Image Downloader Project

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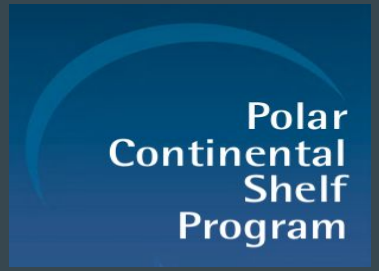
Introduction



Client: Tanya Lemieux, Natural Resources Canada's Polar Continental Shelf Program (PCSP)

What they do: Coordinate logistical support and provide assistance to advance scientific knowledge of the Arctic region. They aim to contribute to Canada's sovereignty over the Arctic region and its adjacent waters.

Client's Vision: Develop a unified platform that consolidates all of their Arctic operational data, making it accessible through one interactive map. This is to enhance the efficiency and safety of the Arctic operations, given the region's challenging weather conditions.

Project Purpose and Scope

- The primary goal is to develop a tool that provides near-real-time satellite imagery of a specified area of interest to possibly support Arctic operations and research.

- PCSP relies on NRT weather data to support operations and facilitate transportation. Retrieving accurate information at a specified location via KML is important for reaching the Client's end vision.

- The tool was developed in Python, and makes use of a few exterior tools such as Heg and Task Scheduler. The main goal of the tool is to retrieve the most recent images available for the user's AOI.

Photo from PCSP's Brochure chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://natural-resources.canada.ca/sites/nrcan/files/earthsciences/files/pdf/polar/PCSP-Brochure_eng.pdf

Client Requirements

- Near Real Time Imagery of Site Location
- Georeferenced
- Multiple Bands (e.g True Colour, False Colour Composite, etc.)
- KML(Z) File Format for Google Earth Pro
- Interoperability, adaptability and integration to achieve end vision

Project Tools

Required Tools:

- HEG Tool - A conversion tool developed by NASA for converting their HDF format to GeoTIFF

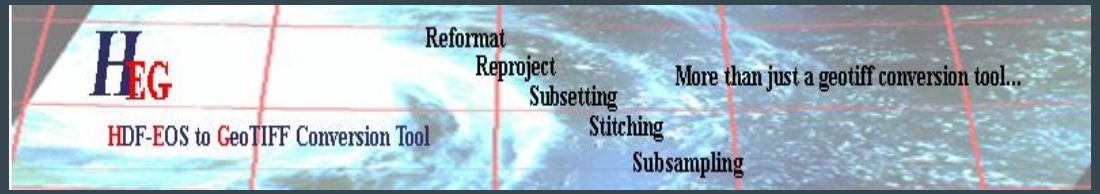
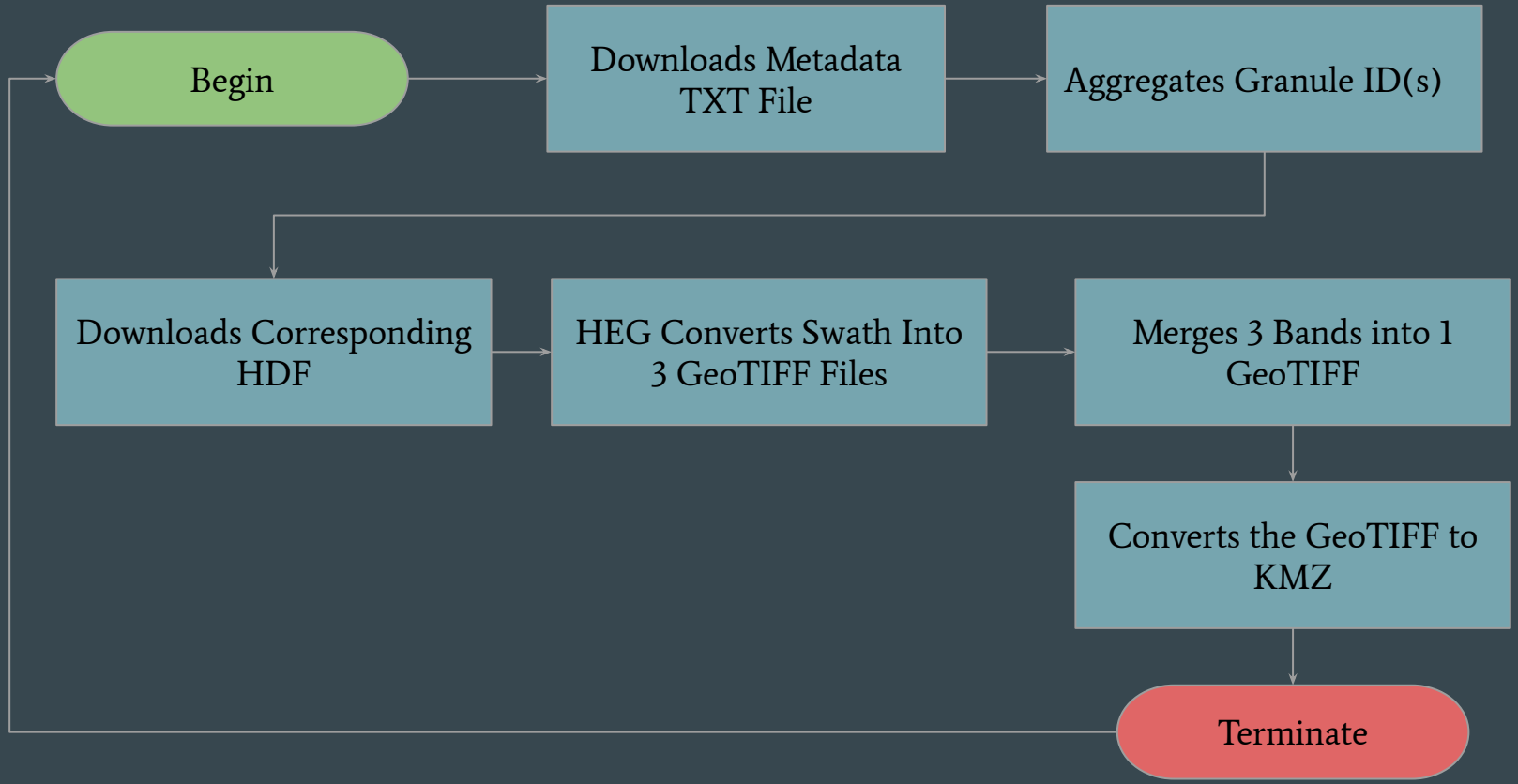


Figure adapted from NASA's HEG Service page, https://wiki.earthdata.nasa.gov/display/DAS/HEG%3A++HDF-EOS+to+GeoTIFF+Conversion+Tool

- Task Scheduler - A tool that allows the user to run the script 'behind the scenes' for automation

Project Workflow



Challenges

- Accessing NRT imagery using GIBS:
  - Initially we had tried using GIBS endpoint to grab imagery using WMS v 1.3.0
  - NASA's documentation says NRT imagery is possible using this service but upon contact they direct us to LANCE
  - We used LANCE to grab metadata and corresponding HDF of the imagery

- Distortion around the pole when processing Arctic Imagery
  - Imagery close to the North Pole causes an issue when selecting Swaths
  - The imagery shows up well, but the swath selected is not representative of the AOI because it is interrupted by the North Pole

- Merging Bands
  - We experienced some confusion when merging the separate band tiff files
  - The bands derived from the HDF were encoded in 16 bit, when we needed 8 bit
  - Solution was to change the band image encoding

Results and Demonstration

- Results:
  - The tool is not fully tested and debugged but still returns quality imagery of specified AOI
  - Relatively efficient process that reliably runs over long periods of time
  - Completely dependent on the efficiency of MODIS metadata updates
  - HDF files are not always complete (due to processing times, etc.) so a complete image with all bands is not always possible
  - Limited coverage due to only accessing one satellite

Further Improvements/Contributions

- To expand coverage/data availability MODIS TERRA sensor could also easily be accessed through the TXT metadata file.

- Other band combinations such as false color composite can be explored to get a different interpretation of the area of interest.

- The process is redundant at times (5 minute interval) as it downloads the same HDF. To expand data coverage include TERRA, and increase time interval in scheduler.

Conclusion

- We created a proof-of-concept tool that provides near-real-time satellite imagery of a specified area of interest in goal of supporting PCSP's Arctic Logistics and Operations/Research

- This tool is a step forward in developing a consolidated platform. With improvements to the data coverage and availability, this tool could be used to acquire NRT imagery and format it correctly

- With data formatted as GeoTiff and KML, interoperability between softwares and platforms is reality. This tool enables the collection of NRT data to be integrated into a consolidated platform. An example use case is creating an interactive map that calls on data collected by the "ImageDownloader" Tool

Acknowledgements

We would like to acknowledge our Professor, Dr. Derek Mueller for his aide in advising the project and revising the code.

Questions?