NASA Satellite Measurements and Modeling Contributions to Decision Support in the Energy Sector

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NASA Energy Management

Prediction Of Worldwide Energy Resource Project

NASA POWER Project

Objective: *Improve the Nation's public and private capability for integrating environmental data into sound management of energy production and energy efficiency systems.*

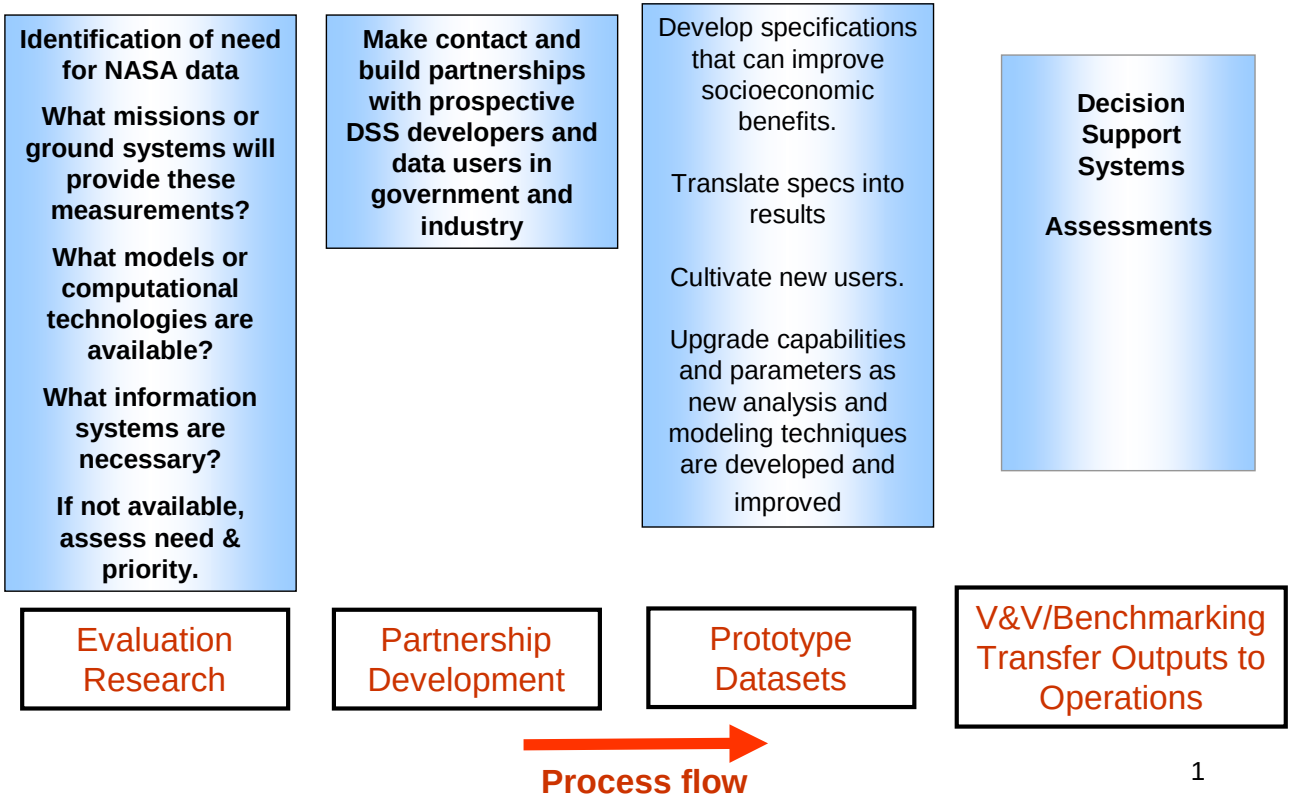
Goals:

1. *Establish partnerships to facilitate the integration and adaptation of NASA satellite analysis and modeling data into electric power industry Decision Support System's (DSS) and databases.*
2. *Target such datasets for Electric Power, Renewable Energy, Energy-Efficient Building Design and Biomass Crop Development Industries*
3. *Transition operational capabilities to government and/or private sector entities.*

NASA Energy Management

Process Flow Plan

Energy Management Process Flow



NASA POWER Project:
Integrated System Solution

EARTH SYSTEM MODELS

- Earth System & Climate Change: ***GMAO Analysis, NCEP Analysis***
- Seasonal Prediction Models: ***NSIPP Analysis, NCEP Analysis***
- Aerosol Transport Models: ***RAQMS, GMAO fvCAM, NCAR WRF, GFDL FMS Atmosphere***
- Climate Models: ***GISS Model II, GFDL FMS B-Grid Atmosphere***
- Atmospheric Analysis Projects: ***ISCCP, SRB, CERES-SARB, GVAP, GPCP***

****Supported Non-NASA Model***

Data

EARTH OBSERVATIONS

- **Atmosphere:** *GOES, POES, TRMM, Terra, Aqua, TOMS, Aeronet, AIRNow,* ***INTEX, Aura, CALIPSO, APS, CloudSat, GPM, NPP, GIFTS, HYDROS***
- **Land :** *Terra, Aqua, Landsat, Terrestrial Networks, BSRN, ARM, SURFRAD,*

****Future Mission***

Predictions

- 20+ years
- Past 90 days
- 1 – 15 day forecasts
- 12 – 18 month seasonal forecasts
- 10 – 20 year forecasts

Observations

- Temperature & humidity profiles
- Cloud systems
- Land cover albedo
- Land surface temperature
- Soil Moisture
- Ocean Surface Winds
- Global Precipitation
- Total Aerosol Amount
- Land Surface Topography
- Trace gas profiles

DECISION SUPPORT TOOLS

RETScreen

- Provides common platform for evaluating project proposals while significantly reducing the costs and uncertainties of preliminary studies
- Reduces the time and errors of a preliminary study

NREL

- HOMER
- National Solar Radiation Database (NSRDB)
- Provides data sets for numerous energy management decisions

EPRI

- Neural Net Load Forecast Tools
- Forecasting tool for Energy industry
- Integration of renewable sources to traditional power grids

energy.gov U.S. DEPARTMENT OF ENERGY

UNEP

Natural Resources Canada

NOAA

VALUE & BENEFITS

- Optimize renewable energy systems for power production
- Optimal integration of traditional and renewable energy supply systems into electric power grid
- Improved prediction of electric power need and supply – mitigate power shortages, prevent price increase
- Reduction in greenhouse emissions from energy production

POWER Historical Data for Renewable Energy

Earth-Sun System Science → **Applied Science Outcome**

NASA Satellite Measurements, Analysis and Modeling

Terra

Aqua

ISCCP

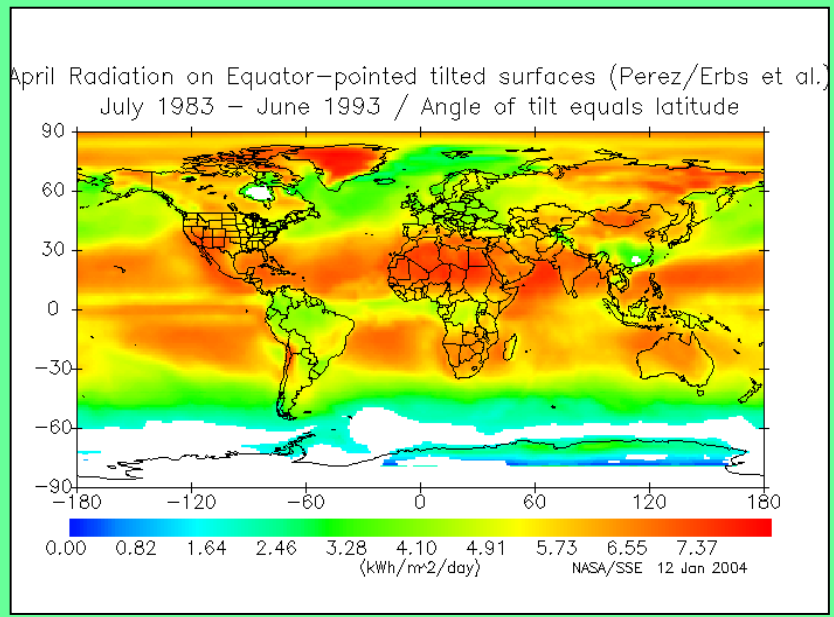
SRB

GMAO

CERES

Surface Meteorology and Solar Energy (SSE) Datasets And Web interface

SSE



Growing over the last 5 years to nearly 14,000 users, nearly 3.6 million hits and 700,000 data downloads

SSE Web Site

http://eosweb.larc.nasa.gov/sse/

Over 200 solar energy and meteorology parameters averaged from 10 years of data

NASA

NASA POWER Project:

Logistical Approach

NASA Input Sources

Satellite-Based Retrievals and Analysis
(ISCCP, SRB, CERES)

Data Assimil-ation
(GMAO, NOAA NCEP)

Forecast Models (Days to Decadal):
(NASA GMAO, NSIPP, GISS; NOAA Wx, SFM, GFDL)

POWER
Integration and Algorithm Benchmarking

DSS Needs

Historic Records:
Renewables (RETScreen, NREL), Buildings (ASHRAE), Biomass, Utilities (EPRI)

Near-Term Records (last 90 days):
Utilities (EPRI), Biomass

Forecasts (day – yrs):
Utilities (EPRI), Renewables (NREL), Buildings (ASHRAE), Biomass

NASA POWER Partnership Example:

RETScreen from NRCAN/CANMET

Natural Resources Canada RETScreen

RETScreen Design System (>68,000 Global Users)

POWER Plans

Additional Web-based Data and Prototypes

- **Historic global datasets and industry prototypes:**
  - SSE Release 5 (spanning July '83 – Oct '95): complete
  - *20+ Year SSE Rel. 6: spring 2006 (Joint Release with RETScreen 4)*
  - Sustainable Buildings Prototype: Release 1, complete
  - Agroclimatology/Biomass Prototype: Release 1, Dec. 2005
- **Near-term global prototype datasets (FLASHFlux/CERES):**
  - Prototype operational system (archived up to 6 months from real-time): Limited operations Oct. 1; full operations Dec 1.
- **Forecasted datasets:**
  - Preliminary discussions w/modeling partners underway; new partners being sought in climate prediction
    - *Now supporting PNNL's MINICAM*
  - Short-term regional prototype - Summer 2006
  - Seasonal prototypes 2006 - 2007

NASA Energy Management
Conclusions and Future Plans

- NASA's Energy Management Program is aimed at transitioning improved satellite analysis and modeling information to Decision Support Systems (DSS) in the Energy sector
- Energy Management's POWER project has already demonstrated the value of external partnerships with DSS owners
  - *POWER/RETScreen plans for continued collaboration and a joint release of respective SSE and RETScreen Software versions*
- Other opportunities for collaboration are possible and being actively sought