python, MS2GT(fornav,Il2cr),bash shell,H5py,HDFView,basemap, Pyresample,

- While in Earth's orbit the satellite Suomi NPP collects data about the earth.
- Satellite dishes here back on Earth, in our case on top of the North Academic Center (NAC) building receive the raw signals and sends it to a high computation server to get ready for processing.
- On the Server, the data is converted from RDR (raw data format) to SDR files which as stored in the form of HDF files.
- Using scripts in python and bash, The longitude and latitude as well as reflectance values are read from the SDR I bands (250m resolution)..
- Using specialized software such as MS2GT and Pyresample, the SDR data and geo reference information is reprojected on a map grid.
- The projected data is then mapped using Basemap to generate images.

Observations

Bow-Tie Effect: The images shows bow-tie effects. The scan angle of the detectors on the satellite produces increased pixel counts projected onto the Earth as the scan is further from nadir causing consecutive scans overlap away from nadir which is trim and deleted. This phenomena can be corrected during the reprojection and mapping process while taking into account the missing/deleted pixel values.
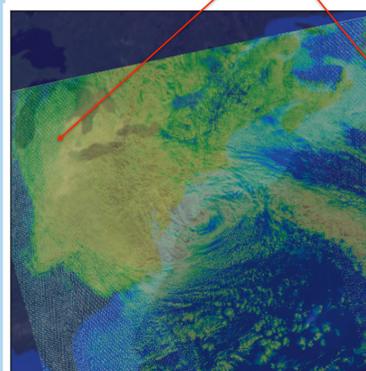
Corrected Image

Hurricane Sandy in the North East Coast of USA : VIRS I Band on Oct 29 17:30 UTC
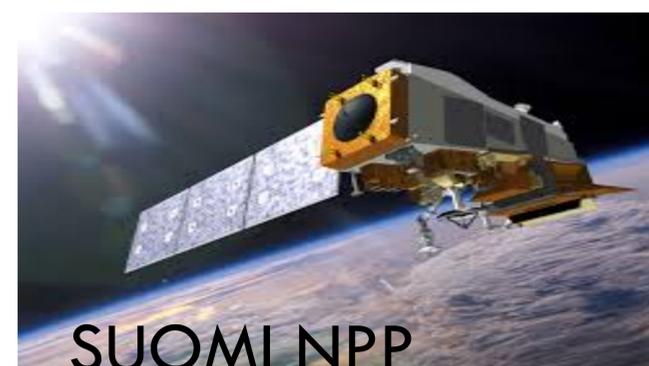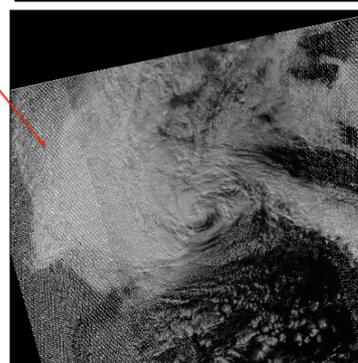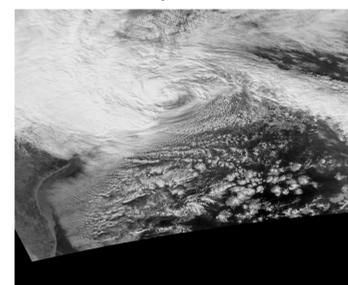
SUOMI NPP

Results

Suomi NPP Hudson Bay, Northeastern Canada
Oct 29 17:36 UTC
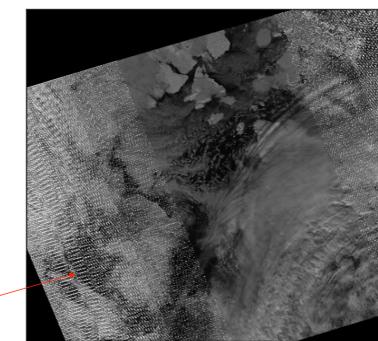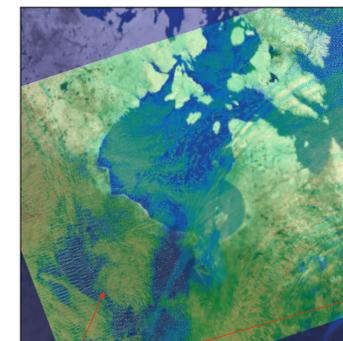
The missing pixels in this images show the **Bow-Tie Effect**.

Corrected Image
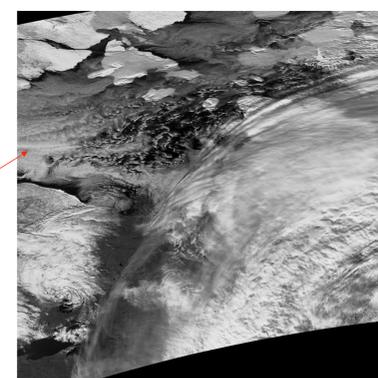
Conclusion

Ultimately satellites are very helpful in everyday life. They help us to understand the intensity of natural events for example hurricanes and tornadoes and notify us so we can be prepared.

Acknowledgements