Democratizing Climate Data for Vulnerability Analysis and Decision Making

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Assessments of future climate change are needed for diverse stakeholders, ranging from individuals, NGOs, and researchers to local, state, and federal governments. Simple metrics of key climate signatures and extreme events, or "climate indicators," are the easiest to track and communicate. For example, these indicators might include the number of days exceeding heat stress thresholds, drought frequency, or maximum 24-hour rainfall. Unfortunately, many potential consumers of such indicators lack the time, knowledge, or computational resources to extract this climate information from large ensembles of climate model projections available through the Climate Model Intercomparison Project (CMIP) and related efforts.
Here, we derive and publicly host a suite of climate indicators with uniform, global coverage to increase access to climate change information. The resulting outputs will enable climate vulnerability assessment through three modes, allowing users with a wide range of technical skill to engage: i) an interactive, web-based mapping app for data exploration or retrieval; ii) a public data repository hosting geospatial datasets of climate indicators for download and use; and iii) the code repository used for CMIP data processing, enabling community modifications for future extensions.

Our derived climate indicator dataset is based on NASA Earth Exchange Global Downscaled Daily Projections (NEX GDDP), a publicly available data product which statistically downscales CMIP6 ensemble model projections to 0.25 degree resolution. We use Google Earth Engine to access NEX GDDP and reduce the 30 TB dataset into a set of ready-to-use climate indicators based on the World Climate Research Programme's climate indicator definitions. The resulting data product provides upwards of 20 indicators by individual GCM and ensemble metrics for the available climate scenarios, with decadal summaries through 2100.

Our developed climate indicators offer a starting point for climate change assessment and allow many practitioners, lacking capacity to directly process 30 TB of climate data, to easily analyze and visualize the climate indicators, with options to access the datasets for use in custom workflows. Also, the developed open code repository toolkit leveraging Google Earth Engine provides an accessible means to work with future climate information, including transferability to other climate projection datasets. The data can be combined with other publicly available geospatial data sets to further analyze the impact of future climate change on ecosystems, biodiversity, and human systems.