



NOAA-NASA GOES-R Program and GMU CSISS Joint Efforts for Supporting GEOSS AIP-3 Drought Scenario

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Outline of Contributions

- **SBA scenario development and demonstration**
 - Water – drought & extreme precipitation
- **Goal**
 - Infuse and reuse NOAA/NASA data and products into the SBA
 - Develop drought products using service chaining
- **Standard-based services to support the SBA scenario**
 - Data services
 - Geospatial processing Web services
 - Workflow engine service (BPELPower)
 - Geospatial processing portal service (GeOnAs)





SBA scenario development and demonstration

- Water - Drought Scenario
 - Soil moisture and precipitation are an important indicators of drought
 - GOES Precipitation product (North and South America), NASA EOS AMSR-E Soil moisture (25 km), CSISS downscaling high resolution soil moisture (1 KM).
 - WCS service available for those products
 - Infusion of those products into water- drought scenario





Drought Definition



- Conceptual definitions
 - formulated in general terms, help people understand the concept of drought, e.g., a protracted period of deficient precipitation resulting in extensive damage to crops, resulting in loss of yield.
- Operational definitions
 - help people identify the beginning, end, and degree of severity of a drought.
 - Many definitions (>150); No single definition works for all circumstances.
- Categorized operational definitions
 - Wilhite and Glantz (1984)
 - Based of four basic approaches to measuring drought
 - Meteorological, hydrological, agricultural, and socioeconomic

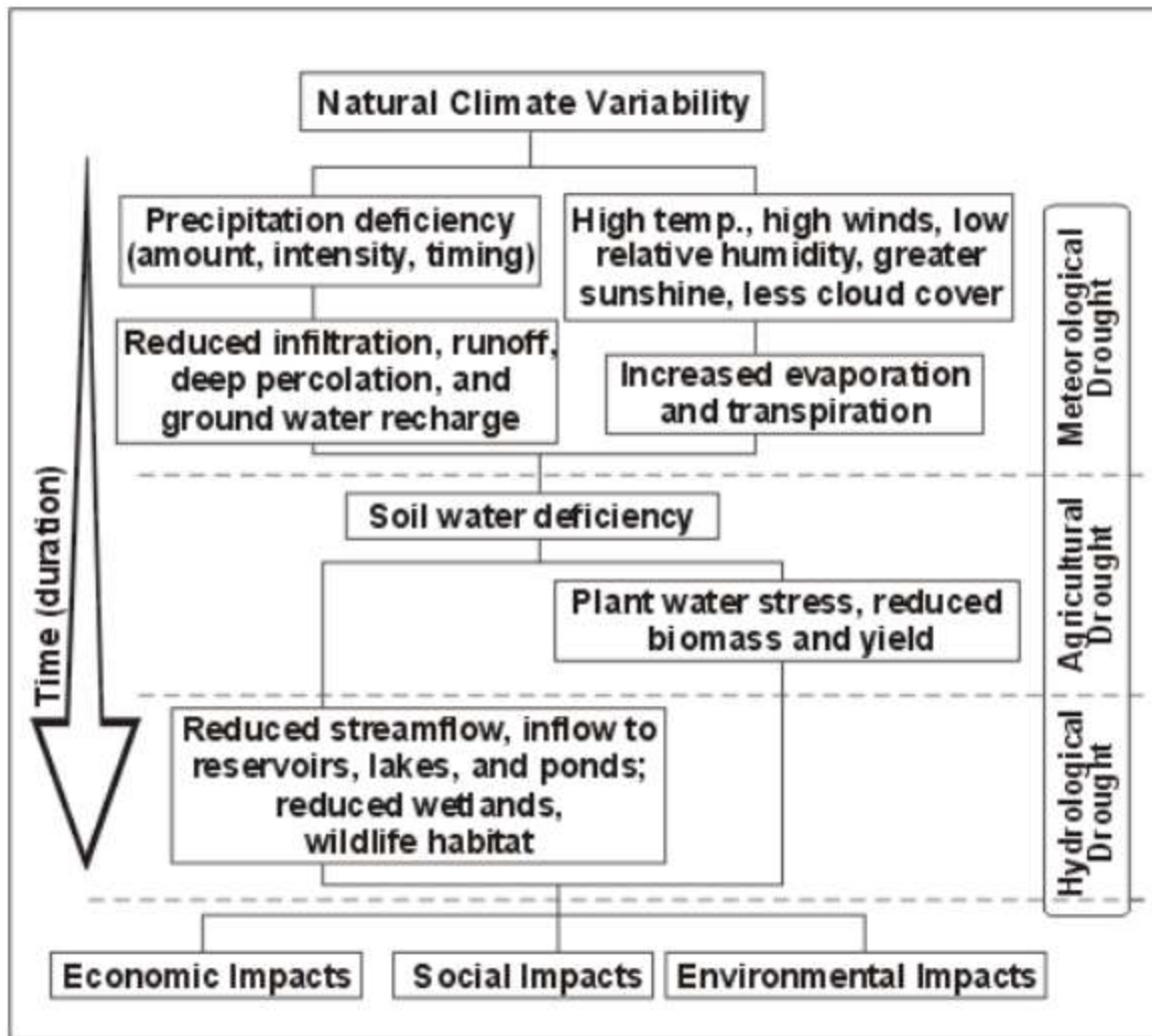


From <http://www.drought.unl.edu/whatis/define.htm>





Sequence of Drought Impacts



From <http://www.drought.unl.edu/whatis/concept.htm>





Drought Indices

- Many indices are used, for example
 - Palmer Drought Severity Index (PDSI)
 - Crop Moisture Index (CMI)
 - Moisture Availability Index (MAI)
 - Index of Moisture Adequacy (IMA)
 - Standardized Precipitation Index (SPI)
 - Effective Drought Index (EDI)
 - Surface Water Supply Index (SWSI)
 - Percentage of Normal
- GMU/CSISS to produce two high resolution soil moisture parameters
 - Root zone soil moisture
 - Surface soil moisture
 - Can also be input to drought indices





Deal with Drought Event

- Pre-event
 - Vulnerable/risk area
 - Prevention and Mitigation Plans
 - Potential risk/impact estimation
 - Prediction
 - Monitoring
- During-event
 - Real-time monitoring
 - Mitigation
 - Relief
- After-event
 - Impact assessment





Actors

- Data producers
 - Any person/organization producing index/indices.
 - GMU/CSISS publishes soil moisture and drought indices
 - GMU/CSISS to use Geospatial Web Service technologies.
- Data users
 - Wide range of communities: scientists, policy makers, resources planners, farmer, general public, ...





Scenario (1/2)

- Event trigger: drought or potential drought
- User needs: drought information
- Discovery: from service/data registry
- Request: user sends a request
- On-demand production
 - the request is accepted and the production begins with the automatic workflow (get source data from sensor observation services, e.g., NASA aqua data, start work flow, done index generation, respond to the user)





Scenario (2/2)

- Actions: user uses the results to take actions (e.g., change in irrigation planning/management/practice);
- Event condition changes (drought relieved/progressed), user needs more info/prediction and sends more requests
- Interaction continues





Drought index development

- To be representative
 - Combining both surface soil moisture
 - And root zone soil moisture
- Soil moisture to be generated
 - Surface soil moisture: downscaling
 - Root zone soil moisture: Based on energy balance theory (Di, 1991)





Implementation as WPS processes

- Downscaling soil moisture
- Root zone soil moisture





Workflow

- AMSR-E soil moisture + MODIS data => downscaled soil moisture





Persistent data storage service

- Data services
 - WCS
- Presentation
 - WMS





GeoBrain Online Analysis System

The screenshot displays the GeoBrain Online Analysis System (GeoOnAS) interface within a Windows Internet Explorer browser window. The browser address bar shows the URL <http://geobrain.laits.gmu.edu/OnAS/main.htm>. The interface includes a menu bar (File, View, Map, Vector, Raster, Web Service, Tools, Help) and a toolbar with various icons for data management and analysis.

A "Raster Dataset Selection" dialog box is open, displaying a table of search results. The table lists 5 results, all of which are "WindSat Land Data, EASE-Grid, Date: 20030510". The table columns are No, Preview, Description, Size, Format, and List All Scenes. The first result is highlighted.

No	Preview	Description	Size	Format	List All Scenes
1		WindSat Land Data, 25km Resolution EASE-Grid, Date: 20030510	0.42	application/x-gzip	Data Customization
2		WindSat Land Data, EASE-Grid, Date: 20030510			
3		WindSat Land Data, EASE-Grid, Date: 20030510			
4		WindSat Land Data, EASE-Grid, Date: 20030510			
5		WindSat Land Data, EASE-Grid, Date: 20030510			

Below the table, there are navigation controls including "Page 1".

A second browser window is open, displaying a map titled "WindSat Global Soil Moisture (Fraction), 20030510". The map shows a global view of soil moisture data, with a color scale ranging from 0 to 60. The map is centered on the Atlantic Ocean, showing the Americas on the left and Europe and Africa on the right. The x-axis ranges from -100 to 100, and the y-axis ranges from -60 to 60.





Geospatial Data Products Download



The screenshot shows a web browser window titled "Geospatial Data Downloading - Windows Internet Explorer" with the URL <http://geobrain.laits.gmu.edu/GeoDataDownload/index.jsp>. The page content includes:

- Basic Query:** A form with three rows of input fields and dropdown menus. The first row is for "Platform Short Name" with a dropdown set to "Any". The second row is for "Sensor Short Name" with a dropdown set to "Any". The third row is for "Dataset Collections" with a dropdown set to "Any".
- Spatial Query:** A section with a "Map" button and a "Satellite" button. Below is a map of the United States. Below the map are two columns of input fields: "Specify a Location By Name" (with "State in United States" and "Country, City, etc" dropdowns) and "Or Input A Bounding Box" (with "Projection: WGS84 Lat/Lon", "Northern" and "Southern" dropdowns, and "Western: -180" and "Eastern: 180" input fields).
- Temporal Query:** A section with "Collection Range" and "Begin/End DateTime" fields, each with a dropdown arrow and a date input field.
- Additional Options:** A section with a "Choose Additional Options" checkbox.
- Buttons:** "Set To Default" and "Make Query" buttons at the bottom right.

