Studying Aerosols, Temperature, Clouds, Precipitation and Fires in the Northern Eurasia Using the NASA Remote Sensing Data

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[3]Voeikov Main Geophysical Observatory of Roshydromet, St.Petersburg, Russia, [4]Hydrometcentre of Russia, Moscow, Russia, [5]Research & Development Center ScanEx, Moscow, Russia, [6]Scientific-Research Center for Radiobiology and Radiation Ecology, Tbilisi, Georgia, [7]Hadley Centre for Climate Prediction and Research, UK Met Office, Exete United Kingdom

Abstract

As part of the Northern Eurasia Earth Science Partnership Initiative (NEESPI), the NASA Earth Sciences Data Support System and Services for NEESPI brings together data from various spaceborne instruments and models to address effect of aerosols on regional patterns in clouds, precipitation, and other atmospheric parameters. It also provides data on fires and potential sources of aerosols, along with data on various trace gases. In many areas of the Northern Eurasia, only the satellite data can guarantee routine monitoring of atmospheric and surface properties. The NASA for NEESPI project provides convenient, through one portal, access to geophysical parameters measured in the Northern Eurasia region without any need for a daunting data discovery process, or for learning complicated remote sensing data formats, or for retrieval and processing of large data volumes. It also allows performing quick exploration through visualization and statistical analysis Giovanni tool, by studying spatial and temporal correlation of fire counts, aerosol concentration and/or type, cloud optical properties, water vapor and the precipitation amounts.

Goals of the NASA NEESPI Data and Services Center

- **Facilitate climate, land cover/land use change, hydrological and environmental studies** over the NEESPI region by producing a **collection of coarse spatial resolution satellite-derived and model datasets**, and by **developing on-line tools for data search and analysis, and for fast and effective access** to the data.
- **Integrate remote sensing data** from AVHRR, MODIS, and other NASA instruments on board polar-orbiting satellites, customized data products from climatology data sets (e.g., ISLSCP) and model data (e.g., NCEP/NCAR) into a single, dedicated to NEESPI, "one-stop-shopping" interdisciplinary NASA-NESSPI data support system
- Provide **convenient, through one portal, access to geophysical parameters** measured in the Northern Eurasia **region** without any need for a daunting data discovery process, or for learning complicated remote sensing data formats, or for retrieval and processing of large data volumes
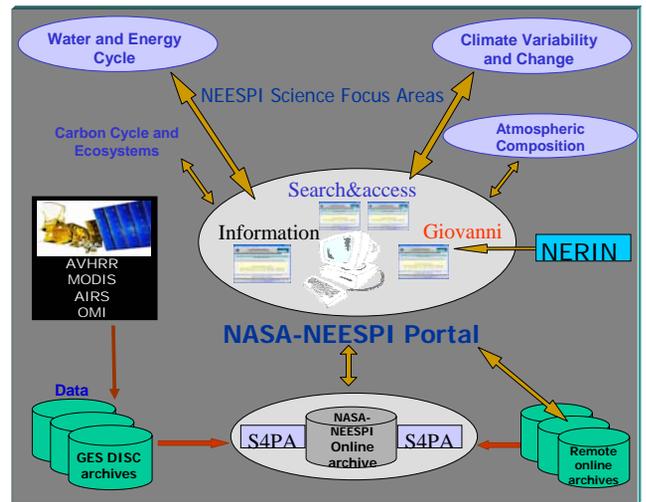- Support NEESPI projects and NEESPI-related models

Online archive (S4PA)

1. **What is S4PA?**
   The Simple, Scalable, Script-Based, Science Processing Archive (S4PA) is a radically simplified data archive architecture for supporting our users with online access to data.
2. **How does S4PA store data?**
   S4PA stored data on disk in a hierarchical structure. At the top are data set groups (closely related data sets). Below that are datasets. Below that the data are divided into directories by the begin time of the data files.
3. **How are data backed up in S4PA?**
   Data are saved to tape at regular intervals, using standard system backup procedures.
4. **What about metadata in S4PA?**
   S4PA stores metadata in separate XML files alongside each data file.
5. **What metadata are required for S4PA?**
   At a minimum, the XML metadata file needs short name identifying the dataset, the version of the dataset, and the start and stop (aka begin and end) date/time of the data file. For data that need to be searchable by spatial area, some geographic information (polygons or bounding boxes) is also necessary. Metadata needed for full documentation of the data file and its production should be included within the data file itself, in a form that is at the discretion of the data producer. S4PA does not need this metadata to manage the data.
6. **Can data still be ingested into S4PA without separate XML files with metadata?**
   Yes, S4PA can include dataset-specific metadata extractors, in order to extract the key metadata from the data files.
7. **How do users search S4PA data?**
8. There are several search interfaces for the data. The current one is known as the Web Hierarchical Ordering Mechanism (WHOM). Another is a Google-like interface Mirador.
9. **Can I get data by subscription?**
   Currently, users can sign up to get a notification when new data of a specified type are added to the archive. Also, FTP and SFTP push subscriptions are available.
10. **What other services will be available on the data?**
    Services that are currently provided on-the-fly, such as Giovanni analysis and on-the-fly subsetting, will be available for data hosted in an S4PA instance.
11. **How much data can S4PA hold? Is it scalable?**
    Though S4PA presents a lightweight management system for data, its holding capacity is limited only by that of the disk systems it manages. Likewise, its ingest performance is close to the disk transfer rates, unless significant processing is needed for ingest (e.g. compression or decompression).It is also easy to stand up multiple S4PA instances by partitioning data holdings by data set.

Giovanni: On-line Visualization and Analysis

NASA-NEESPI DISC Web site

First "surface" data sets in the NEESPI Giovanni

Snow/ice monthly statistics and climatology for Northern Hemisphere

The product includes monthly snow/ice statistics (frequency of occurrence) and snow/ice occurrence climatology for Northern Hemisphere at 1 degree spatial resolution. The dataset covers the time period starting January 2000. Currently the last month processed is May 2006. Monthly snow/ice maps and climatology were derived from daily snow and cover charts produced at NOAA/NESDIS within Interactive Multisensor Snow and Ice Mapping System (IMS) Original IMS snow/ice charts are produced on a 1024x1024 grid in polar projection at a nominal resolution of about 24 km (see http://www.ssd.noaa.gov/PS/SNOW/index.html)
The monthly snow and ice frequency of occurrence for 1 degree grid cells is calculated as an average of all daily fractions of snow and ice for a given month. The monthly climatology was obtained through averaging monthly data for individual years. Data files are 1-byte binary with 360 pixels per line and 90 lines. The projection is latitude-longitude with the upper left corner of the first pixel of the first line positioned at 90N 180W.

File naming convention:
ims_snow_ice_stat_mm_yyyy is the monthly snow cover statistics.
"mm" is a two digit month number, and "yyy" is a four-digit year
ims_snow_ice_clim_mm is the monthly average.
"mm" is a two-digit month number.

Byte values:
0 : snow free land surface
1-100 : snow frequency of occurrence (from 1 to 100%)
120 : ice free sea surface
121-220: sea ice frequency of occurrence (from 1 to 100%)

Gridded MODIS Active Fire products

The gridded MODIS active fire products present gridded statistical summaries of fire pixel information (Giglio et al., 2003). These products are intended for use in Giovanni system focused on regional (NEESPI) analysis of surface processes and climate modeling. The products are generated at 1 degree spatial resolution for time period of one calendar month. These products are generated from MODIS CMG 0.5 degree products (Giglio et al., 2006).

File naming convention: MOD14CM1.YYYYMM.CCC.VV.hdf
MOD14 indicates that the data included are from the Terra satellite
CM1 indicates Climate Modeling 1 degree grid
YYYY is a four digit number for year (e.g. 2003)
MM is a two digit number for month (e.g. 01)
CCC is a three digit number for MODIS collection (e.g. 004)
VV is a two digit number of the version within a collection (e.g. 03)
e.g. MOD14CM1.200101.004.03.hdf
File format: HDF
Data type: floating point
Dimension: 360 x 180
Resolution: 1 x 1 degree
Upper Left Corner: (-180.0, 90.0)
File Size: depends on the number of attributes
Fill Value: -1.00

Data search and delivery options (current and future)

Google Earth

Direct FTP

Direct ftp download from S4PA

OPenDAP

Open-source Project for a Network Data Access Protocol

Mirador

Google-like data search interface (Mirador) with a hierarchical data inventory browsing feature

GIS

OGC-compliant GIS map and coverage servers