Enhancing the NASA Prediction Of Worldwide Energy Resource Web Data Delivery System with Geographic Information System (GIS) Capabilities

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The Description of the Prediction of Worldwide Energy Resource (POWER) Project

Renewable-energy technologies are changing the face of the world’s energy market. Currently, these technologies are being incorporated within existing structures to increase energy efficiency. Crucial to the success of the emerging renewable market is the availability of accurate, global-scale, solar radiation, and meteorology data. This paper reviews the history of the development of an effort to distribute data parameters from NASA research for use in the energy sector applications spanning from renewable energy to energy efficiency. These data are the mainstay of several renewable energy sector web and wind power generation, agricultural crop modeling, and sustainable urban planning efforts.

The POWER project, which was developed as an outgrowth of research efforts at the NASA Langley Research Center, is a culmination of over twenty years of research in renewable energy, agricultural, and related fields.

The POWER/SSE are currently undergoing major updates that include the production and validation of data products in the new spatial resolution of ¼ x ¼ degree and the expansion of the data set to a full 36 years. As part of this function, data parameters from the Modern Era Retrospective-Reanalysis for Research and Applications (MERRA) and the National Aeronautics and Space Administration (NASA) Modern-Era Retrospective analysis for Research and Applications (MERRA) are now being used for the main data source for surface meteorological data parameters. This shows validation of the new data products with the former data sets and parameters.

A recent focus has been to process, formulate, and geographically enable current data to formats consistent with Esri and openGIS tools useful for decision support systems. Functions in the development to improve upon the current site capabilities to produce data products through the MODIS, Landsat, and MODIS Clone projects that extend beyond the single location to regional and global scales. A major anticipated change in the inclusion of GIS with POWER will be the development of Open Geospatial Consortium (OGC) compliant web services (WMS, WCS, WPS, and OWS) and East ArcGIS Image Services. This will provide additional data accessibility options and geoprocessing tools for the renewable energy and agricultural application users. This will extend graphical functionality to the POWER web applications, allowing users to view and project images of their desired parameters in relation to a larger geographical area.

New GIS Applications on the POWER web site

• High quality viewing (Desktop/Mobile) and printing
• Data Extraction/Subsetting
• Simultaneous Dataset Visualization (Layering)
• Temporal Visualization
• Custom Color Ramps
• Pixel Attribute Identification at Selected Location

The poster summarizes the POWER project efforts to distribute data parameters for the emerging renewable energy sector as part of web and mobile applications spanning from renewable energy to energy efficiency. The summary highlights the expansion of the site’s data and processing to meet the energy sector needs, products and technologies, and highlights the inclusion of GIS with POWER will be the development of OGC compliant web services (WMS, WCS, WPS, and OWS) and East ArcGIS Image Services. This will provide additional data accessibility options and geoprocessing tools for the renewable energy and agricultural application users. This will extend graphical functionality to the POWER web applications, allowing users to view and project images of their desired parameters in relation to a larger geographical area.

This sample plot was produced on a test web server where the ArcGIS tools are being developed.

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• 22 years of data
• Spatial resolution of 1° x 1°
• Temporal resolution of 1 day to monthly averages
• Includes high-quality satellite radiation and meteorology data

POWER/SSE partnerships and collaboration have resulted in notable improvements to the web site and formula. The most important boost to the site was the establishment of the Modern-Era Retrospective analysis for Research and Applications (MERRA) by NASA. MERRA has been incorporated into the POWER/SSE project.

Under POWER, SSE was expanded to include additional parameters, one every 30 years. The parameters were increased in quality in 1° x 1° and temporally to daily averages. POWER increased the utility of methods for accessing data in the POWER/SSE projects. Providing users with more data and parameters enables them to derive/validate/provide parameters to other users more easily.

The POWER project has resulted in a significant increase in the availability of reliable and accurate climate-related data for applications spanning from renewable energy to agricultural and related fields.

The current spatial resolution is 1° x 1° atmospheric reanalysis (GEOS-5) radiation data. To accomplish this, surface meteorological and solar energy parameters, including environmental data from the GMAO, GEWEX SRB, and CERES. SSE was also incorporated into the POWER/SSE project.

New Future Changes

As part of these capabilities, the Surface meteorology and Solar Energy (SSE) web site was incorporated into the POWER project and provide recent collaboration for the development of web services for energy. SSE has been incorporated into the POWER/SSE project.

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