EVALUATING DATA RELEVANCE, FIDELITY, INTEGRATION, METADATA AND NEW TECHNOLOGIES

Drought assessments use a variety of *in situ*, modeled, and remote data sources and products. The quality and relevance of these datasets needs to be consistently evaluated for efficacy in characterizing drought in a changing climate. A clearinghouse to verify performance for new and commonly used metrics and indices would greatly benefit scientists and climate service providers. A scientific board could convene to provide guidance and research results to climate service providers who currently disseminate various drought information. The accuracy, completeness, consistency, and timeliness of data—data fidelity—will continue to be important in a changing climate. Careful consideration should be made to streamline, integrate, and, in some instances, consolidate or discontinue existing data products and services, before or alongside the development of new products. This is especially important as new technologies in data science, artificial intelligence, and soft computing create previously unavailable capabilities in leveraging data for improved design, understanding, prediction, and communication of environmental data and the systems used to collect them. Examples of applying these new technologies include using:

- *fuzzy inference systems* for characterizing water availability in a way that is holistic, quantitative, and objective while integrating experiential (e.g., expert and stakeholder) knowledge (Fleming et al., 2014);
- *information theory* and complex *network theory* for improving and rationalizing the design of environmental monitoring networks (e.g., Caselton & Husain, 1980; Halverson & Fleming, 2015); and,
- *artificial intelligence* applications relevant to environmental science and climate hazards.

There is the potential for these new technologies (e.g., artificial intelligence, soft computing) to enhance overall relevance of various datasets used in drought assessment. However, efforts are needed to increase the transparency and explainability of these new technologies, improve understanding of these technologies and their appropriate use for environmental and water resource communities, and build systems specifically suited for practical operational applications (e.g., McGovern et al., 2019; Kratzert et al., 2018; Fleming et al., 2021a,b).

Priority Actions:

1. Characterize drought at seasonal, monthly, daily, and sub-daily time scales to connect drought indicators with impacts in real-time to inform the scale and pace of response and adaptation.
2. Develop a consistent metadata framework for drought metrics. Within the framework, metadata should include period of reference given the sensitivity of drought metrics to length-of-record or truncated reference period.
3. Ensure complete metadata includes data reuse restrictions and ownership to ensure proper attribution when considering the integration of ITEK and other knowledge systems into drought assessment.
4. Integrate information from several different data sources and platforms to contextualize drought by offering different, yet well documented, temporal and spatial perspectives to changing conditions. This will allow observations and assessment to be packaged in a way that communicates the condition, impact, and consequence to inform the appropriate response.
5. Explore new data science and soft computing technologies and their appropriate and transparent uses for practical operational applications to improve environmental and resource management.