EGU2020, Hydrology, Society & Environmental Change

Intra-year distribution of water discharge in global rivers

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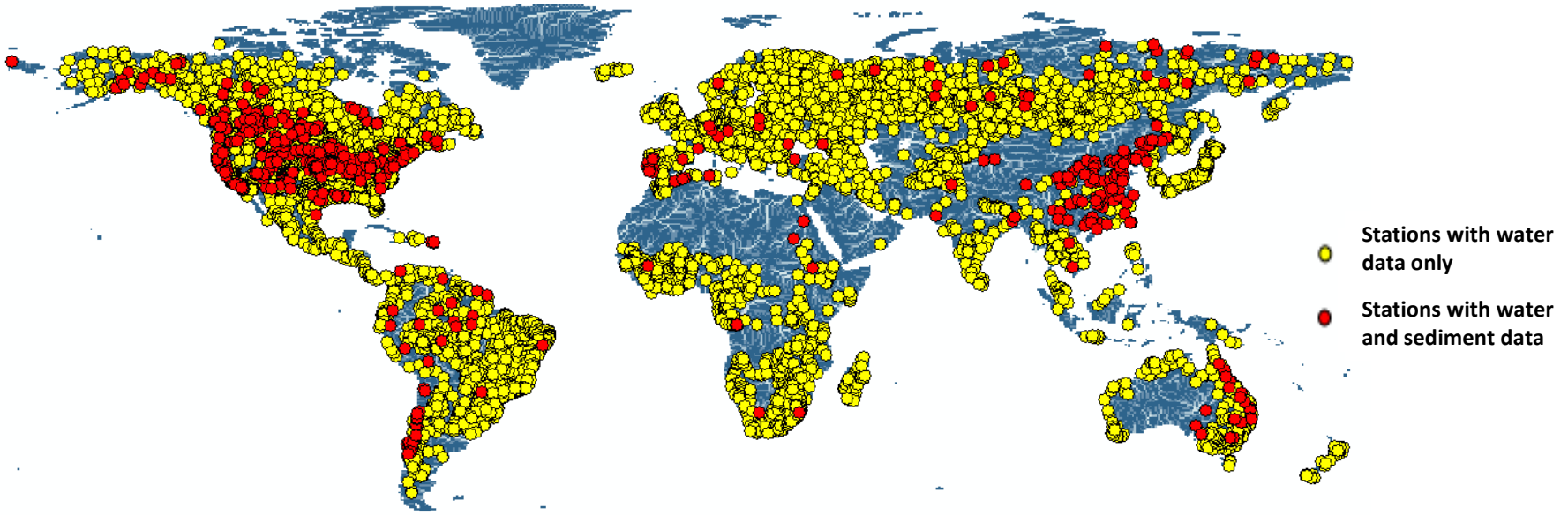
4-8 May, 2020

Global water-sediment database

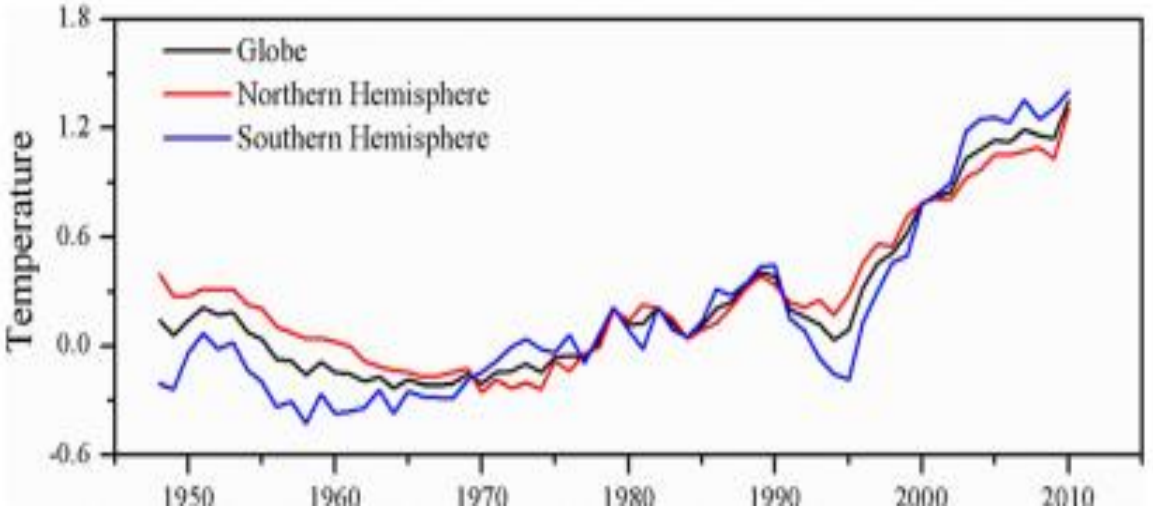


Large rivers with drainage area larger than 1,000 km^2

So far the largest database

- Water: **4307** large rivers, **8089** stations
  Sediment: **309** large rivers, **495** stations
- Including six continents
- **88%** of the world total drainage area
- **62%** data length longer than 30 years
- **50%** extended to 2000s

Climate change and human activities

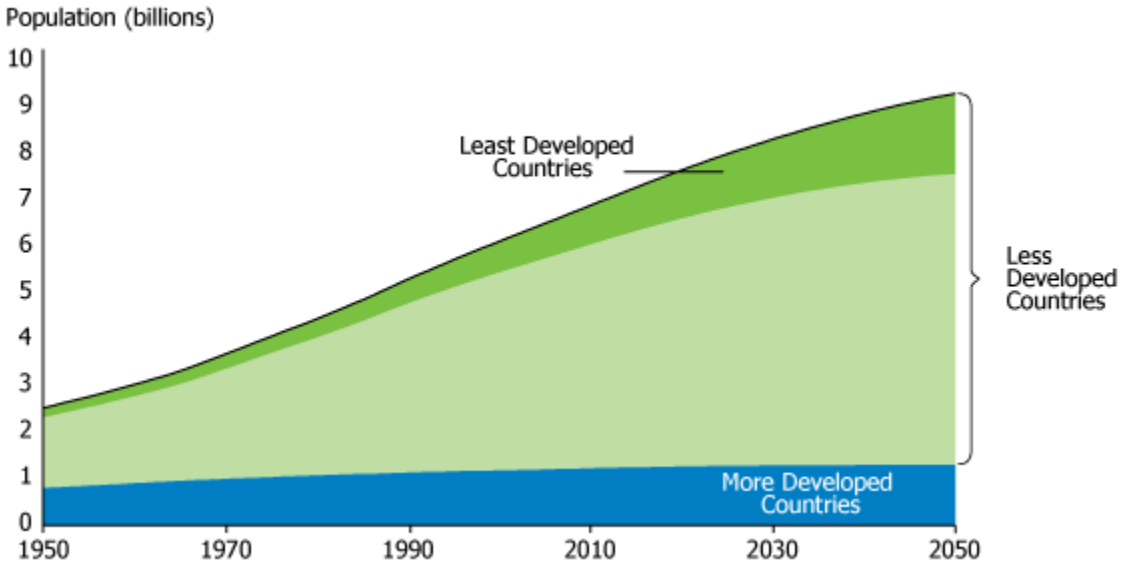


Climate Change

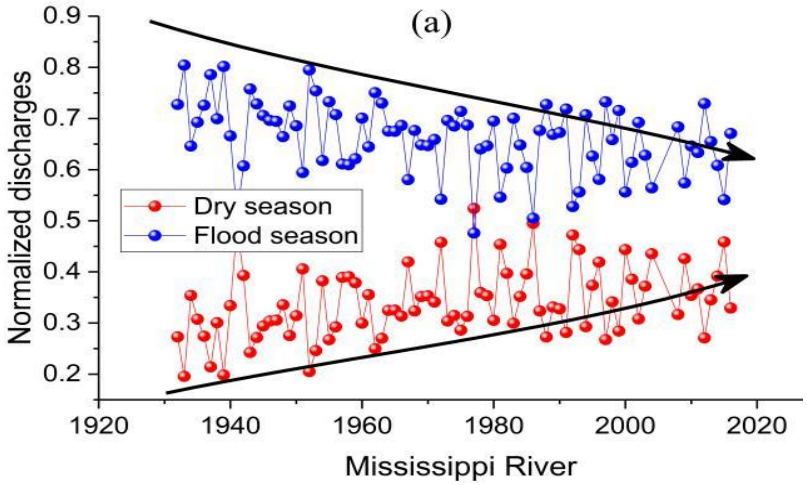
- Higher Mean Air Temperature
- Shrinking Ice Cap
- Extreme Climate events

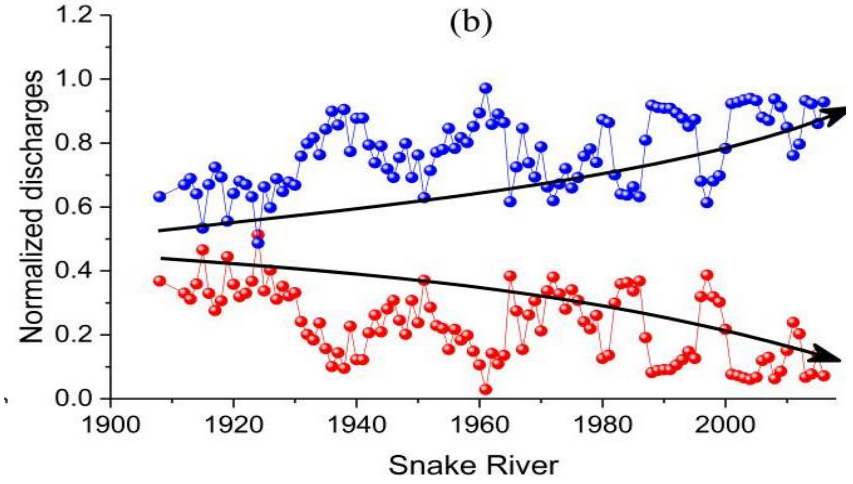
Human Activities

- Increasing demand for water resources
- More dams
- Land cover changes



Homogenization and polarization

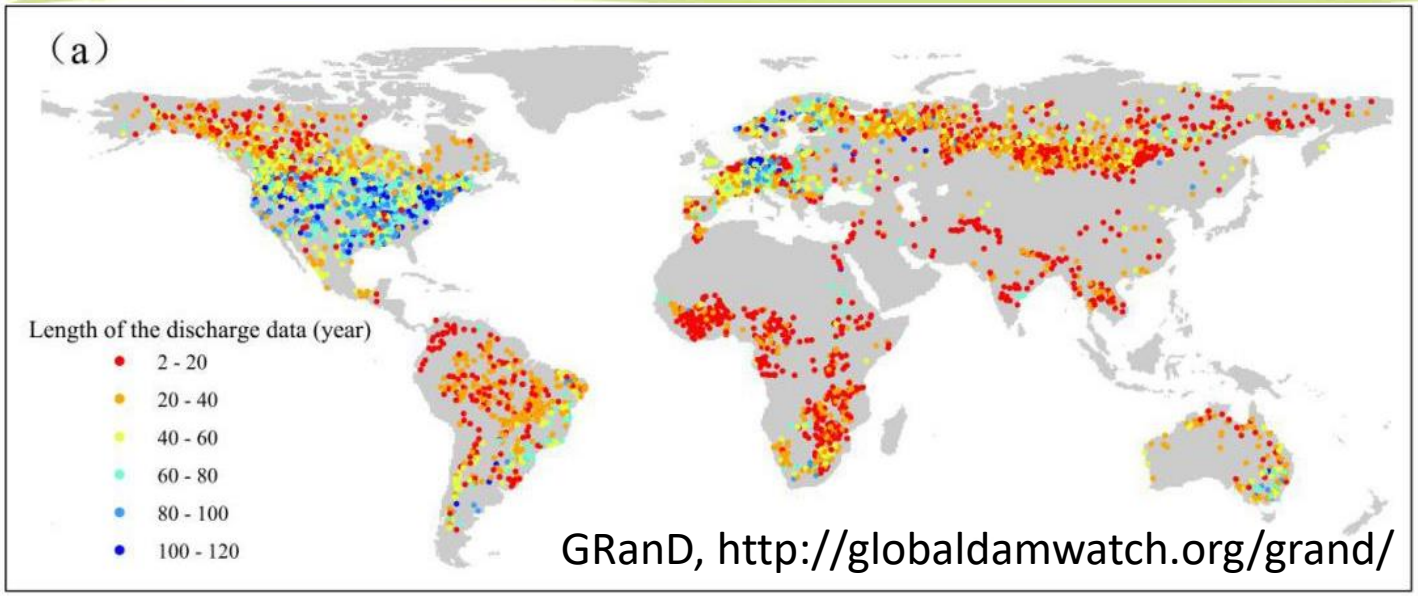




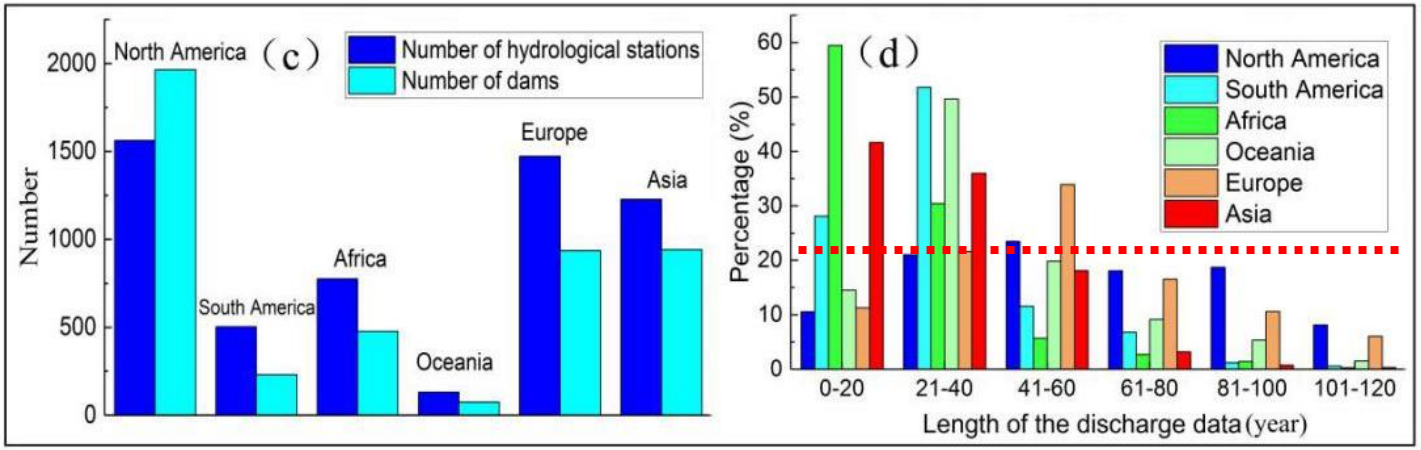
Homogenization

Polarization

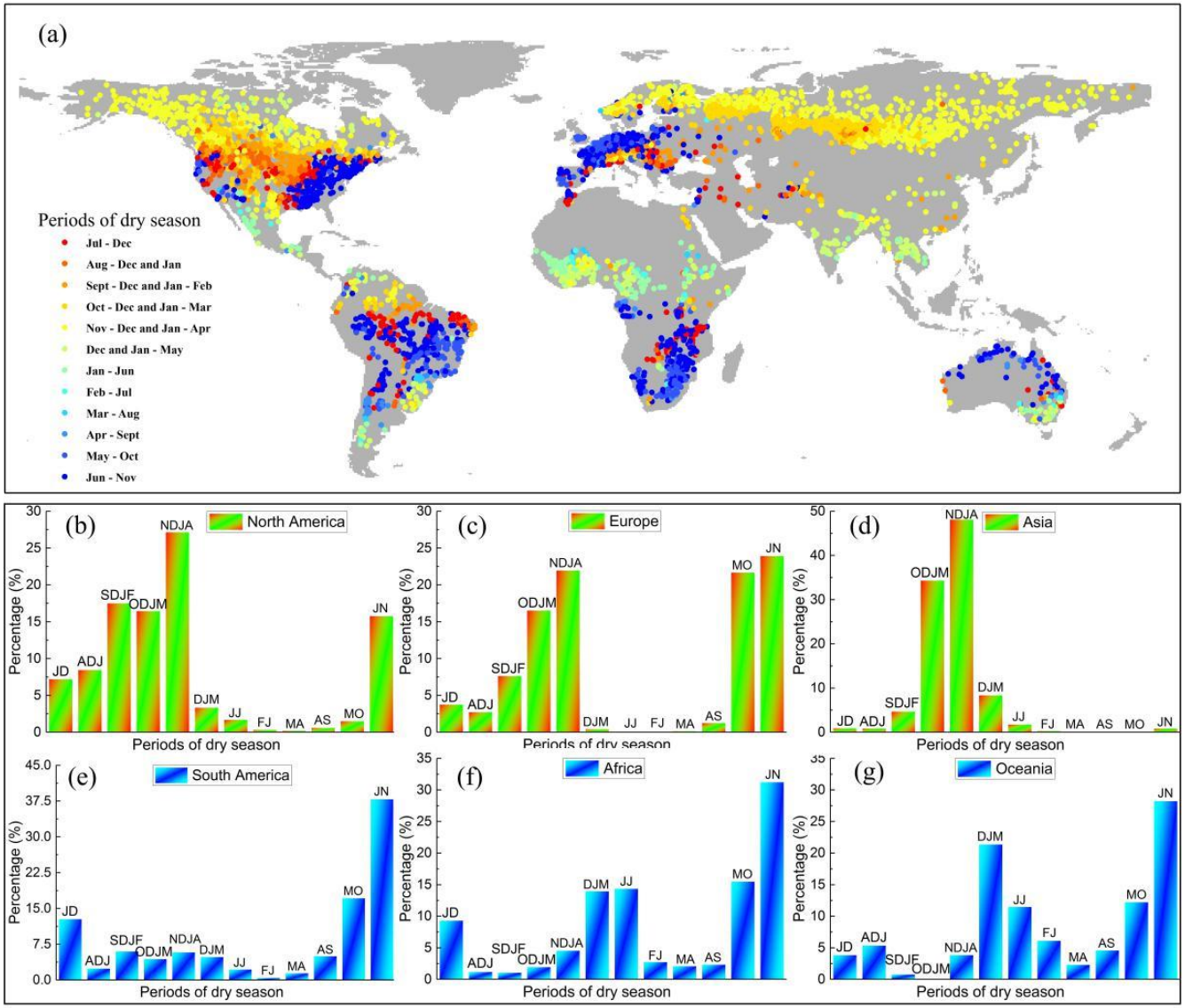
Global intra-year discharge data



5668 hydrological stations, 2/3 of total land area.



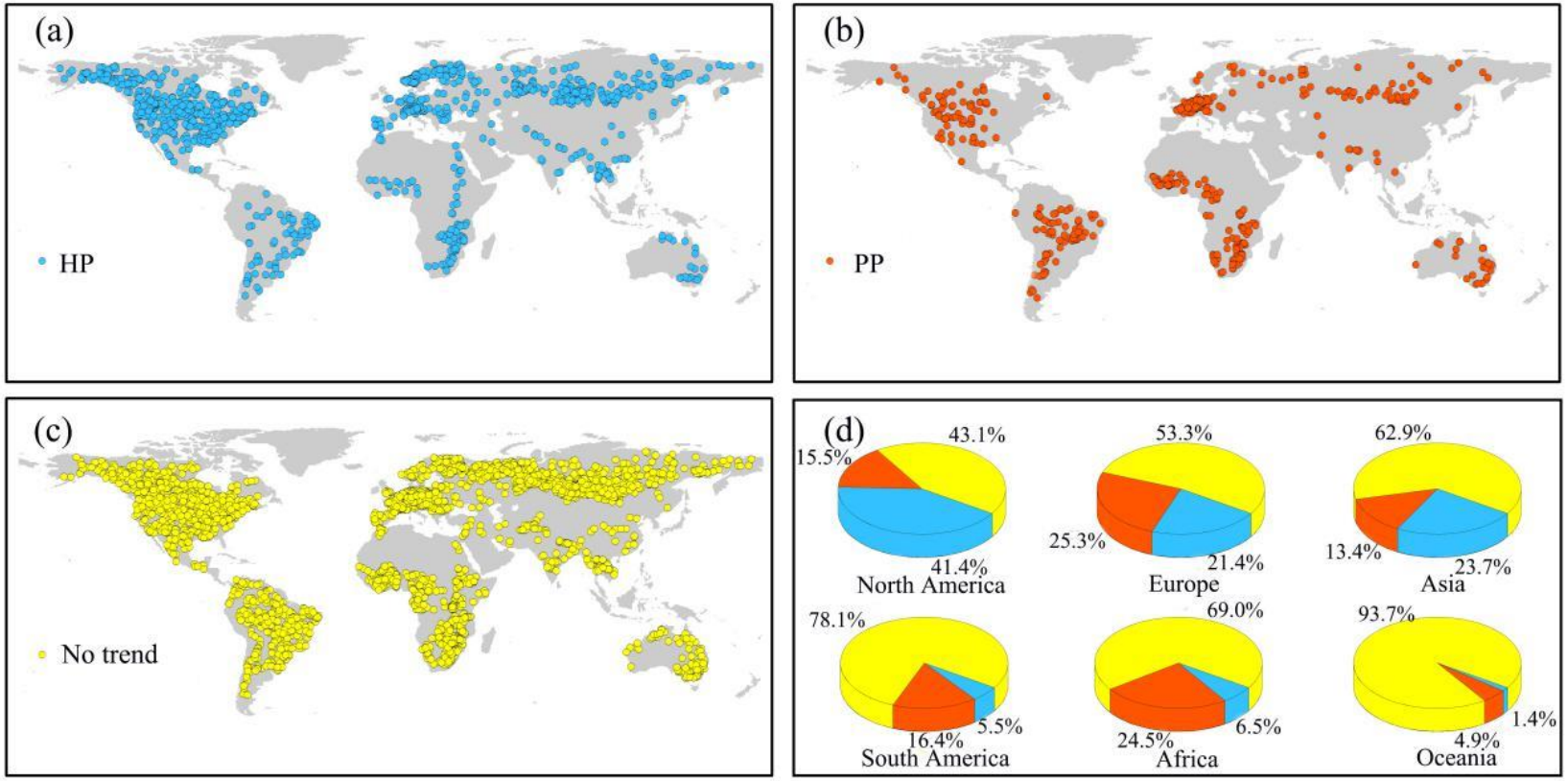
Division of dry and flood seasons



Flood season:
Consecutive six months with the highest sum of runoff

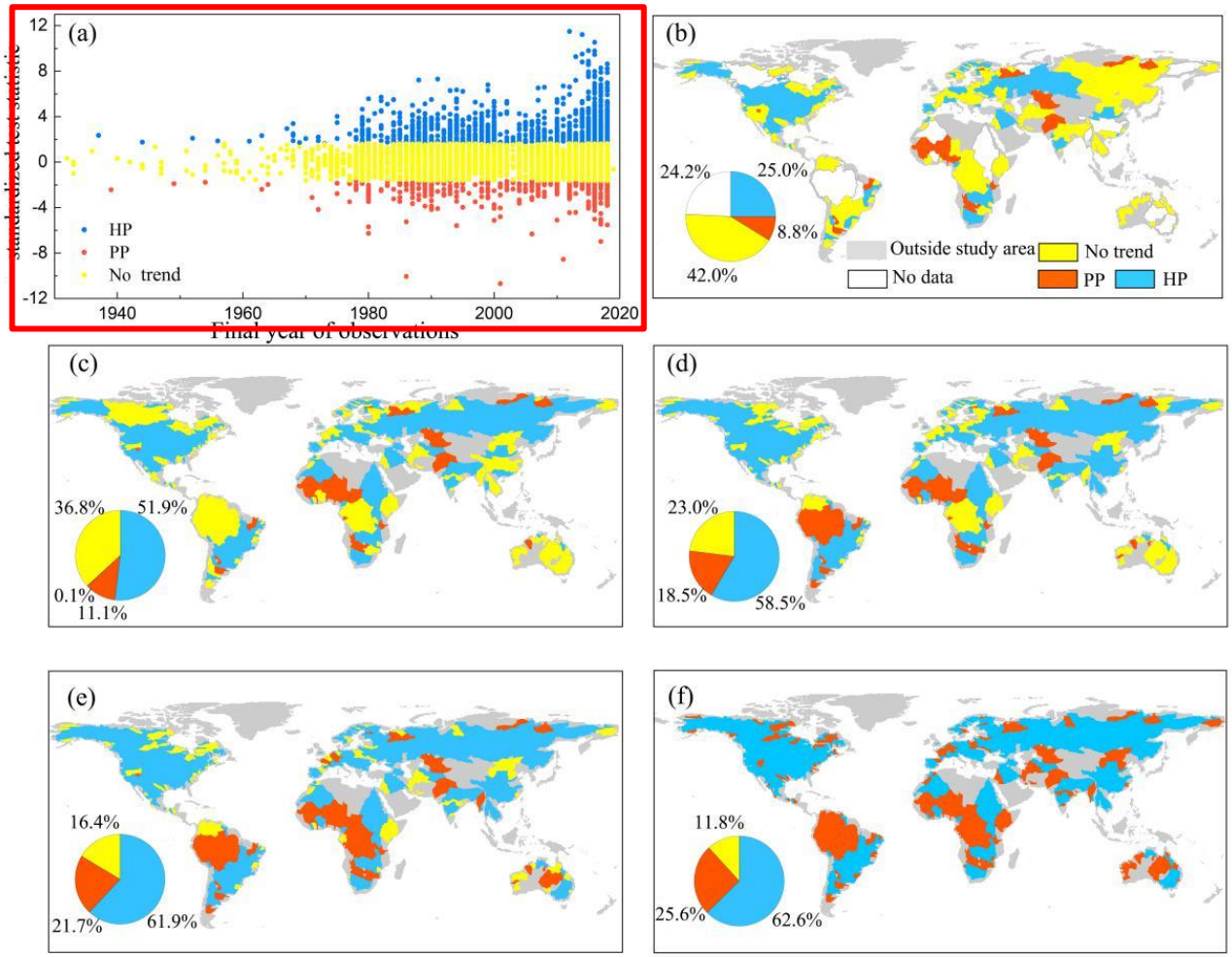
Dry season:
The remaining six months.

TFPW-MK Method to test trends



Trend free pre-whitening MK method

Global trends of intra-year discharge

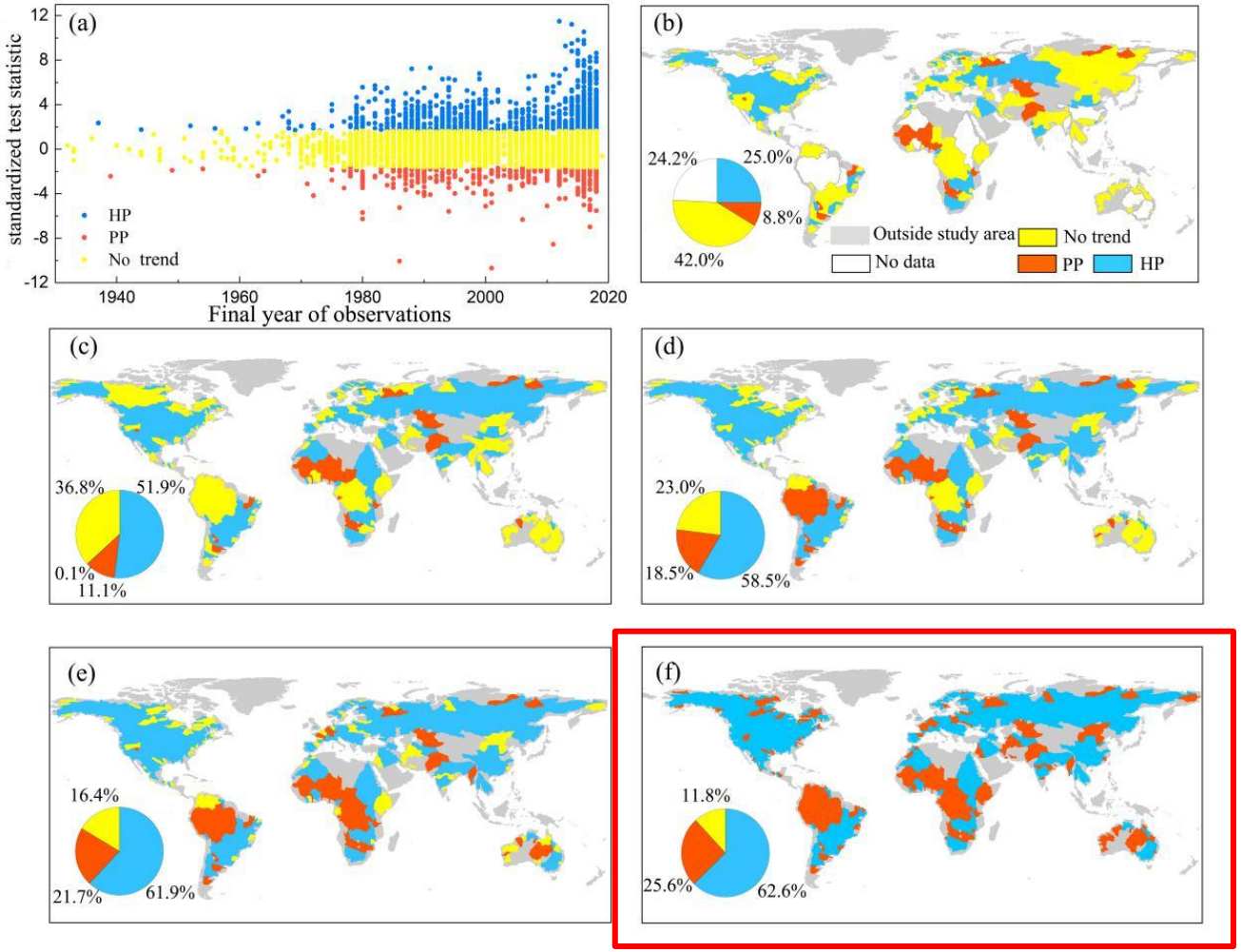


Homogenization Phenomenon: 22.7% of the hydrological stations (1287 stations);

Polarization Phenomenon: 8.3% of the hydrological stations (470 stations)

Confidence level exceeding 90% .

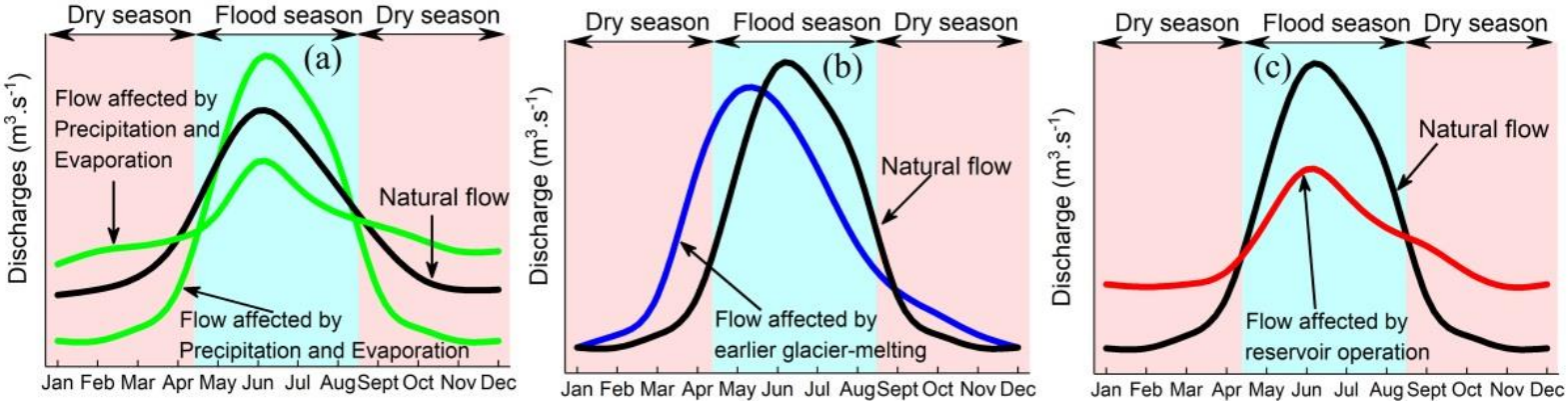
Global trends of intra-year discharge



Homogenization Phenomenon:
181 of the 314 independent basins, 62.6% of the total area studied;

Polarization Phenomenon:
39 independent basins, 25.6% of the total area studied.

Reasoning the changes.



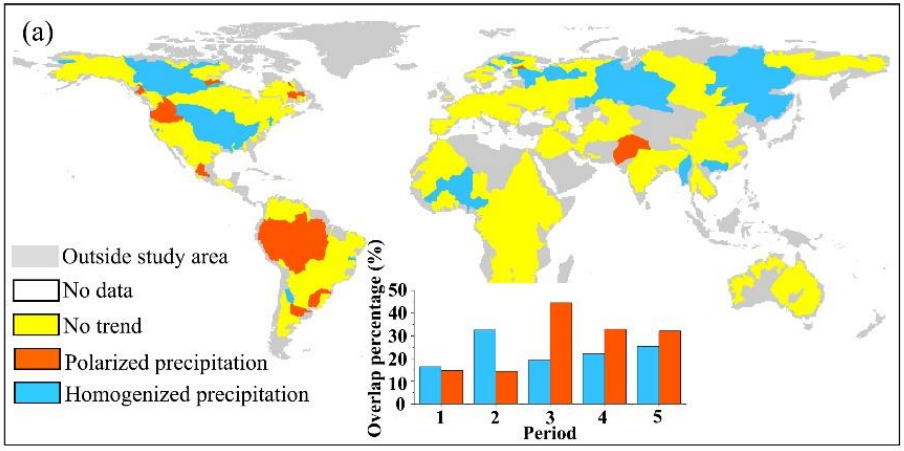
CLIMATE

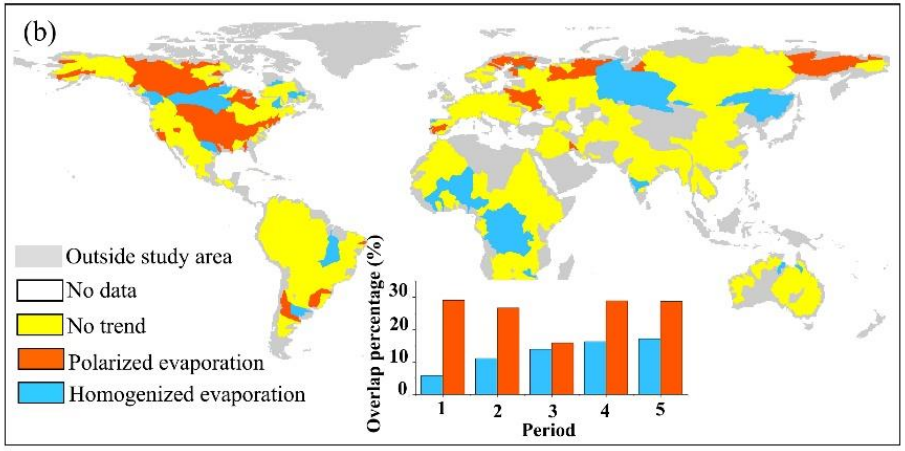
- Precipitation & Evaporation
- Glacial Runoff

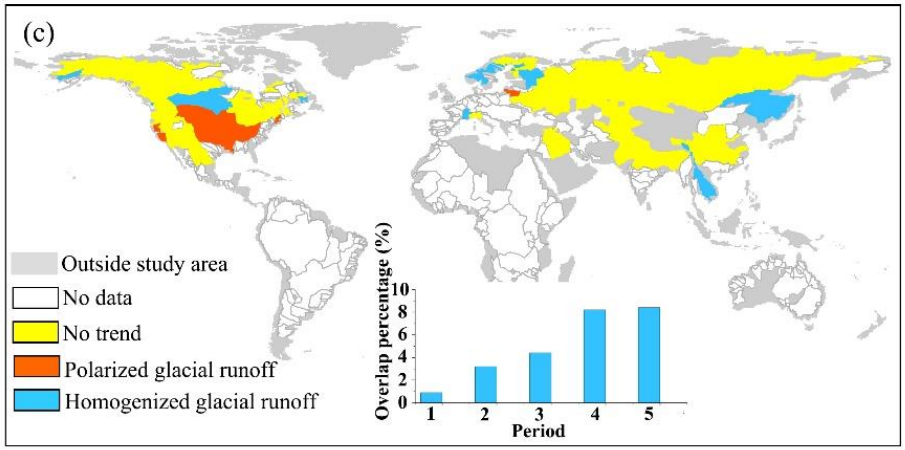
Human Activities

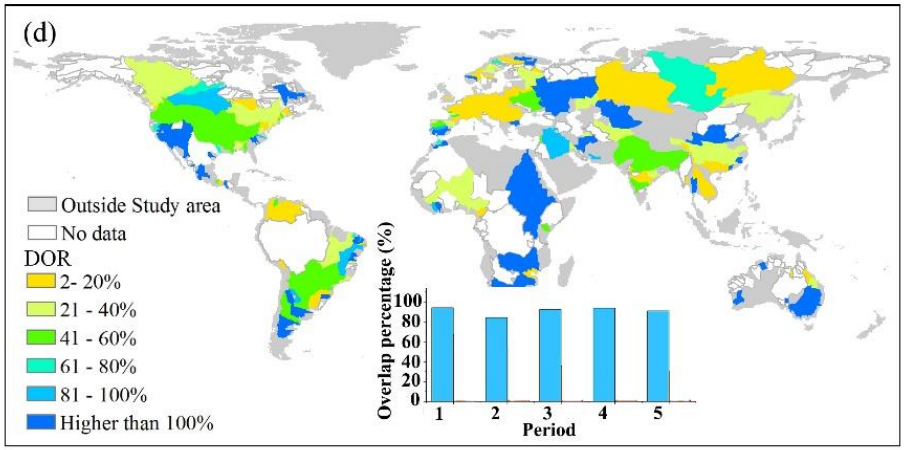
- Dam construction

Reasoning the changes.

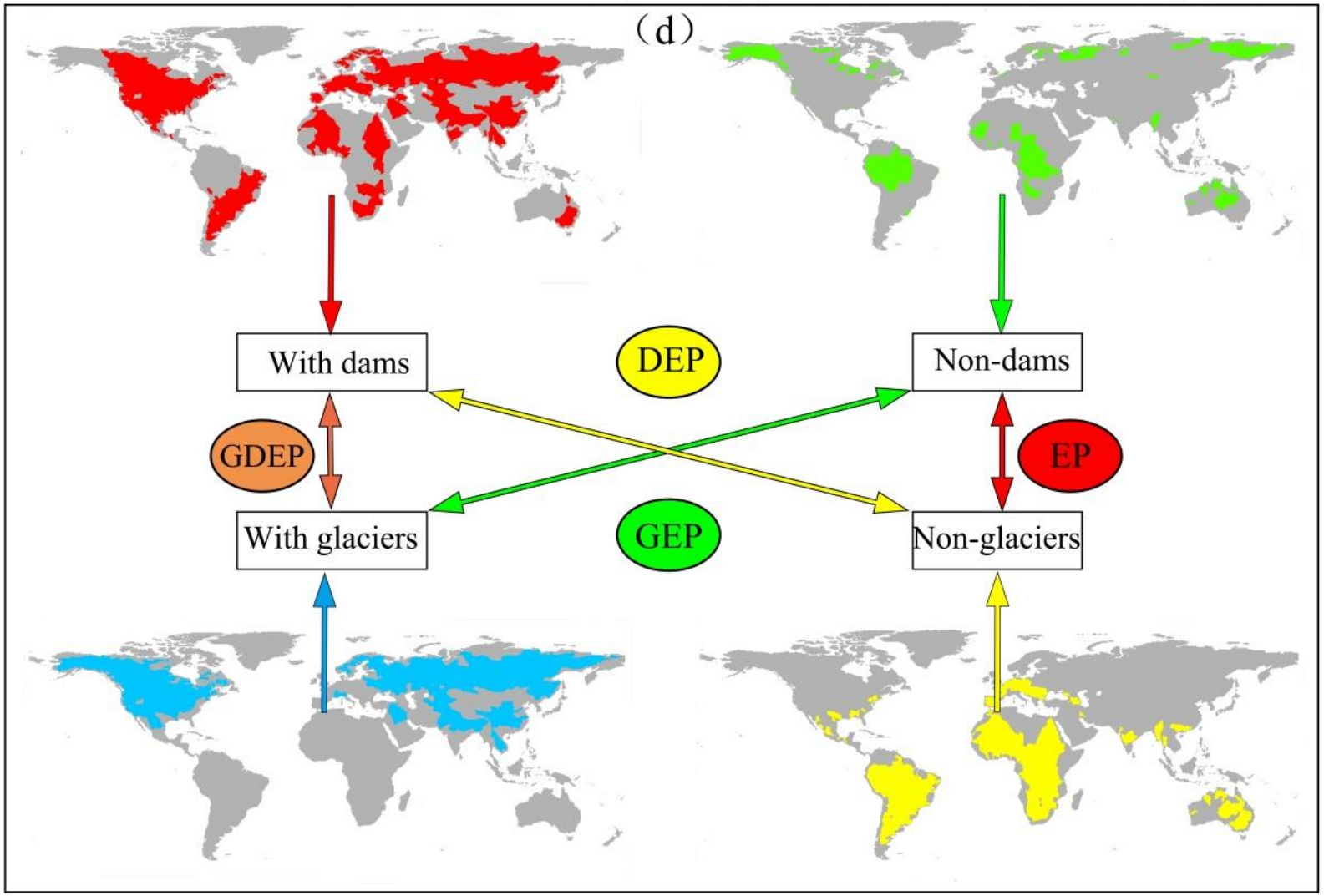








Reasoning the changes.



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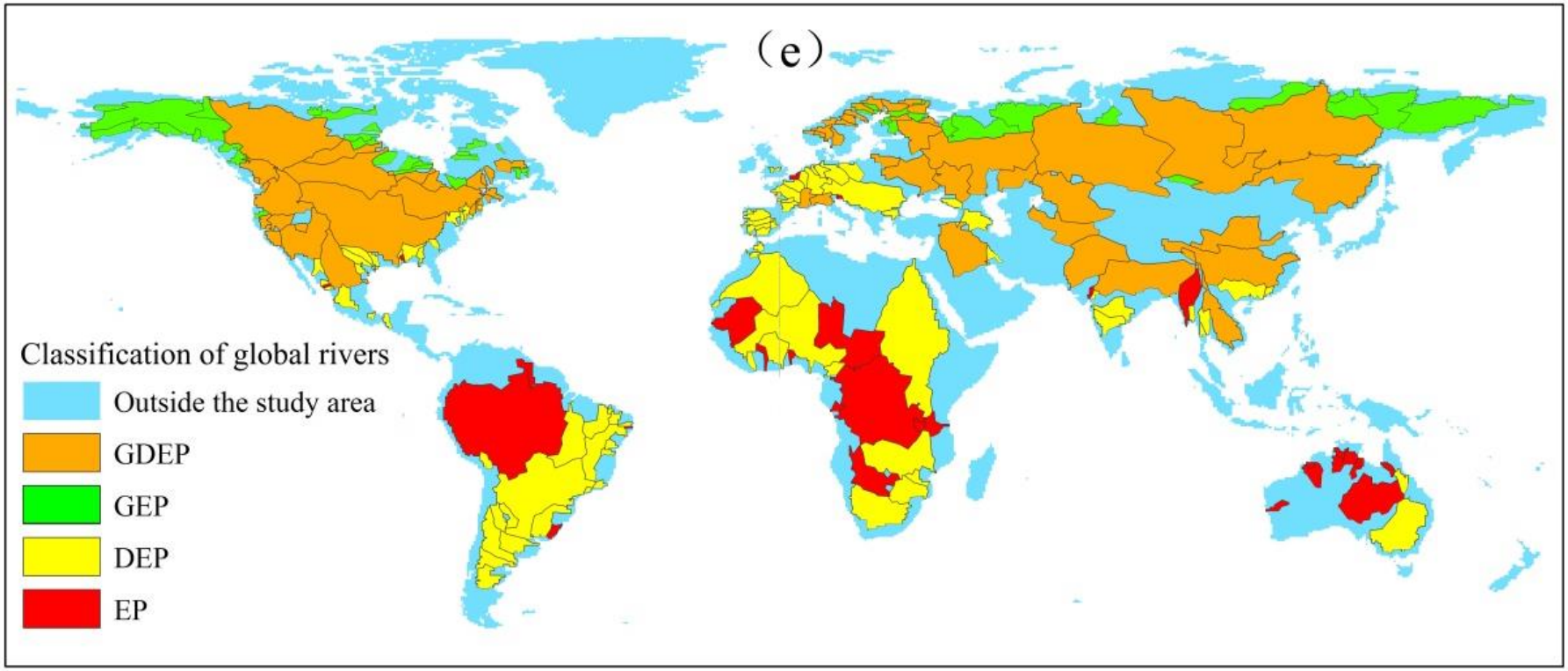
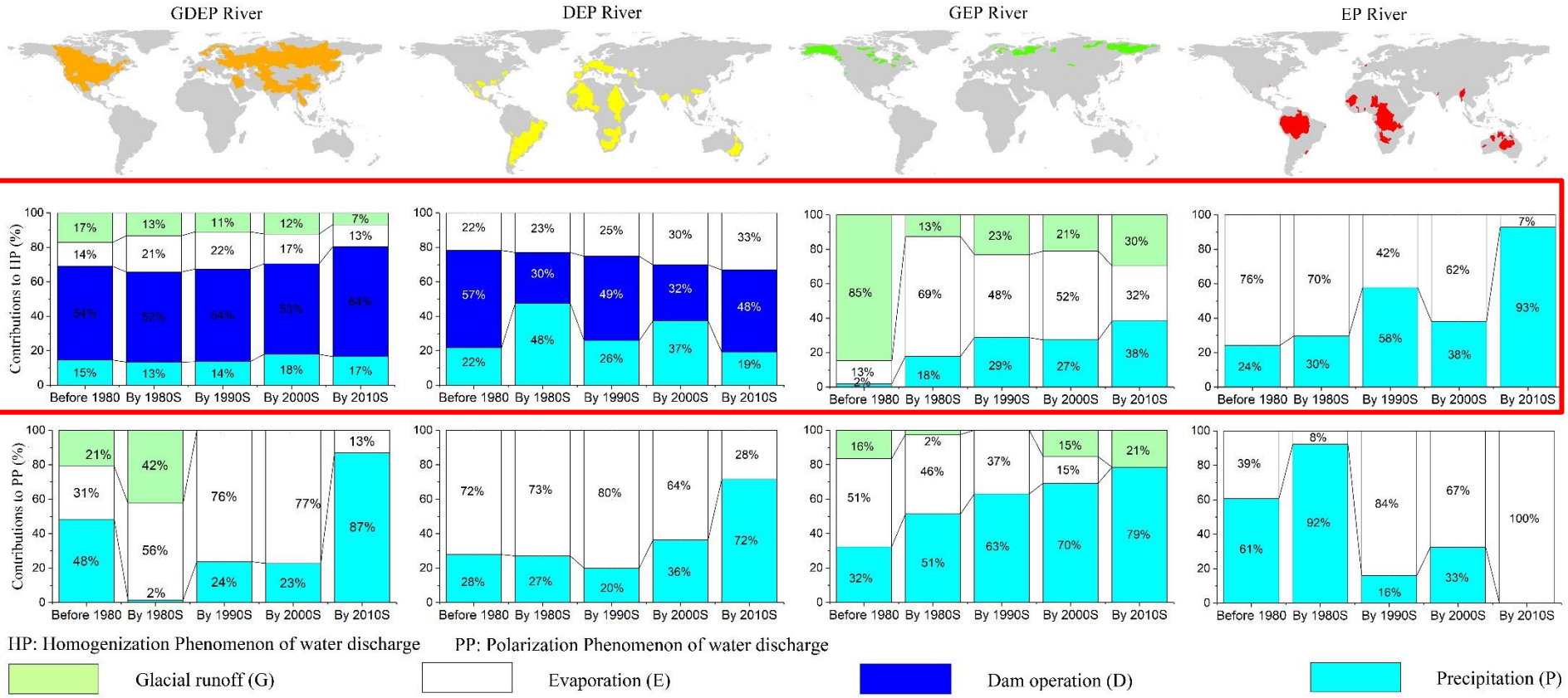


Contributions of the major factors

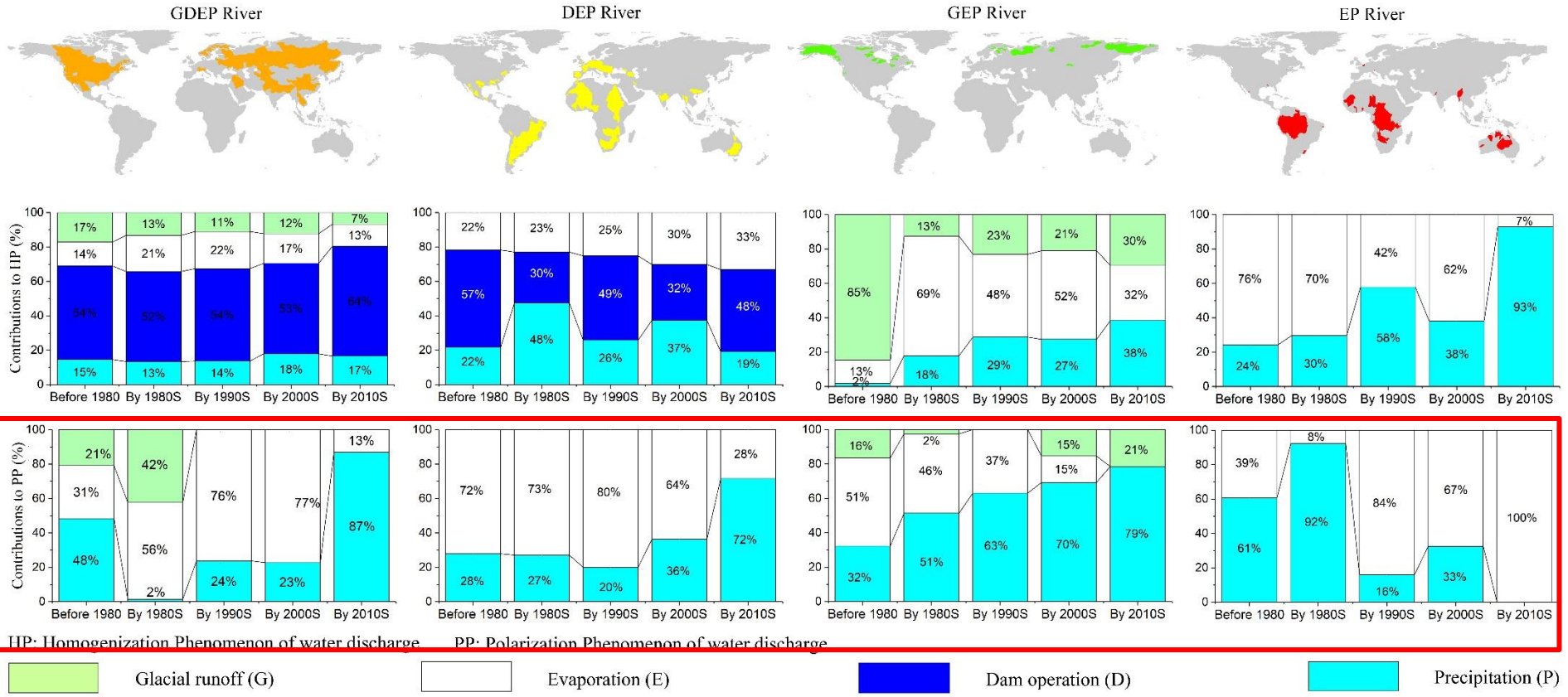


Homogenization phenomenon

dominated by dam operations in GDEP and DEP river basins,

primarily affected by homogenized precipitation in GEP and EP river basins.

Contributions of the major factors



Polarization phenomenon

Evaporation and precipitation are primary factors contributing 56% and 41.2%, respectively

Conclusions

- *Homogenization phenomenon* occurred in 181 independent river catchments occupying 62.6% (5532.6 km^2) of the study area
- *polarization phenomenon* occurred in 39 independent basins taking up 25.6% (2262.5 km^2) of the study area.

- Dam operations (D) make a major contribution (41.9%) to the *homogenization phenomenon* of seasonal water discharge in GDEP and DEP river basins.

- In GEP and EP river basins, changes in seasonal precipitation are the dominant factor behind the *homogenization phenomenon* of the intra-year water discharge distribution.

- Dam operation has no effect on the *polarization phenomenon* of water discharge.

Conclusions

- However, evaporation (E) and precipitation (P) generally account for the *polarization phenomenon*, contributing 56.0% and 41.2% respectively.

- Premature glacial runoff (G) also had a significant effect on the seasonal water discharge *homogenization* and *polarization* phenomena, especially in GEP river basins, with contributions of 30% and 21% respectively.

- This paper provides basis both for controlling flood and drought disasters, and for preventing ecological damages induced by the redistribution of the intra-year water discharge in hot spot regions.

Main References

- Yuanfang Chai, **Yao Yue***, Lin Zhang, Chiyuan Miao, Alistair GL Borthwick, Boyuan Zhu, Yitian Li, AJ Dolman, Homogenization and polarization of the seasonal water discharge of global rivers in response to climatic and anthropogenic effects, Science of the Total Environment, 2020, 709: 136062.

- Li Li, Jinren Ni*, Fang Chang, **Yao Yue**, Natalia Frolova, Dimitry Magritsky, Alistair GL Borthwick, Philippe Ciais, Yichu Wang, Chunmiao Zheng, Desmond E Walling, Global trends in water and sediment fluxes of the world's large rivers, Science Bulletin, 2020, 65(1): 62-69.

Thank you for attention!