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Satellite Visualization of Tropical Storm Erika using VIIRS Imagery

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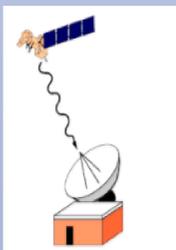
ABSTRACT

A satellite refers to astronomical bodies that orbit planets or larger astronomical bodies. Machine based satellites orbit around Earth in order to help us gain a better understanding of the planet. There are two types of environmental satellites: Geostationary Operational Environmental Satellites (GOES) and polar orbiting satellites. These satellites help provide continuous monitoring necessary for data analysis for global and regional coverage about earth's surface including water vapor, pressure, surface temperature, ocean color, and atmospheric pressure.

The Visible Infrared Imaging Radiometer Suite (VIIRS) is one of the sensors on the Suomi National Polar-Orbiting Partnership (Suomi NPP) spacecraft. VIIRS produces higher resolution and accurate measurements of sea surface temperature and generates products for the operational weather community. Its visible imagery can detect cloud features that GOES does not resolve. It provides better situational awareness through a Day/Night band designed to detect radiance from the brightness daytime scenes to dim nighttime scenes.

In this project, VIIRS visualizes and maps conditions during Tropical storm Erika in 2015. The storm lasted for 4 days. From August 25 to August 29, the storm had traveled across the Caribbean Sea and heavily affected Puerto Rico, Haiti, the Dominican Republic, Jamaica, Cuba, the Cayman Islands and more. Using VIIRS, we will be able to show the extent, size and strength of Tropical storm Erika and we can show the damage it had inflicted upon the islands in the Caribbean Sea.

PROCEDURE



The satellite orbits earth, collects data and sends signals to the dish on Earth.

Data is then received and processed through a server.



Images are then produced and mapped onto Earth



METHODOLOGY

System Applications

Suomi NPP VIIRS Data, Linux OS, Antennas in CCNY,

Software Applications

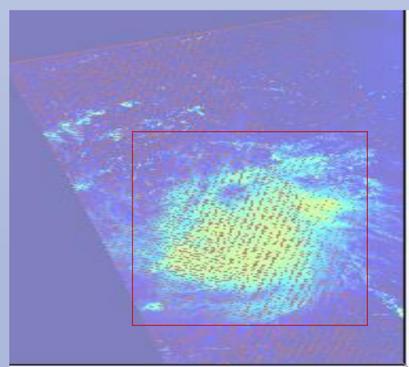
Python, H5py, HDF view, Basemap, Putty, Pyhdf, CSPP

- When in orbit, the satellite Suomi NPP collects data about Earth.
- The dishes back on earth receive raw signals which are then sent to a computation server.
- When the signals are being processed, the raw data is converted to SDR (Sensor Data Records) files, which are stored as HDF files.
- While using python, the longitude, latitude, and reflectance values are read from SDR I-bands.
- Using CSPP, the SDR geolocation files are re-projected on a map grid.
- The projected data is then mapped to generate high resolution images.

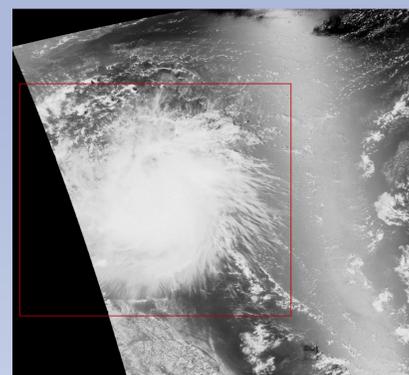
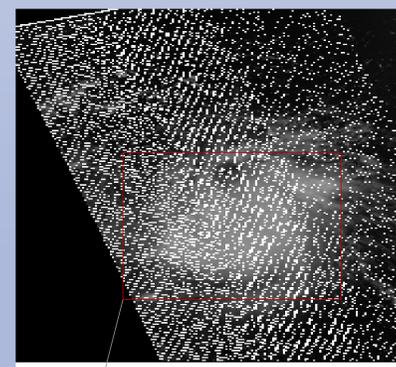
OBSERVATIONS

Tropical storm Erika
August 27, 2015 16:39 UTC

Hyperspectral thermal



Greyscale



Corrected (Greyscale) image

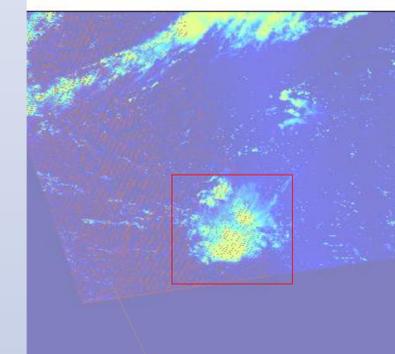
Bow-Tie effect is demonstrated by the satellite, Suomi-NPP, using VIIRS. When a pixel count is increased, a red pixel line appears on the scanned image, indicating that the duplicate from the first pixel image was deleted. The Duplicate is deleted in order to give an accurate scan of a region, without replicating equal images. The effect can be corrected during reprojection and mapping process, while adding back the deleted pixels.

RESULTS

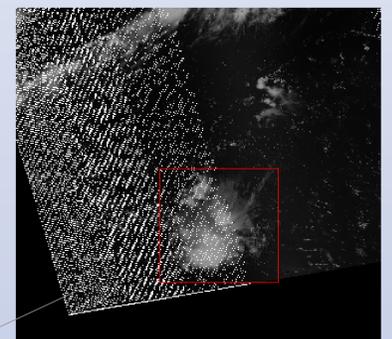
Suomi NPP

Tropical storm Erika
August 25, 2015 17:20 UTC

Hyperspectral thermal

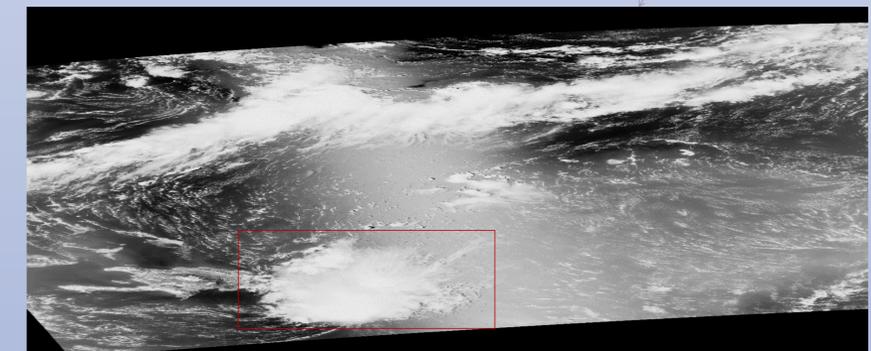


Greyscale



Bow Tie Effect

Corrected (Greyscale) image



CONCLUSIONS

Using VIIRS, a scanning radiometer, we were able to collect geolocation information, calculate it and write it into a file. Data was converted from raw to reflectance, processed and mapped onto a Cylindrical Equal Distance projection. We were able to map Tropical storm Erika and examine her size and strength as she travelled over the Caribbean sea. Due to the Bow-Tie effect limiting our view, the images were re-projected in order to create clear greyscale high resolution image.

ACKNOWLEDGEMENTS

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