GEWEX activity relevant to WGSIP

WGSIP – 5 Nov. 2024

Constantin Ardilouze

What is GEWEX ?

- GEWEX (The Global Energy and Water Exchanges program) : core project of WCRP

- Dedicated to understanding Earth's water cycle and energy fluxes at and below the surface and in the atmosphere.

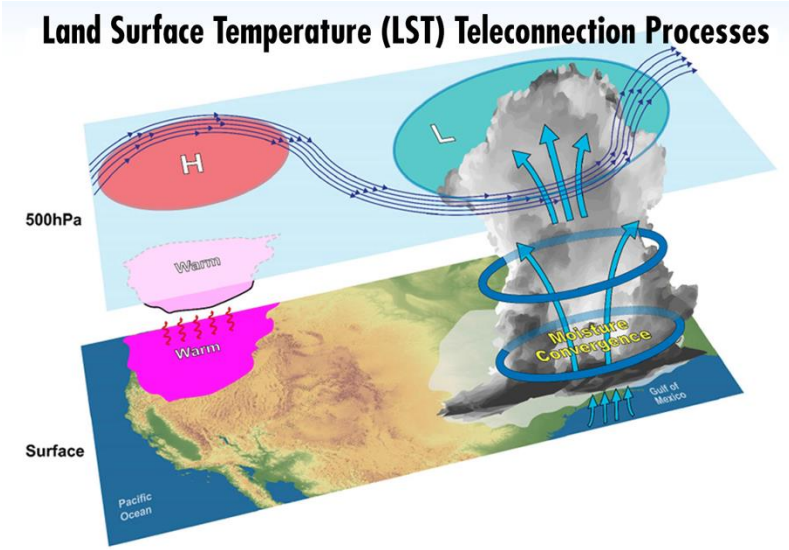
GDAP (GEWEX Data and Analysis Panel) : production and evaluation of long term, global atmospheric, surface water, and energy budget products

GHP (GEWEX Hydroclimatology Panel) : understand and predict continental to local-scale hydroclimates for hydrologic applications

GLASS (Global Land-Atmosphere System Study) : model development and evaluation, concentrating on the new generation of land surface models.

GASS (Global Atmospheric System Studies) : projects that bring together experts to contribute to the development of atmospheric models

The LS4P project (GEWEX/GASS)



- Spring **Land Surface Temperature (LST)** over high altitude regions (Rocky Mountains, Tibetan Plateau) impacts downstream summer temperature/precipitation *(Xue et al. 2016, 2018)*

-> LST potential source of atmospheric predictability

- LS4P : a coordinated multi-model forecast experiment

- **General idea** : Adjust LST spring initial conditions over high elevation regions (t2m bias reduction) in S2S forecasts and evaluate the impact on precipitation/circulation anomalies ... and skill

Pr. Yongkang Xue, UCLA

The LS4P project (GEWEX/GASS)

- Setup of a large **multi-model predictability study** :

*Impact of Initialized Land Temperature and Snowpack on Sub-seasonal to Seasonal Prediction (**LS4P**, Xue et al. 2021)*

- Endorsed by GEWEX (38 institutions involved, https://ls4p.geog.ucla.edu/)

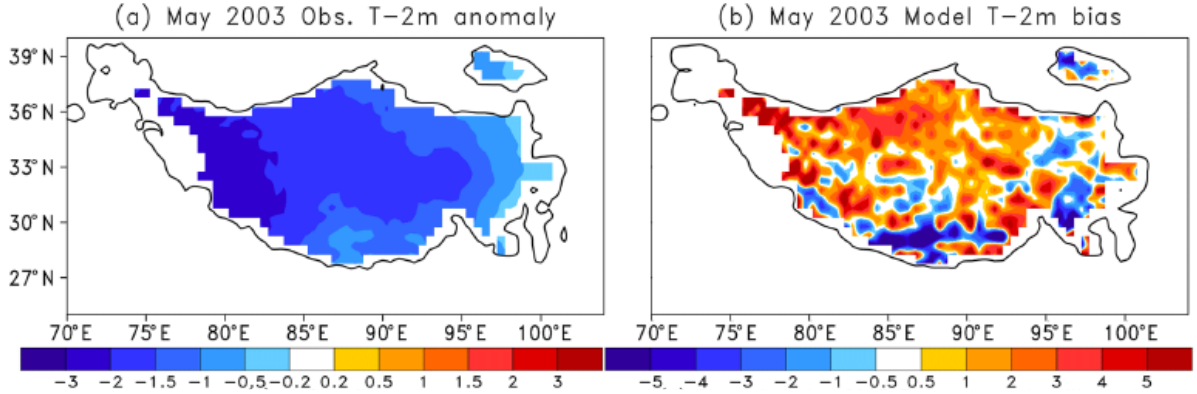
21 ESM Groups;
9 RCM Groups;
7 Data Groups;
1 Data Base

Five workshops (1998, 1999, 2022, 2023 AGU, 1999 Nanjing University)

Phase 1 of the LS4P (ending in 2023)

- Case study of **May-June 2003** : extreme summer drought/flood occurred in East Asia after a very cold spring in the TP

- Initialization strategy :



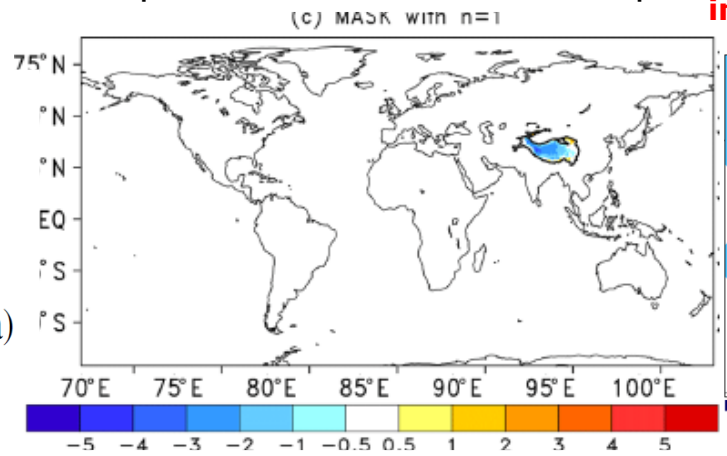
Applying the mask, $\tilde{T}_0(i,j)$, will be defined as follows:

$$\tilde{T}_0(i,j) = T_0(i,j) + \Delta T_{\text{mask}}(i,j) = T_0(i,j) + \left[-n \times T_{\text{obs anomaly}}(i,j) - T_{\text{bias}}(i,j)\right],$$

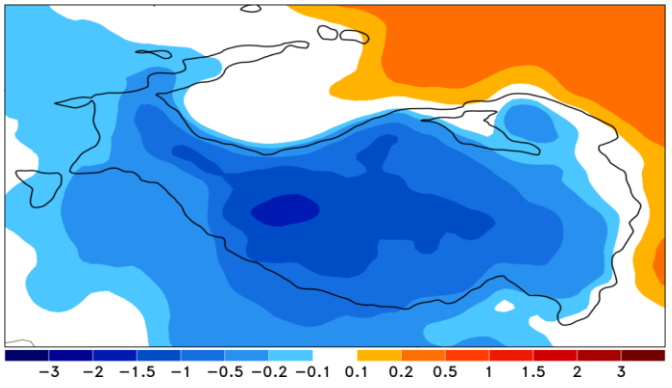
$$\text{when } \bar{T}_{\text{obs anomaly}} \times \bar{T}_{\text{bias}} \geq 0, \qquad \text{(1a)}$$

Xue et al. (2021, GMD)

Imposed Mask at 1st time step



Simulated May T-2m difference after imposing mask for initial condition



Phase 1 of the LS4P (ending in 2023)

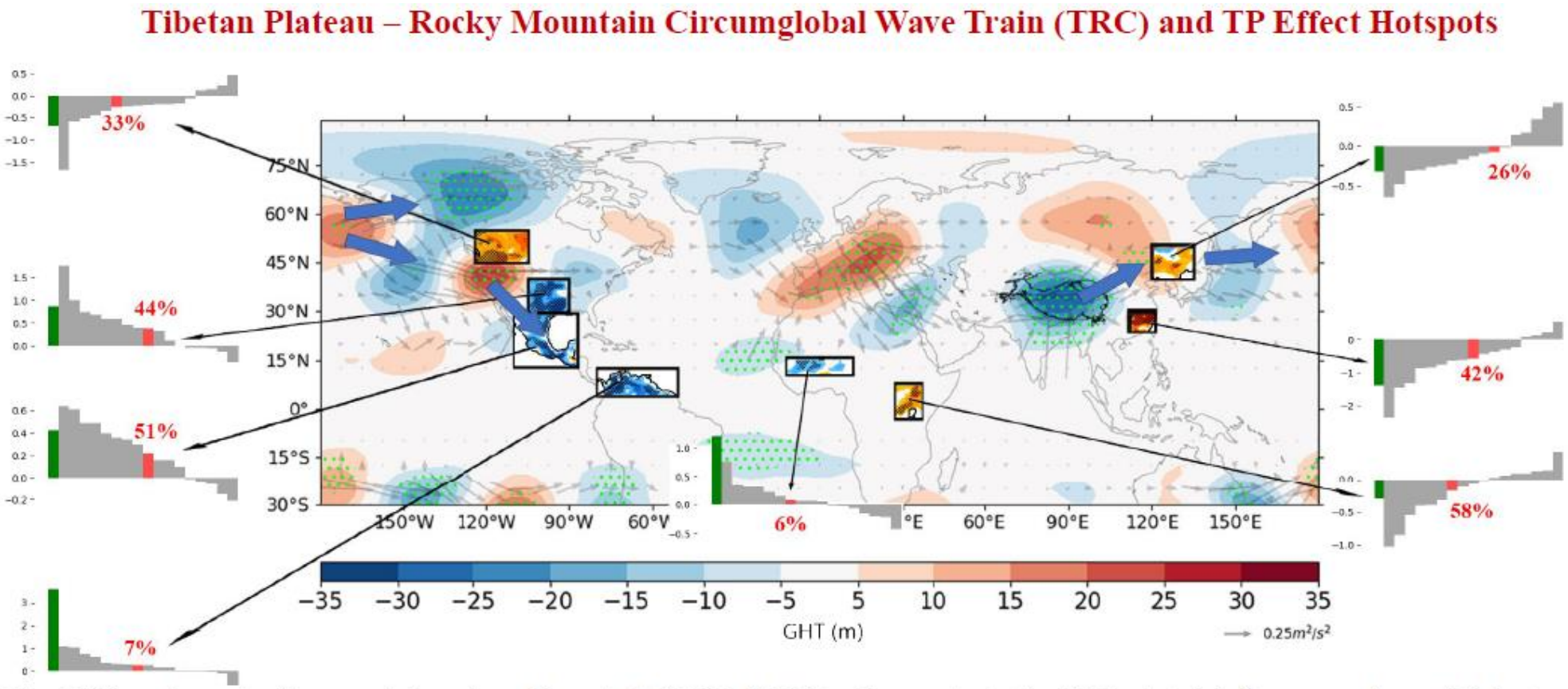


Fig. 2 The schematic diagram is based on Xue et al. (2022, 2024) to demonstrate the TRC global influence and possible hotspots (8 bold boxes). The color shadings within the boxes are snapshots of the LS4P multi-model ensemble means June 2003 precipitation anomaly due to the effect of cold TP LST/SUBT (based on Xue et al., 2024), and elsewhere are observed 200-hPa geopotential height (GHT) anomaly due to cold TP temperature. Green bar is observation, and red bar is ensemble mean in each hot spot. Green dots in wave train represent statical significance at $p<0.1$. The vectors are wave activity flux and heavy arrows illustrate the TRC propagation.

LS4P main findings

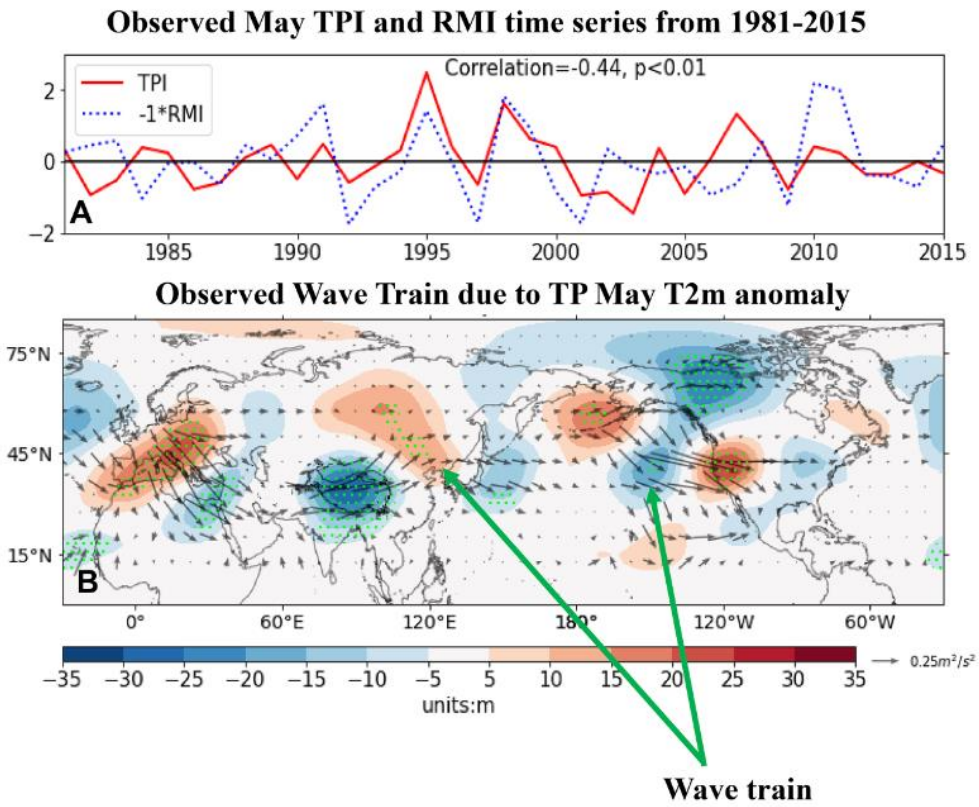
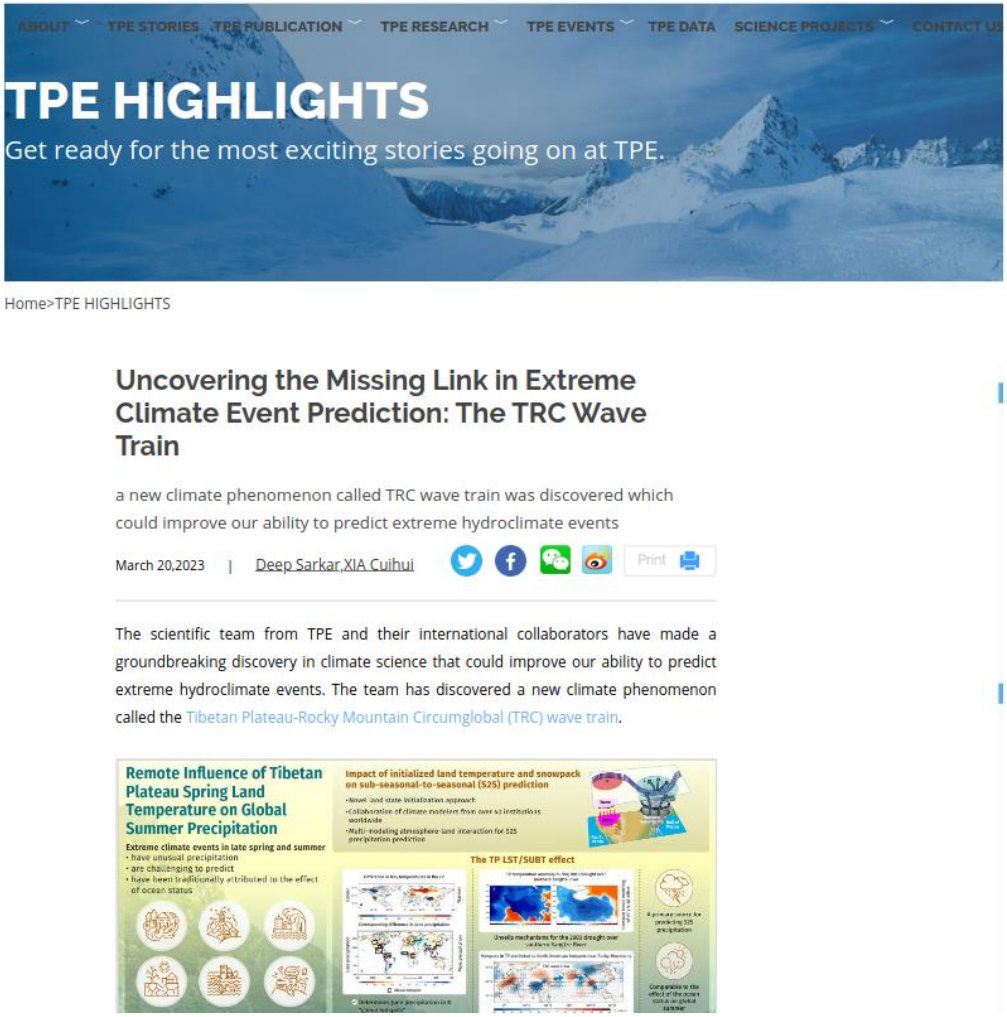


Fig. 4. Linkage between the TP and North America. (a) TPI and RMI time series. (b) Wave train. The plot in (b) is the regression of May 200-hPa geopotential height (m) of NCEP Reanalysis I from 1981 to 2015 onto (−1) times the normalized May TPI and corresponding wave activity flux (WAF; $m^2 s^{-2}$). In (b) the shading denotes the geopotential height, and vectors denote the WAF.

(Xue et al., BAMS 2022)



Publications

Geosci. Model Dev., 14, 4465–4494, 2021
https://doi.org/10.5194/gmd-14-4465-2021

Geoscientific Model Development
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EGU

2021 GMD

Impact of Initialized Land Surface Temperature and Snowpack on Subseasonal to Seasonal Prediction Project, Phase I (LS4P-I): organization and experimental design

Yongkang Xue[1], Tandong Yao[2], Aaron A. Boone[3], Ismaila Diallo[1], Ye Liu[1], Xubin Zeng[4], William K. M. Lau[5], Shiori Sugimoto[6], Qi Tang[7], Xiaoduo Pan[2], Peter J. van Oevelen[8], Daniel Klocke[9], Myung-Seo Koo[10], Tomonori Sato[11], Zhaohui Lin[12], Yuhei Takaya[13], Constantin Ardilouze[3], Stefano Materia[14], Subodh K. Saha[15], Retish Senan[16], Tetsu Nakamura[11], Hailan Wang[17], Jing Yang[18], Hongliang Zhang[19], Mei Zhao[20], Xin-Zhong Liang[5], J. David Neelin[1], Frederic Vitart[16], Xin Li[2], Ping Zhao[21], Chunxiang Shi[22], Weidong Guo[23], Jianping Tang[23], Miao Yu[24], Yun Qian[25], Samuel S. P. Shen[26], Yang Zhang[23], Kun Yang[27], Ruby Leung[25], Yuan Qiu[12], Daniele Peano[14], Xin Qi[18], Yanling Zhan[12], Michael A. Brunke[4], Sin Chan Chou[28], Michael Ek[29], Tianyi Fan[18,10], Hong Guan[30], Hai Lin[31], Shunlin Liang[32], Helin Wei[17], Shaocheng Xie[7], Haoran Xu[5], Weiping Li[33], Xueli Shi[33], Paulo Nobre[28], Yan Pan[23], Yi Qin[27,7], Jeff Dozier[34], Craig R. Ferguson[35], Gianpaolo Balsamo[16], Qing Bao[36], Jinming Feng[12], Jinkyu Hong[37], Songyou Hong[10], Huilin Huang[1], Duoying Ji[18], Zhenming Ji[38], Shichang Kang[39,40], Yanluan Lin[27], Weiguang Liu[41,24], Ryan Muncaster[31], Patricia de Rosnay[16], Hiroshi G. Takahashi[42], Guiling Wang[41], Shuyu Wang[23,15], Weicai Wang[2], Xu Zhou[2], and Yuejian Zhu[17]

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2022 BAMS In Box

Spring Land Temperature in Tibetan Plateau and Global-Scale Summer Precipitation

Initialization and Improved Prediction

Yongkang Xue, Ismaila Diallo, Aaron A. Boone, Tandong Yao, Yang Zhang, Xubin Zeng, J. David Neelin, William K. M. Lau, Yan Pan, Ye Liu, Xiaoduo Pan, Qi Tang, Peter J. van Oevelen, Tomonori Sato, Myung-Seo Koo, Stefano Materia, Chunxiang Shi, Jing Yang, Constantin Ardilouze, Zhaohui Lin, Xin Qi, Tetsu Nakamura, Subodh K. Saha, Retish Senan, Yuhei Takaya, Hailan Wang, Hongliang Zhang, Mei Zhao, Hara Prasad Nayak, Qiuyu Chen, Jinming Feng, Michael A. Brunke, Tianyi Fan, Songyou Hong, Paulo Nobre, Daniele Peano, Yi Qin, Frederic Vitart, Shaocheng Xie, Yanling Zhan, Daniel Klocke, Ruby Leung, Xin Li, Michael Ek, Weidong Guo, Gianpaolo Balsamo, Qing Bao, Sin Chan Chou, Patricia de Rosnay, Yanluan Lin, Yuejian Zhu, Yun Qian, Ping Zhao, Jianping Tang, Xin-Zhong Liang, Jinkyu Hong, Duoying Ji, Zhenming Ji, Yuan Qiu, Shiori Sugimoto, Weicai Wang, Kun Yang, and Miao Yu

Volume 62 · Number 4 · April 2024

Special Issue: Subseasonal-to-Seasonal predictability of extreme precipitation and land forcing

Guest Editors: Yongkang Xue · William K-M Lau

EDITORIAL

ORIGINAL ARTICLES

The LS4P project : current status and prospects

- Ongoing : **phase-2** of the project
- **Case study of May-June 1998** :
  - Severe drought in Texas/Oklahoma with a cold spring in the western U.S.
  - Severe flooding in the Yangtze River Basin with a warm spring in the TP.
  - Strong El Nino year : Effect to compare with high elevation LSTs.
- Third (and last ?) phase to kick-off in ~one year (AGU 2025) : **focus on the Andes** spring LST and the impact on the subsequent **Southern Hemisphere atmospheric circulation**

WGSIP Connections with other GEWEX Panels

- GHP Potential Crosscutting Projects :

Seasonal hydrologic prediction : 'desirable' CC activities by GHP.
Currently seeking a project leader.

- GEWEX OSC :

A few available presentations from the following sessions :

- Land-Atmosphere Interactions and Climate Predictability, Including S2S)
- Predictability and prediction of extreme events
- Advances in flood research, including prediction

https://www.gewexevents.org/osc2024-presentations/

Any questions ?