

Arctic Image Downloader

User Guide

The Arctic Image Downloader is a tool that automatically retrieves and processes near real-time satellite imagery from NASA's MODIS (Moderate Resolution Imaging Spectroradiometer) sensors aboard the Terra and Aqua satellites. This tool is designed to help monitor weather conditions in Arctic regions, particularly for planning safe aircraft operations.

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Prerequisites

Before using the Arctic Image Downloader, you'll need:

- A computer with Windows operating system (required for Task Scheduler)
- NASA Earthdata account credentials (username and password)
- Internet connection to download satellite imagery
- At least 10GB of free disk space for image processing and storage

Installation

1. **Install Anaconda:**
 - Download Anaconda from <https://www.anaconda.com/download>
 - Follow the installation instructions for your operating system
2. **Clone or download the repository:**

- Download the project from <https://github.com/GEOM4009/W25Image-Downloader>
 - Extract the ZIP file to a location on your computer (e.g., `C:\Arctic_Image_Downloader`)
- 3. Create the Conda environment:**
- Open Anaconda Prompt (can be found in the Start menu)
 - Navigate to the project directory:
`cd C:\Arctic_Image_Downloader`
 - Create the environment using the provided environment.yml file:
`conda env create -f environment.yml`
 - This will create an environment called "ImageDownloader" with all the necessary dependencies
- 4. Activate the environment:**
- ```
conda activate ImageDownloader
```

## Configuration

Before running the tool, you need to configure your NASA Earthdata credentials and define your area of interest (AOI):

- 1. Open the script in a text editor:**
  - Navigate to the main script file (e.g., `arctic_image_downloader.py`) in the project folder
  - Open it using a text editor like Notepad++, Visual Studio Code, or any code editor
- 2. Configure NASA Earthdata credentials:**
  - Locate the following section in the code:  

```
os.environ['EARTHDATA_USERNAME'] = 'username'
os.environ['EARTHDATA_PASSWORD'] = 'password'
```
  - Replace 'username' and 'password' with your actual NASA Earthdata account credentials
- 3. Define your Area of Interest (AOI):**

- Locate the following section in the code:

```
aoi = {
 'min_lon': -76.0, # Western boundary
 'min_lat': 45.2, # Southern boundary
 'max_lon': -75.3, # Eastern boundary
 'max_lat': 45.6 # Northern boundary
}
```

- Modify these coordinates to define your area of interest
- Note: Using a smaller area will result in faster processing and smaller file sizes

#### 4. Optional: Adjust time range:

- If you need to change how far back in time the tool searches for imagery, find the `hours_ago` parameter in the `get_modis_imagery` function call and adjust it as needed
- Default is 5 hours

#### 5. Save your changes

## Running the Tool

1. Open Anaconda Prompt
2. Navigate to the project directory:

```
cd C:\Arctic_Image_Downloader
```

3. Activate the environment:

```
conda activate ImageDownloader
```

4. Run the script:

```
python arctic_image_downloader.py
```

5. The script will:

- Authenticate with NASA Earthdata
- Search for recent MODIS imagery
- Download and process the images
- Create composite images from matching pairs
- Save the results in the `./downloads` folder

## Viewing the Images

After the tool has completed processing, you'll find the output images in the `./downloads` folder. To view and properly visualize these images:

### 1. Install QGIS:

- Download QGIS from <https://qgis.org/en/site/forusers/download.html>
- Follow the installation instructions

### 2. Open the composite image in QGIS:

- Launch QGIS
- Go to "Layer" → "Add Layer" → "Add Raster Layer"
- Navigate to the `./downloads` folder and select the composite image (named something like `Composite_YYYYMMDD_HHMMSS.tiff`)

### 3. Create a True Color visualization:

- Right-click on the layer in the Layers panel and select "Properties"
- Go to the "Symbolology" tab
- Change "Render type" to "Multiband color"
- Set "Red band" to 1, "Green band" to 4, and "Blue band" to 3
- Adjust the "Min" and "Max" values for each band to improve contrast:
  - Suggested starting values: Min = 0.1, Max = 0.7
  - These values may need adjustment based on the specific image
- Click "Apply" and then "OK"

### 4. Create a False Color visualization:

- Right-click on the layer in the Layers panel and select "Duplicate"
- Rename the duplicate layer to "False Color"
- Right-click on the new layer and select "Properties"
- Go to the "Symbolology" tab
- Set "Red band" to 2, "Green band" to 2, and "Blue band" to 1
- Adjust the "Min" and "Max" values for each band as needed
- Click "Apply" and then "OK"

### 5. Save the visualization settings:

- Right-click on the layer and select "Styles" → "Save as Default"
- This will save your visualization settings for future use

## Automating with Task Scheduler

To automate the script to run at regular intervals:

### 1. Open Task Scheduler:

- Press Windows key + R
- Type `taskschd.msc` and press Enter

### 2. Create a new task:

- In the right panel, click "Create Task..."
- In the General tab, enter a name (for example, "Arctic Image Downloader") and an optional description.
- Choose the appropriate security options (for example, select "Run whether user is logged on or not" and check "Run with highest privileges" if required).

### 3. Set up the trigger:

Select how often you want the script to run (e.g., "Daily")

- Switch to the Triggers tab and click "New..."
- For the trigger, set "Begin the task:" to "On a schedule" and choose "Daily".
- Specify the Start time.
- Enable Repetition: In the same New Trigger window, check "Repeat task every:" and manually enter "1 hour" (or choose it from the drop-down if available). Set "For a duration:" to "Indefinitely" (or "1 day," depending on your needs) so that the task repeats each hour continuously.
- Click OK to save the trigger.

### 4. Set the action:

- Go to the Actions tab and click "New..."
- Set the Action to "Start a program".
- In the Program/script field, type:  
`cmd.exe`
- In the Add arguments: field, enter the following:

```
/c "C:\Users\YourUsername\anaconda3\Scripts\activate.bat &&
conda activate image_downloader && python
C:\path\to\Arctic_Image_Downloader.py"
```

- This command tells the command prompt to run the Anaconda activation script, activate the specific Conda environment (`image_downloader`), and then execute your Python script. (update `YourUsername` & path (`C:\path\to\Arctic_Image_Downloader.py`) as necessary)
- Optionally, in the Start in (optional): field, enter your project directory (for example, `C:\Arctic_Image_Downloader`)
- Click OK.

#### 5. Review and finish:

- In the Conditions and Settings tabs, adjust any additional preferences. It's a good idea to check "Run task as soon as possible after a scheduled start is missed" in the Settings tab.
- Click OK to save the task.
- You will be prompted to enter the password for the account you specified, enter it and click OK.

The script will now run automatically at your specified intervals, downloading and processing the latest MODIS imagery.