High Resolution Satellite GeoProcessing Tool

for creating Mosaic Datasets

Usage Guide

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Intended Audience

The tools, scripts and data described in this package are intended to enable users of ArcGIS Desktop version 10.4 to create mosaic datasets using high resolution satellite imagery. This workflow is also compatible with ArcGIS 10.3.1 after installation of the software patch available here. Mosaic datasets created with these tools in ArcGIS Desktop are compatible with ArcGIS Pro 1.2, but note that Pro 1.2 has some limitations with regard to viewing the function chains. The details of the chains may not be visible, but the functionality will be applied.

The specific satellites that are supported in this version include Geoeye, Ikonos, Pleiades, Spot6, Spot7, Quickbird, Worldview-1, and WorldView-2 satellites.

Note that, for most satellites, there are many different products available, based on different processing levels. This workflow presumes the user is working with the basic products (typically "1B"). The products supported by this version are listed in the following table:

Sensor	Product
Geoeye	Basic1B
Ikonos	Geo
Pleiades	PRIMARY
Quickbird	Basic1B
SPOT6	PRIMARY
SPOT7	PRIMARY
Worldview1	Basic1B
Worldview2	Basic1B OR Standard2A
Worldview3	Basic1B OR Standard2A

Table 1.   Satellite products supported by this tool

Purpose

The workflow using this geoprocessing (GP) tool and scripts with documentation in this package provides an example of "best practices" for creating mosaic datasets using high resolution satellite imagery. One key objective with this workflow is to standardize the configuration of spectral bands which are most commonly used, since the satellites use different band order for the blue, green, red, near infrared, and panchromatic bands. The configurations for mosaic datasets output by this tool ensures that users can select true color, color infrared, NDVI, and pan sharpened views from any of the supported satellites.

The GP tools provided within the Python tool box will help the user to build and populate mosaic datasets. Based on sensor type, the corresponding GP tool can be used to create the mosaic dataset. The python tool box contains separate GP tools for each satellite: Geoeye, Ikonos, Pleiades, Spot6, Spot7, Quickbird, Worldview-1, and WorldView-2.

Contents of zip file.

a.   Directories

The zip files from ArcGIS Online should be extracted to a working folder, e.g. c:\Image_Mgmt_Workflows, creating the subdirectories shown below.   For details regarding the contents of each directory, refer to the general

discussion of the mosaic dataset Configuration Script (MDCS) in the document titled "MDCS – mosaic dataset Configuration Script Usage Documentation" provided in the Documentation folder.

c:\Image_Mgmt_Workflows\HighResolution\Batchfiles\

c:\Image_Mgmt_Workflows\HighResolution\Logs\

c:\Image_Mgmt_Workflows\HighResolution\MD\

c:\Image_Mgmt_Workflows\HighResolution\Doc\

c:\Image_Mgmt_Workflows\HighResolution\Parameter\

c:\Image_Mgmt_Workflows\HighResolution\Scripts\
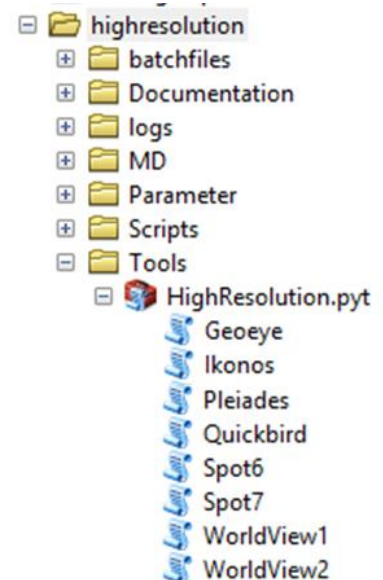
c:\Image_Mgmt_Workflows\HighResolution\Tools\

Installation of zip file.

The zip file attached should be unzipped to a working folder as noted above. The contents and folder structure should be left as is in the zip file. Refer to Contents of zip file above.

Example of a particular tool: IKONOS

Ikonos GP Tool

The Ikonos GP tool provided in the python tool box can be used to build mosaic datasets using Ikonos data. This tool takes as input the geodatabase path, mosaic dataset name and input data path. The GP tool also allows the user to specify a variety of output products to be built. This tool can create Multispectral, Panchromatic and Pansharpened mosaic datasets from the Ikonos imagery specified as input. All mosaic datasets are corrected to top-of-atmosphere reflectance values. The name of the mosaic dataset specified in the *Mosaic Dataset Name* field will be used to create the multispectral mosaic dataset. If either of the other two mosaic datasets are selected, the name will be appended with the corresponding name of the output product. For example, a panchromatic mosaic dataset will have its name as "<inputMDName>_Pan.
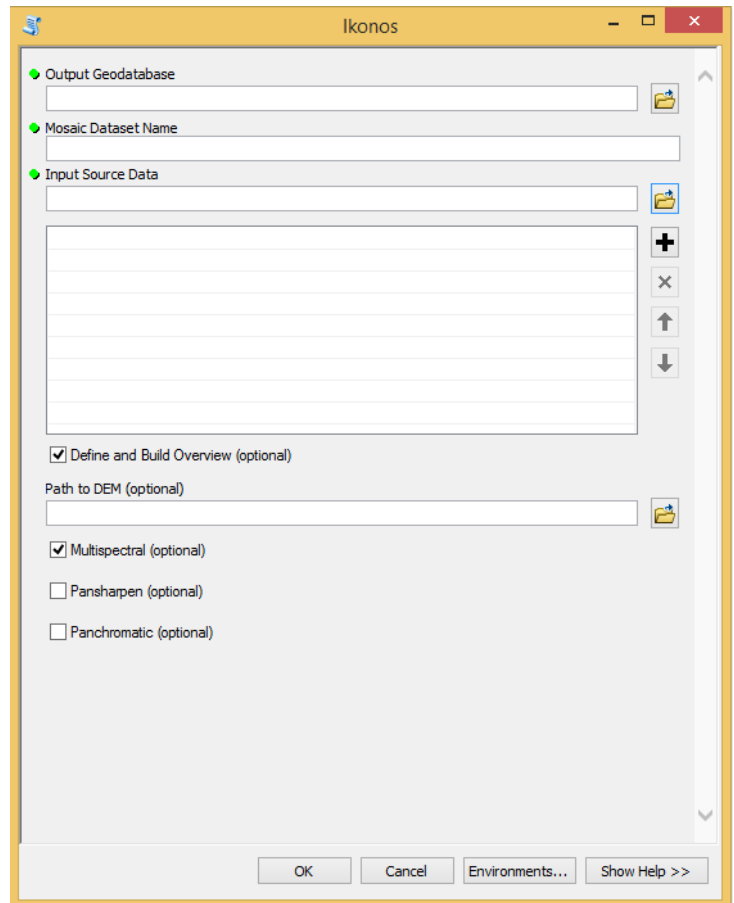

GP tool Usage

To use the GP tool, follow these steps below:

    A. Open ArcGIS.
    B. Using the catalog, browse to the working folder (e.g. c:\Image_Mgmt_Workflows) where the contents of the zip file were unzipped.
    C. Locate the folder named Tools in this working folder.
    D. Locate the python tool box *HighResolution.pyt*.

Open the GP tool

1. Double click on the ***Ikonos*** tool.
2. Select the output Geodatabase.
   NOTE: You can also pick an existing mosaic dataset at this point. If you pick a mosaic dataset, the geodatabase is populated, and the mosaic dataset name is automatically entered into the mosaic dataset field.
3. Type in the Mosaic Dataset Name if creating a new mosaic dataset, or pick an existing mosaic dataset in the step above.
4. Select the input Folder where the satellite data is stored.
5. If overviews are desired, click on the checkbox to define and build overviews.
   a. Note if you decide not to build overviews when this tool is run, you can run the geoprocessing tools available in ArcGIS at a later time to ***Define Overviews*** and ***Build Overviews***.
6. Select the DEM path, if you have a DEM (based on orthometric[1] height) for the project area. This DEM will be used to orthorectify the imagery.
   a. If you do not have a DEM, the Mosaic Datasets will be created, but the imagery will not be orthorectified.
   b. Note that elevation data is available from the ArcGIS Online Terrain service (see http://www.esri.com/elevation). If using the terrain service, it is recommended to export a local copy of the elevation data for your full project area based on the available resolution.
7. Click on at least one of the output products – "Multispectral" generates a mosaic dataset with all spectral bands included; "Pansharpen" creates a mosaic dataset of visible and near infrared bands, with panchromatic sharpening applied when the resolution of the requested view is finer than the resolution of the multispectral bands; and "Panchromatic" creates a mosaic dataset containing only the panchromatic band.
8. Click OK to continue.

As noted above, this example focuses only on the Ikonos GP tool. Usage of tools to create source mosaic datasets including imagery from other satellites would require similar actions.

Output mosaic dataset configuration notes

The resulting mosaic dataset(s) will be configured according to Esri's recommended best practices for data from high resolution satellites. Key details follow:

1. The coordinate system of the mosaic dataset will be set to Web Mercator Auxiliary Sphere. Note this is only the projection used to manage the footprints and create the overviews. It does not affect the projection of the source data, and the mosaic dataset may be viewed or analyzed in any desired projection.

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[1] Note: If your DEM is referenced to ellipsoidal height, you will need to convert it to orthometric height for use with this tool. See help documentation **here** for conversion from orthometric height to ellipsoidal, and note that you'll need to reverse the instructions.

2. The default mosaic method will be set to "By Attribute" using the "Date" field, such that the newest imagery will be displayed on top.
3. Dynamic Range
   a. Data values from the high resolution sensors are stored as 16 bit signed integers, and scaled to a range of [0..10,000].
4. Raster Functions are provided in the \Parameter\RasterFunctionTemplates folder, and some or all of these will be added as Processing Templates for the mosaic dataset, depending on which output options are selected.
5. The raster functions applied to the output mosaic datasets include the Apparent Reflectance function. This should work properly for the satellite products listed in Table 1 above, but it is always possible that users may acquire a collection of data that is missing the expected Sensor Gain and Bias values for each spectral channel. If this occurs, the Apparent Reflectance function will fail, and the script will not complete the output mosaic dataset. In this case, if desired, the user may modify the *.rft.xml files in .\HighResolution\Parameter\RasterFunctionTemplates\ to remove the Apparent Reflectance function, but back up all files before beginning.

If you are uncertain regarding the product type and processing level of your satellite data, you can review *Properties* by right-clicking the Raster Product file (see

the icon that shows a satellite overlaid on a raster) in ArcCatalog and look for Properties/Key Metadata/Product Name:

Property	Value
⊟ **Raster Metadata**	
Sensor Name	IKONOS-2
Product Name	Geo
Acquisition Date	7/25/2002 7:19:00 PM
Cloud Cover (percent)	11.00
Sun Azimuth (degrees)	150.96
Sun Elevation (degrees)	61.96
Sensor Azimuth (degrees)	210.96
Sensor Elevation (degrees)	82.63
Off-Nadir (degrees)	7.37
⊟ **Wavelength (nm)**	
⊟ Blue	
Min	445.00
Max	516.00
⊞ Green	
⊞ Red	