frontiers | Frontiers in Climate

EDITORIAL
published: 05 April 2022
doi: 10.3389/fclim.2022.852202

Editorial: Emerging Technologies in Climate Services: Advancing End-User Data Accessibility and Application Through Web-Based Platforms

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Keywords: climate services, cloud computing, web applications, application ready data, open science

Editorial on the Research Topic

Emerging Technologies in Climate Services: Advancing End-User Data Accessibility and Application Through Web-Based Platforms

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Specialty section:
This article was submitted to Climate Services, a section of the journal Frontiers in Climate

Received: *10 January 2022*
Accepted: *19 January 2022*
Published: *05 April 2022*

Citation:
Flores-Anderson AI and Ellenburg WL (2022) Editorial: Emerging Technologies in Climate Services: Advancing End-User Data Accessibility and Application Through Web-Based Platforms. Front. Clim. 4:852202. doi: 10.3389/fclim.2022.852202

We are in a unique era for Earth observations, climate and weather modeling, and geospatial technologies. Computational advances such as cloud computing and greater availability of satellite data enable us to analyze and model large amounts of data in minimal time and in a more cost-effective manner.

A key challenge remains for the user community in the accessibility of application ready data.

Of particular interest are climate services that provide valuable and needed information for a particular application. At the management and decision-making level, climate information is often needed on short notice and the products desired could easily take hours or days of work from an experienced computer programmer to complete the task. These services can be powered by cloud computing, provide user-friendly platforms through Application Programming Interfaces (APIs) and interactive Web Tools, and are replicable through open-source code repositories. Ultimately, by advancing end-user accessibility and applications, these tools enable scientific collaboration, exploration, and discovery and contribute to the broader open science movement. The manuscripts included in this Research Topic highlight several examples of climate services that leverage these technological advances to address drought resilience, land cover change and deforestation, climate-driven extreme events, and monsoon variability.

In order to prepare and manage the limited water resources in the drought prone region of the Horn of Africa, where droughts are linked to food insecurity, Thomas et al. details the development of the Drought Resilience Impact Platform (DRIP). In linking *in situ* sensors with remote sensing data, DRIP supports the operation and maintenance of groundwater borehole systems by providing regional-level aggregated data such as water pump characteristics and rainfall. This can enable early detection and planning with proactive groundwater management to ensure water availability. The authors showcase the ability to incorporate disparate data sources, like satellite rainfall estimation and borehole pump runtimes, in an accessible web-based data visualization system that can be customized for dissimulation, scaled, and transferred across the region.

Levering the Google Earth Engine (GEE) cloud computing platform and its planetary-scale Earth science data and analysis, Arévalo et al. details the suite of tools for continuous land change monitoring. Their manuscript describes several free tools to interpret results from the

Continuous Change Detection and Classification algorithm (CCDC), which is a time series algorithm that allows for continuous monitoring of land cover and land use change, including rates of deforestation. In this work multiple tools and a code repository is presented to interact with the entire Landsat archive, facilitate the interpretation of CCDC products, and derive new products. These tools and apps increase the access to and applicability of state-of-the-art time series algorithms for scientists that can be used for climate change mitigation programs such as UN-REDD+.

Shukla et al. describes a widely used web-based application, the Early Warning Explorer (EWX) that integrates and provides access to different Earth Observation datasets to support the analysis of climate, vegetation, and land surface conditions to enable the monitoring of natural hazards such as droughts and floods. It also provides access to forecasts to facilitate early warning. The manuscript details the front-end viewer and the back end GeoEngine and database structure as well as the analysis ready data sets. EWX is another example of how web-based tools work toward facilitating the application of EOs in decision-making. This is especially true in data limited regions, such as East Africa, where the authors describe the implementation of a regional instance of the EWX.

Often the success and applicability of web-based platforms to create and disseminate climate services information depend on the implementation teams' ability to collaborate across disciplines, integrating natural, social, and computer science expertise. McMahan et al. highlights this collaboration in the development of a web-based platform to curate and visualize monsoon precipitation data in the Southwestern U.S. The authors describe the backend database structure and associated API and visualization required to successfully integrate a dense network of data of different spatial and temporal resolutions. The portal improves upon previous efforts to track precipitation extremes, such as droughts and floods, in the region and could be utilized in mitigating flash flood impacts at the municipal level.

This Research Topic highlights recent advances in web-based technologies that have allowed for progressions in climate services which enable rapid generation of customizable, place-based climate, and weather data products. The manuscripts within highlight newly developed tools that are advancing climate services and usability by end-users. The tools and applications described in this Research Topic are clear examples of application ready data, capable to address the needs of users about critical climate change issues.

AUTHOR CONTRIBUTIONS

Both authors contributed equally to the creation of this editorial and edited document for cohesiveness. AF-A developed the main structure, introduction, and summaries for articles, while LE added additional article summary and conclusion. Both authors contributed to the article and approved the submitted version.

FUNDING

This editorial was developed through the NASA-UAH Cooperative Agreement NNM11AA01A. The authors would like to thank the SERVIR program and the NASA Applied Sciences Program for supporting the creation of climate services that apply open science principles, and enable generation and accessibility of application ready data.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.