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## WP23\_25: Global Drought Information System

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1254,224

### Basic Information

#### Full title of the Initiative

Global Drought Information System

#### Short Title or Acronym

GDIS

#### Current category in the 2020-2022 GWP

GEO Initiative

#### Proposed category in the 2023-2025 GWP

GEO Initiative

### Points of Contact

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|------------|------------------|-----------------------|
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### Purpose

#### Objective

GDIS is an information system ingesting global space-based and land-based Earth Observations for the purpose of early detection (through monitoring and prediction) of drought, combined with the data processing capability to identify increases of drought occurrence with increases in global warming

#### Please provide a short description of the Initiative

GDIS provides protection to global agriculture, forests, and human habitation through innovating drought monitoring technology to enable them to operate as close as possible to near-real-time and realistic, high resolutions, while, at the same time, combining this monitoring capability with cloud data processing capabilities to enable user-useful maps to be retrievable at high resolutions at any point on the terrestrial globe. GDIS also tracks drought propagation and links these to atmospheric and oceanic events.

#### Why is this Initiative needed?

Increases in temperature and evaporability accompanying global warming are increasing the predisposition towards drought formation; GDIS provides monitoring (and predictive) capability to improve crop failure

**What evidence is there to support this need?**

Increased severity of droughts and heat waves in Western USA, China, Australia, South America, South Asia, East Africa, West Africa, and Europe.

**Is this Initiative open to participation by representatives of any GEO Member, Participating Organization, and GEO Associate?**

Yes

**Are you aware of other projects or initiatives at a global or regional scale (both in GEO and externally) that provide similar products or services?**

Yes

**Please describe.**

European Commission Joint Research Centre Global Drought Observatory (GDO).

While GDO has a larger staff, GDIS is more effective at innovating global drought monitoring; GDIS is also directly tied to operational drought managers (in the USA-NOAA).

GDO (and JRC) has been quite good at documenting drought occurrence (but not exhaustively). They also produce case studies.

**How is this Initiative unique?**

GDO utilizes the DWD Global Precipitation Climatology Centre precipitation which consists of interpolated land-based station observations, taken once a month, after a month's delay. GDIS utilizes combined space-based and station-based measurements, based upon daily precipitation (converted to Standardized Precipitation Index), hence the GDIS values are closer to current, up-to-date measurements for interruptions of precipitation supply. The GDO and GDIS Gravity Recovery and Climate Experiment (GRACE) soil moisture and shallow ground water observations overlap, as does the Vegetation and Crop Health (anomalies in absorbed PAR for JRC; Vegetation Health Index for NOAA). However, GDIS has global monitoring of evaporability (evaporative demand drought index) using the NASA MERRA combined modeling-data assimilation, so it has greater capability to detect short term changes in drought condition.

While GDO has carried out studies of drought frequency, NOAA National Center for Environmental Information has detailed temperature and precipitation climate records, so that drought chronologies can be meshed with their records for inclusion in monthly NOAA and annual WMO Global Climate Reports.

**Please identify the most important actual and/or intended outputs (products, services, etc.) produced by the Initiative, along with their intended and/or actual users. This list does not need to be comprehensive but should identify the outputs which are most used and are expected to have the greatest potential impact.**

| <b>Output</b>   | <b>Status</b>     | <b>Users</b>  | <b>Additional info</b>                       |
|---|-------------------|---|--|
| NOAA Climate Prediction Center morphed global Precipitation converted into Standardized Precipitation Index SPI                   | Regularly updated | Drought Managers for identifying regions with precipitation interruptions   | Drought Monitoring--Precipitation Deficiency |
| Evaporative Demand Drought Index (EDDI) globally applied with NASA MERRA short time scale mesh                                    | Regularly updated | Drought Managers for flash drought detection & weekly changes in drought intensity  |  |
| Global Precipitation Measurement (GPM)  | In development    | GPM is being meshed with nclimgrid, which is the grid form of NOAA NCEI temperature and precipitation climate database. This will merge space-based measurements with station records.  |  |
| Global Precipitation Measurement--global near real time precipitation monitoring--converted into daily SPI for drought monitoring | In development    | GPM is a more inclusive global precipitation measurement than Cmorph  | Drought & Climate Monitoring Precipitation   |
| Global Soil Moisture monitoring   | In development    | During the upcoming 2023-2025 GWP, more monitoring measures for soil moisture will be added, combining European Community Copernicus approaches with some of the NASA GSFC Global Land Data Assimilation System Variable Infiltration Capacity (VIC) modeled soil moisture (and Soil Moisture Active and Passive (SMAP). This will be the global counterpart to set up of the National Soil Moisture Monitoring Network by NIDIS internally inside the USA. |  |

**If needed, please provide additional comments or explanation to accompany the outputs table**

- no answer given -

**What kinds of decisions are the outputs of this Initiative primarily intended to support?**

The overlap among mapped monitoring fields identify drought zones.

**How will these decisions benefit from the outputs of this Initiative?**

Improved, quicker drought identification

**What kinds of impacts (for example, reduced loss of life, monetary savings, conservation of biodiversity, etc.) are anticipated as a result of the use of the outputs of this Initiative?**

Coupled with proven effectiveness of short-term drought prediction, weekly drought monitoring or monitoring changes in drought status will improve crop protection and improve alerts on wildfire conditions

**Has this Initiative been asked to provide specific information (for example, reports, data, services) on an ongoing basis to an international convention, organization, or other multilateral body?**

Yes

**Please identify the requesting organization.**

World Meteorological Organization WMO

**Describe the nature of the request.**

The drought monitoring information in GDIS is used to prepare the precipitation anomaly and drought section of NCEI's monthly Global Climate Report. This is used in preparation of WMO's annual Global Climate Report.

**Please provide supporting documentation of the request.**

- no supporting documents provided -

## **Technical Synopsis**

**Please provide a brief description of the methods used by the Initiative to produce its (actual or planned) outputs.**

The current ArcGIS maps available within the GDIS portal are pretty technical and, hence, have been, up until now, more geared towards drought managers (for example, used in the Global Climate Report). An overview map needs to be assembled out of overlapping index maps that will map existing droughts in an easy-to-understand and practical form such that average users, such as farmers, can understand it and actually use it. Correspondingly, one of the major GDIS tasks for the upcoming 2023-2025 GWP is to create a more "user-friendly" overview map, illustrating the likelihood of the spatial locations of either droughts or "drought hazard" centers or zones, along with a common scale for drought intensity (for example, "yellow" for "mild" droughts and "red" for severe droughts. Another set of measures is the division into "short-term" droughts versus "long-term" droughts. This is measurement methodology is being implemented internally over the USA by NIDIS and will be attempted worldwide outside the USA by GDIS.

**If you would like to provide further details on the technical methods, you may upload one or more documents here.**

- no supporting documents provided -

**Are there any significant scientific or technical challenges that need to be resolved by the Initiative during the 2023-2025 period?**

Yes

**Please describe these challenges and the steps being taken to solve them.**

The medium-range weather prediction extends out to about 10 days (or a few days more). Beyond that, the atmospheric is increasingly chaotic. Nevertheless, after the medium-range window, soil moisture in the ground and other short-term processes may be able to extend probable predictive behavior out beyond this to possibly 3 weeks. Ascertaining reliability of Week 3 and Week 4 drought monitoring

**Does the Initiative expect to complete any key new outputs, improvements to existing outputs, or improvements to the methods of producing outputs, in the 2023-2025 period?**

Yes

**Please describe these new outputs or improvements.**

The NOAA Global Forecasting System (GFS), a medium range forecast, already has had an interface established with Google Earth Engine. NIDIS has already begun preferentially utilizing Google Earth Engine or, more particularly, Climate Engine (a variation of Earth Engine more suited for climate use). The forecast precipitation variables of CFSv2 have also been made available on Google Earth Engine. The forecasting component is a big task and will have to be set up in stages. More than two years may be required for implementation. We don't have a big forecasting staff, so automation is a critical aspect of pulling this off..

**Please identify the key tasks that must be implemented to ensure delivery of these changes, with target dates for completion.**

- no answer given -

## Resources

**Have all resources required to implement the Initiative's planned work in the 2023-2025 period been secured?**

**Please list all financial and non-financial contributions to the Initiative (other than in-kind, voluntary participation by individual contributors) having a value of more than USD 50,000.**

- no answer given -

## Lessons from the 2020-2022 Period

**Were all planned activities for the 2020-2022 period implemented as expected?**

Yes

**Were there any key challenges faced by the Initiative in the 2020-2022 period?**

Yes

**Please describe.**

Manpower and Resource limitations. Since then, agreement has been reached with NOAA-NIDIS to upgrade the portal, moving from "Periodic updates" to "Updates twice a year." Also, hiring additional staff has finally been put on NCEI's agenda.

## Were there any impacts or changes to operations due to COVID-19?

Yes

### Please describe.

The additional difficulty of still attempting to meet the requirements of carrying out US Drought Monitor drought monitoring within the USA while under quarantine conditions decreased in-kind work on GDIS.

## Please describe the key changes proposed for the 2023-2025 period, for example, new projects, new areas of focus, or adjustments to the activity governance.

Work carried out during the 2020-2022 GWP demonstrated by comparing ECMWF SEAS5 seasonal forecasts with actually occurring drought episodes that seasonal forecasting is of very marginal to below marginal value for drought prediction. There is not enough forecast information from ENSO to be very useful for seasonal drought prediction. There is some value in Indian Ocean Dipole forecasting for droughts in the Greater Horn of Africa. Hence, testing for greater drought predictive skill at the short end of the forecast spectrum, where factors such as soil moisture or month long subsidence conditions may provide more forecast information.

## Does the Initiative have outputs (products, services, etc.) available to users now, even if only on a pilot or testing basis?

Yes

### Please provide any available information describing this usage (for example, user statistics, results of user testing) and/or feedback from users (for example, user comments, evaluations).

<https://gdis-noaa.hub.arcgis.com/pages/drought-monitoring>

### Please provide supporting documentation if available.

- no supporting documents provided -

## Do you have evidence of any impacts that have occurred in part as a result of using the outputs of the Initiative (for example, policy decisions taken, behaviour changes by users, risks mitigated)?

No

## Have there been any internal or external reviews or evaluations of the Initiative since 2019?

No

## Please indicate any GEO Work Programme activities with which you have ongoing collaboration.

- GEOGLAM - GEO Global Agricultural Monitoring
- GLOFAS - Global Flood Awareness System

## Please indicate any additional GEO Work Programme activities with which you would like to establish new collaborations.

- GWIS - Global Wildfire Information System

## Stakeholder Engagement and Capacity Building

### Are there specific countries or organizations that your Initiative would like to engage?

No

**Does your Initiative engage users in the work of the Initiative (for example, consultation, testing, co-design)?**

No

**Does the Initiative have a user engagement strategy or similar kind of document?**

No

**Are there categories of users that are not represented at this time, but you would like to engage?**

No

**Does the Initiative have a documented capacity development strategy?**

No

**Please describe the approach to capacity development that is being implemented by the Initiative?**

- no answer given -

**Are there any commercial sector organizations participating in this Initiative?**

No

**Are there opportunities for commercial sector uptake of the outputs of the Initiative?**

No

**Are there opportunities for further commercial sector participation in the Initiative?**

No

**Does the Initiative have a plan for commercial sector engagement?**

No

## **Governance**

**Please describe the roles of each of the key leadership positions, as well as any team structures involved in day-to-day management.**

- no answer given -

**Is there a steering committee or other governance bodies that advise the Initiative but are not involved in day-to-day management?**

Yes

**Please describe the roles of each body. If there are multiple governance bodies, please describe the relationships among them (such as through a governance structure diagram).**

NOAA NCEI Program Management Staff (weak oversight)

- no supporting documents provided -

**What methods does the Initiative use to communicate with its participants?**

- Email / e-newsletters
- Regular conference calls

**Please describe the key risks that could delay or obstruct the completion of the planned activities and outputs of the Initiative, along with any actions taken to mitigate these risks.**

- no answer given -

**What methods are used by the Initiative to monitor its effectiveness?**

- Informal discussions with users / beneficiaries
- Evaluations

**Would the Initiative be interested in assistance from the GEO Secretariat for developing an impact plan?**

No

**How are the results of the monitoring and evaluation activities shared with participants and the wider GEO community?**

- no answer given -

**Are any monitoring or evaluation activities required by funders/contributors?**

Yes

**Please describe and provide reports if available.**

- no answer given -

- no supporting documents provided -

## **Participants**

**Please list the active individual participants in the Initiative**



| First name  | Last name    | Email address                    | Member   | Org  |
|-------------|--------------|----------------------------------|--|--|
| Albert      | Van Dijk     | albert.vandijk@csiro.au          | Australia  | - Australia National University                            |
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| Daniel      | McEvoy       | daniel.mcevoy@dri.edu            | United States  | - Desert Research Institute                                |
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| Florian     | Pappenberger | florian.pappenberger@ecmwf.int   | ECMWF - European Centre for Medium-Range Weather Forecasts | ECMWF - European Centre for Medium-Range Weather Forecasts |
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|          |               |                                  |  |  |
|----------|---------------|----------------------------------|--|--|
|          |               | wf.int                           | European Centre for Medium-Range Weather Forecasts | European Centre for Medium-Range Weather Forecasts     |
| Robert   | Stefanski     | rstefanski@wmo.int               | WMO - World Meteorological Organization            | WMO - World Meteorological Organization                |
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## Other information

**Please provide any other comments or information that was not included in the previous sections, but you would like to appear in the Implementation Plan.**

- no answer given -

- no supporting documents provided -

## Co-Editor Management

### List of co-editors for this initiative

| <b>First name</b> | <b>Last name</b> | <b>Email address</b>  |
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