

Mongolian Plateau Drought Distribution Dataset

Data Documentation

I. Dataset/atlas content features

i. Abstract

Over the past few decades, the severity of drought in the Mongolian Plateau has intensified, characterized by increased frequency, prolonged duration, expanded spatial extent, and heightened ecosystem vulnerability. Annual precipitation in the region has exhibited a declining trend, accompanied by significant spatiotemporal variability. Precipitation during spring and summer has decreased markedly, while autumn and winter temperatures have risen, leading to reduced snowmelt water availability and a critical shortfall in annual effective moisture supply. Concurrently, evaporation rates have remained elevated, with annual potential evapotranspiration far exceeding precipitation levels. This imbalance exacerbates soil moisture deficits, resulting in stunted or halted vegetation growth and a substantial decline in forage production. Notably, moderate-to-severe meteorological droughts have persisted over consecutive years, with certain periods—such as 2020, 2022, and 2024—experiencing drought durations exceeding three months. These prolonged dry spells have significantly weakened the resilience of grassland ecosystems. In this study, a comprehensive drought index (STVDI) was developed within a three-dimensional Euclidean framework, integrating the standardized precipitation evapotranspiration index (SPEI), temperature condition index (TCI), and vegetation condition index (VCI). Leveraging these indices, we systematically constructed a dataset detailing the spatiotemporal distribution of drought across the Mongolian Plateau from 2000 to 2023. The dataset is stored in raster (.tif) format, featuring a spatial resolution of 1 km and an annual temporal resolution, ensuring high spatiotemporal continuity and scalability. These findings provide a robust foundation for subsequent analyses of drought events, assessments of climate change impacts, and evaluations of agricultural drought risks. Furthermore, they offer critical support for advancing drought monitoring systems and enhancing our understanding of climate response mechanisms.

ii. Elements (content fields)

The data file is named in the format "STVDI_mean_XXXX.tif", where XXXX denotes the year. The raster values of the data product range from 0 to 1, with specific intervals representing different drought severity levels: 0–0.2 for extreme drought, 0.2–0.3 for severe drought, 0.3–0.4 for moderate drought, 0.4–0.5 for mild drought, and 0.5–1 for no drought.

iii. Temporal cover

2000 - 2023

iv. Spatial cover

70° E -130° E, 30° N-60° N.

II. Subject/industry scope of dataset/atlas

i. Subject scope

Earth science, remote sensing, etc.

ii. Industry scope

Geographical information services, remote sensing surveying and mapping services, etc.;

iii. Other classifications (optional)

III. Accuracy of dataset/atlas

i. Time frequency

Annual.

ii. Spatial reference, accuracy, and granularity

Spatial reference: GCS_WGS_1984;

Spatial resolution: 1 km.

IV. Dataset/atlas storage management

i. Data quantity

1.41GB

ii. Type format

TIF

iii. Update management

Irregular updating

V. Quality control of the dataset/atlas

i. Production mode

The Standardized Precipitation Evapotranspiration Index (SPEI), Temperature Condition Index (TCI), and Vegetation Condition Index (VCI) were computed using the drought index formula based on MODIS data and the Climatic Research Unit Time-Series (CRU TS) dataset. Subsequently, a three-dimensional Euclidean space was constructed using SPEI, TCI, and VCI as components, and the Comprehensive Drought Index (CDI) was calculated and normalized. The primary data processing tools employed in this study were Python and Google Earth Engine.

ii. Data sources (condition selection)

MODIS data and CRU TS data.

iii. Methods of the data acquisition and processing (condition selection)

The Standardized Precipitation Evapotranspiration Index (SPEI) was derived by standardizing the difference between monthly precipitation and monthly potential evapotranspiration (ET₀), using CRU TS precipitation and evapotranspiration data. The land surface temperature (LST) of the Mongolian Plateau was extracted from MOD11A2 data, and the Temperature Condition Index (TCI) was subsequently calculated. The Normalized Difference Vegetation Index (NDVI) of the Mongolian Plateau was obtained from MOD13Q1 data, enabling the calculation of the Vegetation Condition Index (VCI). By integrating SPEI, TCI, and VCI within a three-dimensional Euclidean space framework, a standardized normalization process was applied, followed by a significant trend test, to derive the Comprehensive Drought Index (STVDI).

VI. Sharing and usage method of the dataset/atlas

i. Sharing methods and restrictions

Fully opened sharing

ii. Contact information of the sharing service (condition selection)

Online link address:

Contact Information for Service:

Name: Service group of Disaster Risk Reduction Knowledge Service System of IKCEST

Address: 11A, Datun Road, Chaoyang District, Beijing, 100101, China, Institute of Geographic Sciences and Natural Resources Research, CAS.

Zip Code: 100101

E-mail: ikcest-drr@lreis.ac.cn

iii. Conditions and methods of usage

The dataset can be read by ArcGIS and ENVI software.

VII. Intellectual property rights of the dataset/atlas

i. Property rights (optional)

The property of the dataset belongs to the Institute of Geographic Sciences and Resources, Chinese Academy of Sciences.

ii. Reference method of the dataset/atlas

Mongolian Plateau Drought Distribution Dataset. Disaster Risk Reduction Knowledge Service of International Knowledge Centre for Engineering Sciences and Technology (IKCEST) under the Auspices of UNESCO, 2025.06

iii. Usage contacts of the datasets/atlas

Name: Service group of Disaster Risk Reduction Knowledge Service System of IKCEST

Address: 11A, Datun Road, Chaoyang District, Beijing, 100101, China, Institute of Geographic Sciences and Natural Resources Research, CAS.

Zip Code: 100101

E-mail: ikcest-drr@lreis.ac.cn

VIII. Others (optional)

In addition to the above, other information must also be explained.

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