Application: **Solar Radiation Geoprocessing Model**
Version: **1.0**
Date: **March 20, 2009**
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Introduction

The ArcGIS Spatial Analyst extension provides tools to perform solar radiation analysis. An overview of these tools can be found at

http://Webhelp.esri.com/arcgisdesktop/9.3/index.cfm?TopicName=An_overview_of_the_Solar_Radiation_tools.

All solar calculations are based on algorithms developed by Fu and Rich, as outlined in

http://Webhelp.esri.com/arcgisdesktop/9.3/index.cfm?TopicName=Solar_radiation_analysis_equations.

The geoprocessing framework allows you to create a geoprocessing model or workflow that can be published as a geoprocessing service. The model provided uses the Points Solar Radiation geoprocessing tool to allow the user to draw a polygon to determine solar potential. This same tool can be used to precalculate the values for building footprints so *a* user can interact with buildings to see their solar potential. The model provided will allow you to point to your data to perform the analysis for your study area.

In addition to the geoprocessing model, a widget for the Flex API will show the solar radiation potential in chart form. This widget works in conjunction with the sample Flex viewer that ESRI provides:

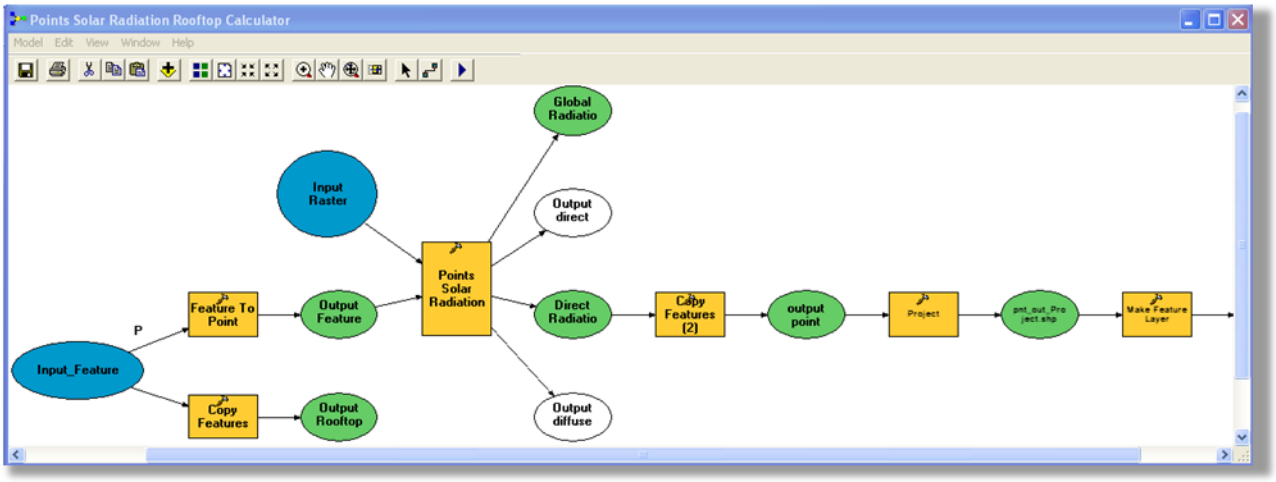
http://resources.esri.com/arcgisserver/apis/flex/index.cfm?fa=codeGalleryDetails&scriptID=15905

Requirements

To run the geoprocessing model through the Solar Radiation widget with your own data, you will need to first author and publish the model in ArcGIS Desktop with the Spatial Analyst extension. Then, to run it through the Web application, you will need ArcGIS Server with the Spatial Analyst extension. All tools assume ArcGIS 9.3 or higher.

Modifying the model to work with your data

Below is a screen shot of the model:



There are two primary inputs to the model: (1) input features that represent a polygon a user would draw for their rooftop and (2) an input digital elevation model (DEM)/surface.

The input features point to a polygon feature class that represents the schema. This currently points to FeatureSetInput.shp in the ToolData folder, which has a local coordinate system. You should use your own polygon with a spatial reference of your project data. In the model, right-click the Input_Features > Properties > Data Type tab, click the button for Import schema and symbology from, and use your own polygon feature class.

You will also need to change the input raster to use your own data. Double-click the Input Raster variable and point to your own data.

Depending on the coordinate system your data is in, you may need to double-click the Project tool and define the geographic transformation.

You may also want to double-click the Points Solar Radiation tool and examine the diffuse_proportion and transmissivity parameter values. The current values are based on Salt Lake City, Utah, estimates. For example, you can obtain the transmissivity value as defined by the Clearness Index by National Renewable Energy Laboratories (NREL) at

http://rredc.nrel.gov/solar/old_data/nsrdb/bluebook/.

Note that the model uses the Points Solar Radiation tool, which is described at http://Webhelp.esri.com/arcgisdesktop/9.3/index.cfm?TopicName=Points_Solar_Radiation. Essentially, the model is taking the polygon uses as input and using the centroid of the polygon to calculate the solar potential. Obviously, there may be other techniques for calculating the total solar potential using the output from the Area Solar Radiation geoprocessing tool. Future models with different techniques will be posted to the ESRI Resource Center as well.

Publishing to ArcGIS Server

For the geoprocessing model to work in ArcGIS Server, you will need to grant the ArcGISSOC account access to the toolbox (SolarRadiation.tbx), the input DEM/raster, and the input features schema polygon as described in

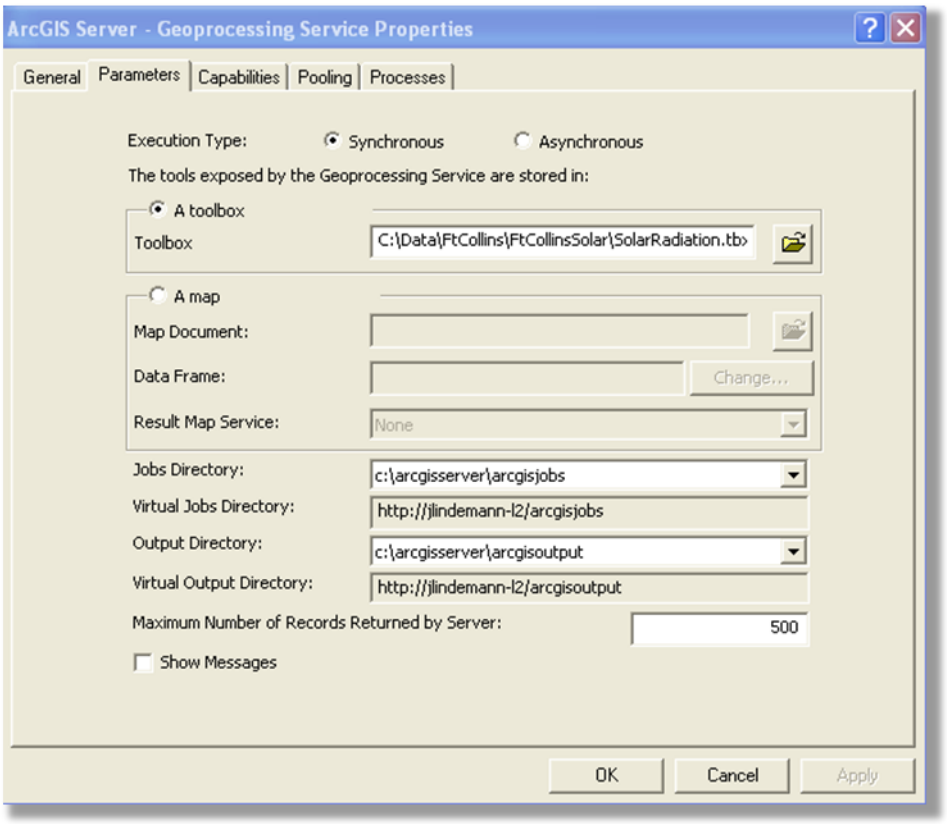
http://Webhelp.esri.com/arcgisserver/9.3/dotnet/index.htm#single_machine_install.htm#data_dir_permissions.

You can publish the geoprocessing model as a geoprocessing service by simply right-clicking the toolbox in ArcCatalog > Publish to ArcGIS Server, as described in

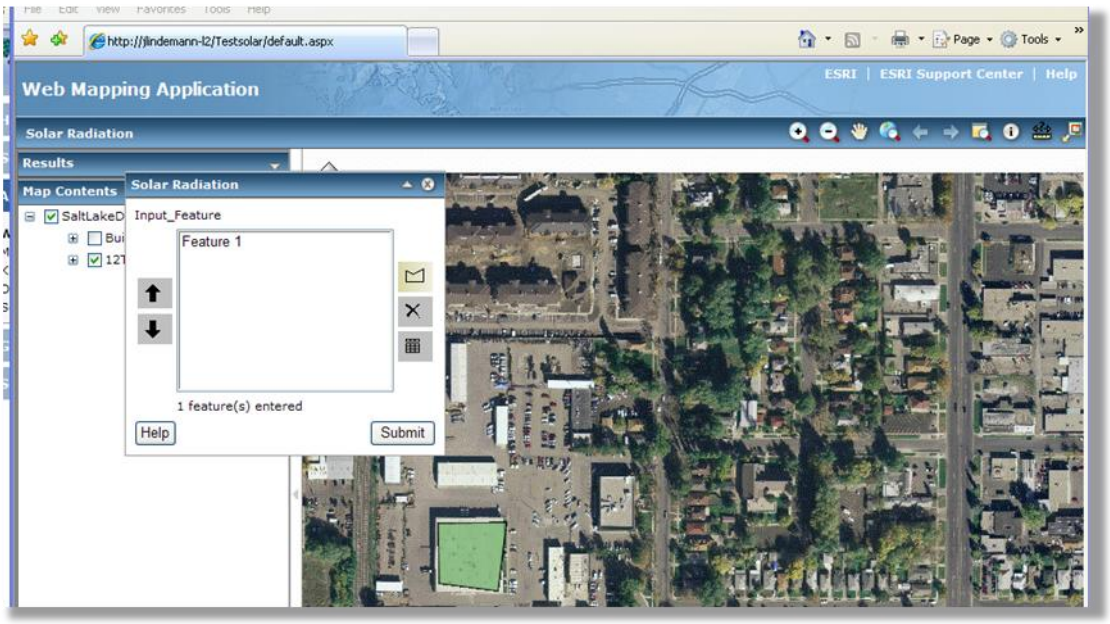
http://webhelp.esri.com/arcgisserver/9.3/dotNet/index.htm#geoprocessing/publis-1288837582.htm

By default, the service will try to publish it with the name SolarRadiation - Service Tools. You will need to remove the "-" and any spaces from the name of the service.

Important: You will need to change the Execution Type to Synchronous for the Flex API widget to work. In ArcCatalog, right-click the service > Stop. Right-click again > Service Properties. Click the Parameters tab and choose Synchronous. By default, it is set to Asynchronous, which will not work with the Flex API widget.

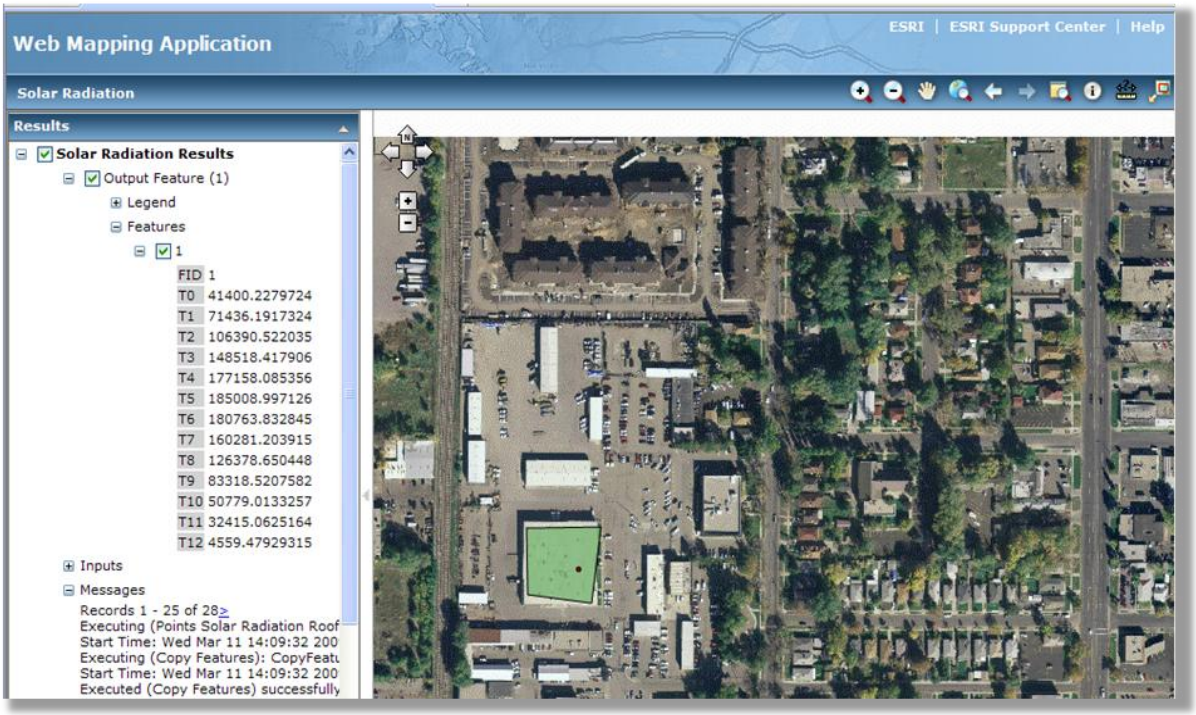


Once the service has been published, you can create an out-of-the-box application with ArcGIS Server Manager that utilizes the service, as the screen shot below illustrates. The user will be presented with a dialog box that allows them to draw a polygon for solar panel placement.



After the user clicks Submit, a result will be returned that is the centroid of the polygon they drew. The output includes additional attributes (t0, t1, t2, and so on), which indicate radiation or duration values for each time interval as defined in the Points Solar Radiation tool in the model. The model is configured to run at 30-day intervals (roughly once a month for each result).

Note that the Points Solar Radiation tool takes the entire input raster/DEM into consideration. Thus, the larger extent and finer cell size of the input surface, the longer the model may take to execute. If you have a very large study area, you could look into modifying the model to clip the raster by a certain distance before running the Points Solar Radiation tool.



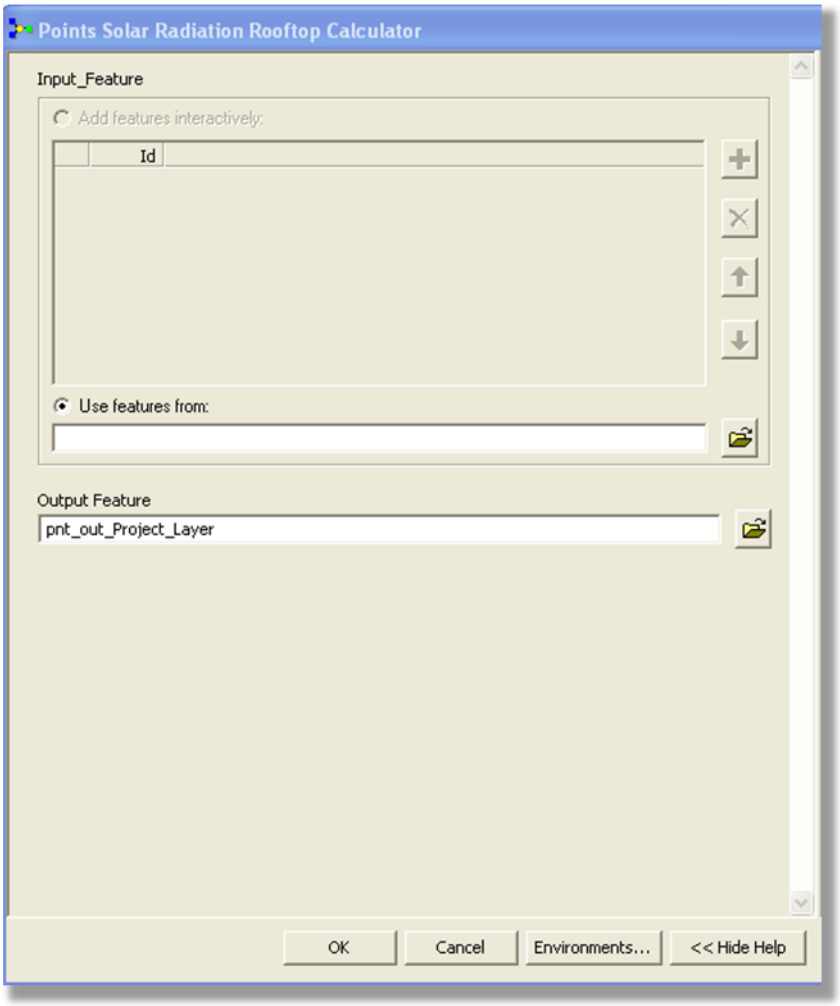
The Flex widget that is supplied allows you to display the output values in a nice graphic interface.

Preprocessing building footprint data

One option the widget provides is to click on a rooftop to obtain solar potential. This is quicker than calculating the potential by letting a user draw a polygon on the fly.

If you do not have existing building footprints, you have the option of removing the button that allows the user to click on an existing building. The SolarWidget_Configuration.pdf guide discusses how you can do this via a configuration file, or you could alter the Flex widget programmatically.

If you do have building footprint data, you can run the same model that was published against building footprint data in ArcGIS Desktop. Instead of using a feature set, you could check Use features from and browse to your building footprint data.



The output of the model will result in points for each building centroid. You could run the Spatial Join tool in ArcToolbox to join the point feature class to the building footprint polygons. The building footprint polygons will then have the attributes (t0, t1, t2, and so on) that indicate radiation or duration values for each time interval. These attributes will be queried by the Flex widget rather than processed on the fly, giving the user quicker results.

Modifying the widget

Please see the SolarFlexWidget_Configuration.pdf document, which will outline how to apply your data and geoprocessing service to the Flex viewer.