

Fig. 4 The 3D DBSCAN algorithm for Event-based Global Monitoring during July—September, 2022

Legends of extreme events (SA: Standardized Anomalies; P: Percentage) Drought (-2.5≤SA<-2) × ExtremPreci (90%≤P≤95%) → Heatwave (90%≤P≤95%) Drought (-3≤SA<-2.5) × ExtremPreci (P >95%) → Heatwave (P >95%)

120°E 150°E 180°

150°W

0°E

60°E

90°E

The 2022 August Flood-inducin

Pakistan extreme precipitation (Aug 5th to Aug 27th)

Coldsurge ($5\% \le P \le 10\%$) Coldsurge (P < 5%)

90°W

60°W

Glo3DHydroClimEventSet(v1.0): A global-scale event set of hydroclimatic extremes detected with the 3D DBSCAN-based workflow (1951—2022) Zhenchen LIU (**刘臻**晨), Wen ZHOU (**周文**)

Department of Atmospheric and Oceanic Sciences & Institute of Atmospheric Sciences, Fudan University

Fig. 5 Global-scale 1951—2022 event-based spatial distributions of typical extreme events ((a)—(d)) and associated Latitude—Event Count evolutions ((e)—(h)). Meteorological drought (a), cold surge (b), heatwave (c), and extreme precipitations (d) are plotted. The peak value of event count and associated latitudinal locations are also marked regarding the latitudinal evolutions of event counts. All the extreme events are retrieved from the *Glo3DHydroClimEventSet(v1.0)* database, with parameters briefly labeled in the caption of each sub-figure.

The General Introduction of XGBoost-based Drought Reconstruction

Tool XGBoost (eXtreme Gradient Boosting), a highly efficient a decision-tree-based ensemble learning technique.

Target 1) Reconstruct hydroclimatic situations at the Drought Peak time using atmosphere dynamic variables and 2) quantitatively assess variable contributions.

Predictor the **90-day Standardized Anomalies** of vertical velocity (OMEGA), relative vorticity (RV), and horizontal divergence (DIV) with 27 pressure levels from 100–1000hPa.

Predictand standardized anomalies of hydrometeorological indices (e.g., **SPAI** precipitation, **STI** near-surface air temperature, **SMsurf** SA surface soil moisture and **E_SA** actual evaporation).

one feature.



References:

0 10 20 30 40 50 60 70 80 90 10

LIU, Z.-C., W. ZHOU*. Glo3DHydroClimEventSet(v1.0): A global-scale event set of hydroclimatic extremes detected with the 3D DBSCANbased workflow (1951-2022) (一套基于3D DBSCAN框架的全球极端水文气候事件集). International Journal of Climatology [J], 43(16), 2023. https://doi.org/10.1002/joc.8289. LIU, Z.-C., W. ZHOU*, et al. Global-Scale Interpretable Drought Reconstruction Utilizing Anomalies of Atmospheric Dynamics (利用大气动力) 异常进行全球干旱可解释性重建). Journal of Hydrometeorology [J], 2022a, 23 (9), 1507-1524. https://doi.org/10.1175/JHM-D-22-0006.1

Predictor contributions measured using **Feature Importance** since each predictor variable is treated as

hydrometeorological reconstruction of the interannual variability and associated predictor contributions regarding the peak time of two regional droughts (the 2010 western Russia summer hot drought and the 2015/2016 South American drought).





Figure 8 (A) and (B) Reconstruction Scheme evaluations at the peak time of globalscale detected severe droughts.

Drought— Omega dominant, and "All" scheme improve a little compared with "omega-only" scheme Temp.Ano.— RV dominant, but "All" scheme improve a lot compared with "RV-only" scheme

Figure 8 (C) and (D) Latitudinal evolutions and frequencies of predictor contributions based on the "ALL (OMEGA+RV+DIV)" schemes.

Region I (Drought)— low-level anticyclonic/cyclonic anomalies to the north of 40° N. Region II (Temp.Ano)— Upper-level anticyclonic/cyclonic anomalies to the north of 30° N. Region III (Temp.Ano)— Upper-level vertical motion between 10° N and 40° S.