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GEO Global Drought Monitor: Hydrological Extremes Monitoring, Forecasting, and Early Warning

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For information

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Can global drought and water scarcity monitoring and forecasting provide a service not met by the national drought monitoring services (where they exist)? The answer is "Yes," because: 1) some countries have limited technical infrastructure to support comprehensive drought and flood monitoring; and 2) drought is partly manifested through global and the large-scale due to factors such as ocean sea surface temperatures and partly due to global factors arising out of global climate change.

In order to effectively deal with transnational droughts (and flooding events), the GEO Global Drought (and Hydrologic Extreme) Monitoring, Forecasting, and Early Warning Framework was established. At the Fourth Plenary Session and Ministerial Summit of the Group on Earth Observations (GEO) held in Cape Town, South Africa, in November 2007, representatives from more than 70 nations reaffirmed their commitment to working together, at both the political and technical levels, to improve the interoperability of observation, prediction and information systems as part of the Global Earth Observation System of Systems (GEOSS). Recognizing the growing problem of drought and its impact on long-term sustainability of Earth's water resources, the event concluded with a U.S. proposal that technical representatives from participating countries build upon existing programs to work toward establishing a Global Drought Early Warning System (GDEWS) within the coming decade to provide: a system of systems for data & information sharing, communication, & capacity building to take on the growing worldwide threat of drought; and regular drought warning assessments issued as frequently as possible with increased frequency during a crisis.

Additional international efforts have been launched through the United Nations (UN) Convention to Combat Desertification (UNCCD). Africa which has a majority of its population engaging in agriculture—even at the subsistence level—while being dependent upon rainfed agriculture is a particularly vulnerable area. The Famine Early Warning Systems Network (FEWSNET) and other famine relief organizations have been carrying out water requirements satisfaction index in a monitoring capacity. Given the lead time required to make agricultural decisions, forecasting is a critical component, particularly where the forecast lead time is lengthened.

The GEO Global Drought Monitor effort is comparing soil moisture observations from remote sensing with model-derived values. In addition, the Gravity Recovery and Climate Experiment (GRACE) satellite provides estimates of total water storage change, which can be subdivided into groundwater changes, soil moisture changes, and other water storage changes (such as snow) to compare with measured changes in streamflow and groundwater. The informatics infrastructure for deployment of the Global Drought Monitoring Portal (GDMP) is being set up by the US National Integrated Drought Information System (NIDIS) and NOAA. The current GDMP includes four sections. The first is an abbreviated monthly drought assessment along with a series of global products. These high-level products, based on large scale monitoring indices such as Standardized Precipitation Index (where applicable), soil moisture, Standardized Runoff Index (where applicable), and GRACE-derived drought indicators, provide a broad-brush look at global drought conditions and are presented as both plain text and static images to encourage use in limited bandwidth areas. Because they use common base periods, they are appropriate for comparing drought status between locations around the world, but do not necessarily represent the severity of a drought at an individual location compared to its full period of record.

The second section of the GDMP includes an interactive map and data viewer. For locations with higher bandwidth, Open Geospatial Consortium (OGC)-compliant Web Mapping Services (WMS) are available and are the mechanism by which regions provide their information to the GDMP. This allows the availability of a larger suite of tools since production and maintenance is distributed, and also allows users to get more detailed local information. Through an interactive map viewer, users can zoom all the way to individual stations to get a detailed look at the drought in a specific location. Currently, North America, Europe, and Africa are providing WMS services to "paint" a global drought picture. Information from Australia should be available soon and Argentina and Brazil are discussing available ways a South American component can be prepared.

The third section of the GDMP houses a capability for users to drill down from the global to the regional scale in order to get a more robust suite of drought products and services than could be efficiently handled through a global interface. These regional sites, such as the North American Drought Monitor (NADM) website and the European Drought Observatory (EDO), provide access to more tools and data than are available at the global level. They also allow users to pass to individual national drought monitoring activities, such as the US Drought Portal, for even more specificity, since it is recognized that drought is dominantly a local phenomenon.

The fourth section of the GDMP is a general information section that includes details about those that participate and will also include help and details about contributing, when it is complete.

In summary, drought and flood forecasting—particularly ensemble forecasting, required to increase the window of lead time—requires extensive technological infrastructure that many underdeveloped countries lack. The GEO Global Drought Monitoring, Forecasting, and Early Warning Framework makes available such forecasts and distributes them through the Early Warning System framework of the World Meteorological Organization (and other regionally supported organizations).