LS4P-II Kick Off Workshop on 11Th Dec. in the 2022 Fall AGU Meeting

LS4P-II Meetings in 2023

19 April: LS4P-II RCM Team Meeting

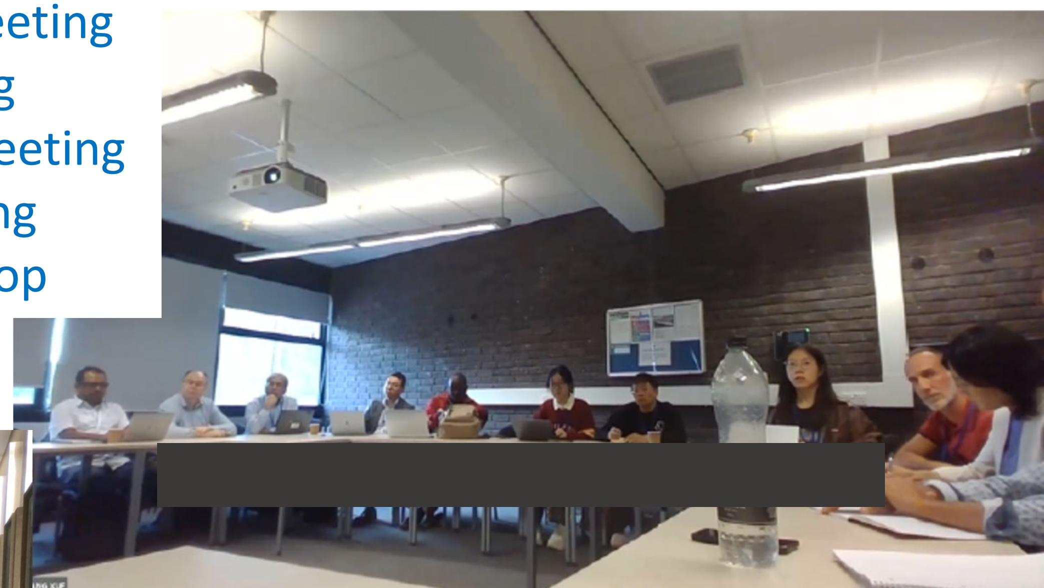
30th May: LS4P-II N. and S. American Team Meeting

6th July: LS4P-II European Hybrid Team Meeting

14-15 Aug. 2023: LS4P-II Asian Hybrid Team Meeting

21 Sept. 2023: Climate model subgroup meeting

10 Dec. 2023: LS4P-II 2nd International Workshop



Publications

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

GMD Geoscientific Model Development EGU

2021

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

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LS4P Website: http://ls4p.geog.ucla.edu

BAMS In Box 2022

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

Climate Dynamics
https://doi.org/10.1007/s00382-023-06905-5

Climate Dynamics, 2023

Remote effects of Tibetan Plateau spring land temperature on global subseasonal to seasonal precipitation prediction and comparison with effects of sea surface temperature: the GEWEX/LS4P Phase I experiment

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Climate Dynamics Special Issue: Sub-seasonal to Seasonal predictability and Land-induced Forcing

	Corresponding Author	Paper Title (in the order of acceptance)
1	Ren, Hong-Li	Understanding the causes of rapidly declining prediction skill of the East Asian summer monsoon rainfall with lead time in BCC_CSM1.1m
2	Feng, Jinming	Memory of land surface and subsurface temperature (LST/SUBT) initial anomalies over Tibetan Plateau in different land models
3	Diallo, Ismaila	Effects of spring Tibetan Plateau land temperature anomalies on early summer floods/droughts over the monsoon regions of South East Asia
4	Saremi, Ali	SWAT and IHACRES models for the simulation of rainfall-runoff of Dez watershed
5	Liang, Xin-Zhong	Regional climate modeling to understand Tibetan heating remote impacts on East China precipitation
6	Risanto, Christoforus	Retrospective sub-seasonal forecasts of extreme precipitation events in the Arabian Peninsula using convective-permitting modeling
7	Zhang, Jingyong	The substantial role of May soil temperature over Central Asia for summer surface air temperature variation and prediction over Northeastern China
8	Sugimoto, Shiori	Influence of convective processes on weather research and forecasting model precipitation biases over East Asia
9	Imteaz, Monzur	Application of gene expression programming for seasonal rainfall forecasting in Western Australia using potential climate indices
10	Delhaye, Steve	Dominant role of early winter Barents–Kara sea ice extent anomalies in subsequent atmospheric circulation changes in CMIP6 models
11	Xue, Yongkang	Remote effects of Tibetan Plateau spring land temperature on global subseasonal to seasonal precipitation prediction and comparison with effects of sea surface temperature: the GEWEX/LS4P Phase I experiment
12	Yang, Jianping	Regional Climate Model Intercomparison over the Tibetan Plateau in the GEWEX/LS4P Phase I
13	Ardilouze, Constantin	Understanding the causes of rapidly declining prediction skill of the East Asian summer monsoon rainfall with lead time in BCC_CSM1.1m
14	Tang, Qi	Memory of land surface and subsurface temperature (LST/SUBT) initial anomalies over Tibetan Plateau in different land models
	Under Revision	
15	Takaya, Yuhei	
16	Ali, Shahzad	
17	Zhang, Yang	

Special Issue publication date: Targeting March 2024

Quarter 1 2023

GEWEX

Hot Spots of the Remote Effect of Tibetan Plateau Spring Temperature in Global S2S Prediction–GEWEX/LS4P Phase I Highlights and Phase II Initiation

In 2018, the Global Energy and Water Exchanges (GEWEX) program launched an initiative, the "Impact of Initialized Land Temperature and Snowpack on Sub-seasonal to Seasonal Prediction" (LS4P, *https://ls4p.geog.ucla.edu*; Xue et al., 2021), as a community effort to test the impact of initializing land temperatures in high mountain regions in multiple Earth System Models (ESMs) on subseasonal to seasonal (S2S) prediction. The World Weather Research Program (WWRP) and World Climate Research Programme (WCRP) S2S project has listed the study of land initialization and configuration as one of its major activities (Merryfield et al., 2020). Climate scientists, especially climate modelers, from more than 40 institutions worldwide, many of which are major climate research and prediction centers, participated in this project.

The development and objectives of LS4P and evidence of land memory and persistence of land temperature anomalies in high mountains have been presented in Xue et al. (2021), which also introduced the LS4P phase I (LS4P-I) experimental protocol. LS4P-I focuses on the remote effect of the land surface temperature (LST) and subsurface temperature (SUBT) in the Tibetan Plateau (TP). The year 2003, when extreme summer drought/flood occurred to the south/north of the Yangtze River, respectively, after a very cold spring in the TP, is the focal case. The causes of the severe drought to the south of the Yangtze River in 2003 have never been identified. As such, LS4P is different from and complements other international projects that focus on operational S2S prediction (Kirtman et al., 2014; Pegion et al., 2019). Eighteen ESM groups have completed the LS4P-I experiment. The highlight of the LS4P-I results from sixteen ESMs[1] has been presented in the *Bulletin of American Meteorological Society* (Xue et al., 2022) to elucidate the new development in the S2S prediction.

UCLA

Newsroom

April 17, 2023

Categories For news media

ENVIRONMENT + CLIMATE

Tibetan Plateau soil temperatures are found to affect climate regionally, globally

UCLA study reveals that thermal variations can impact monsoons and flooding

David Colgan | Apr

Uncovering the Missing Link in Extreme Climate Event Prediction: The TRC Wave Train

a new climate phenomenon called TRC wave train was discovered which could improve our ability to predict extreme hydroclimate events

LS4P-I Major achievements: Establish the TP Global Impact in S2S prediction

Observed differences between 5 cold and 5 warm Mays in the Tibetan Plateau

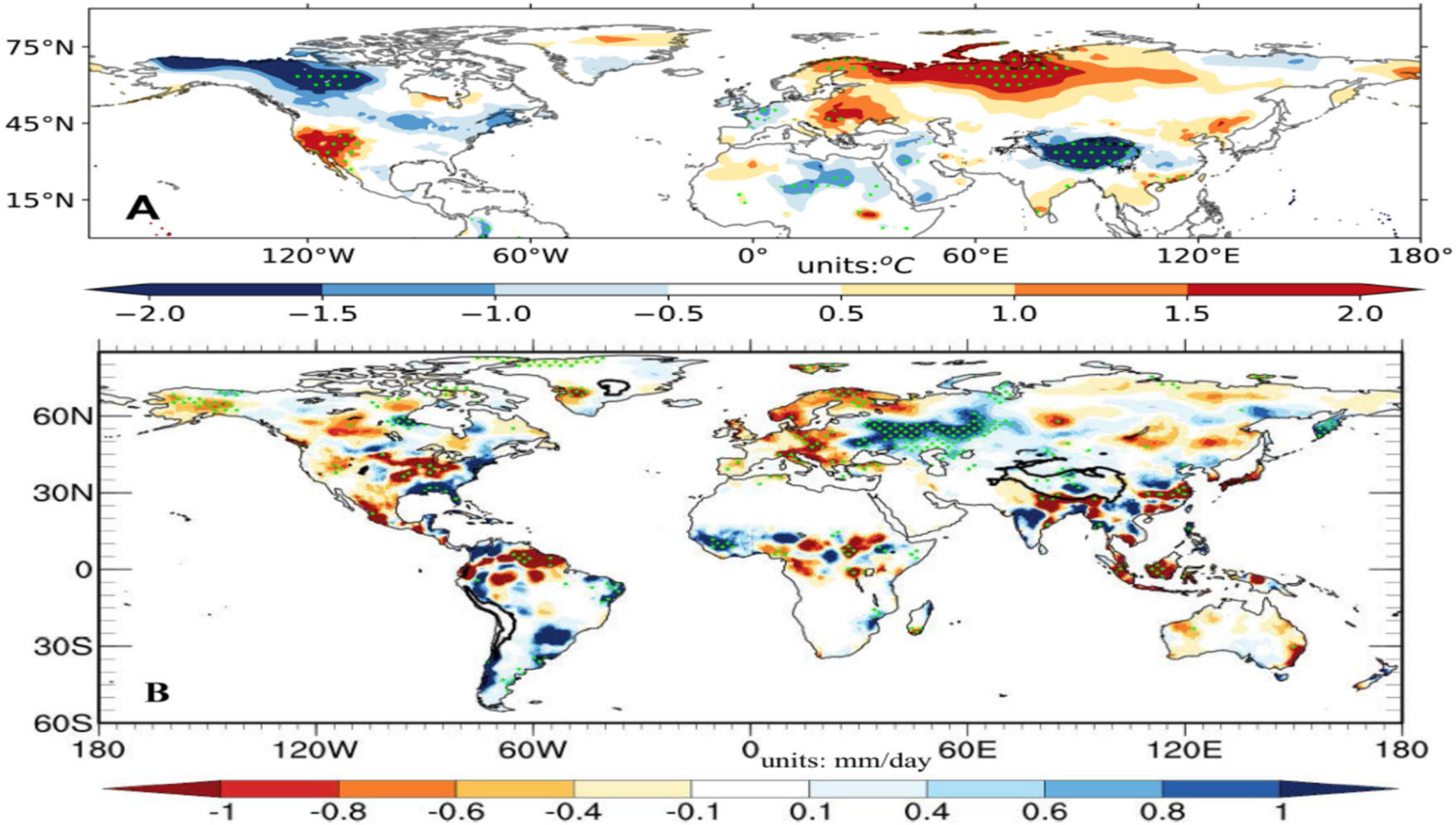
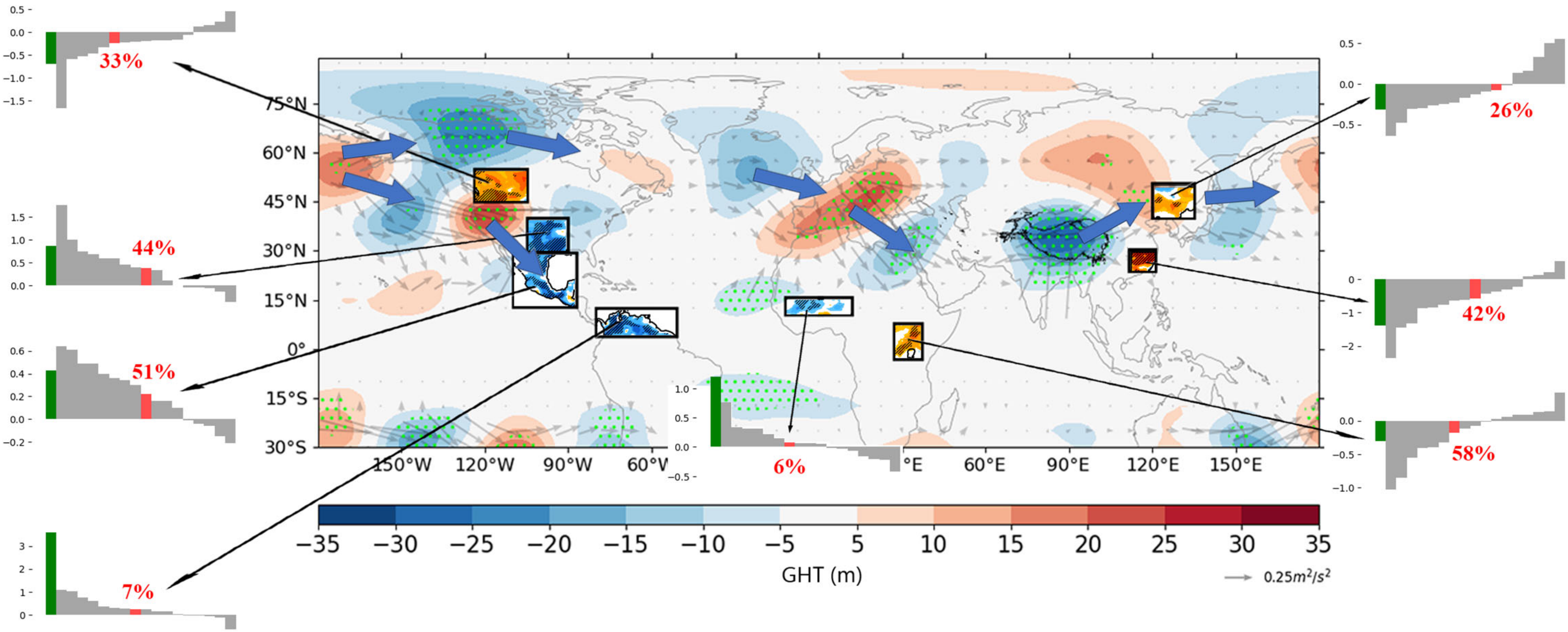


Fig. 1. Observed differences between the five coldest and the five warmest Mays in the Tibetan Plateau. (a) The difference in May T2m (°C) and (b) the difference in June precipitation for the same years. Note that the stippling in both figures denote statistical significance at the $p < 0.1$ level.

Tibetan Plateau – Rocky Mountain Circumglobal Wave Train (TRC) and TP Effect Hotspots



The schematic demonstrates the TRC global influence and possible hotspots. The color shadings within the boxes are snapshots of the LS4P multi-model--simulated June 2003 precipitation anomalies due to the effect of cold Tibetan Plateau land surface and subsurface temperature (LST/SUBT), and elsewhere the shaded areas show the observed 200-hPa geopotential height (GHT) anomalies due to the cold Tibetan Plateau temperature. The green bar corresponds to the observations and the red bar is the ensemble mean in each hot spot. Green dots represent a statistical significance at $p<0.1$. The light vectors are wave activity flux, and the heavy blue arrows indicate the TRC propagation. The figure is based on Xue et al. (BAMS, 2022, Climate Dynamics 2023).

TRC Wave Train Effects

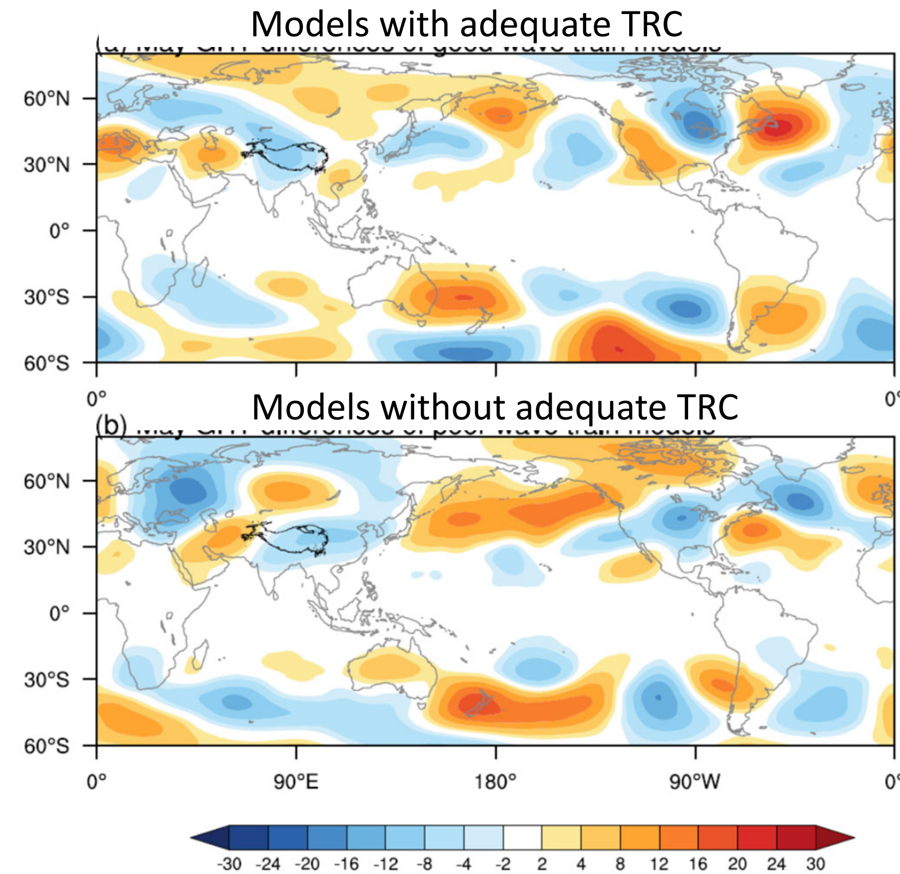
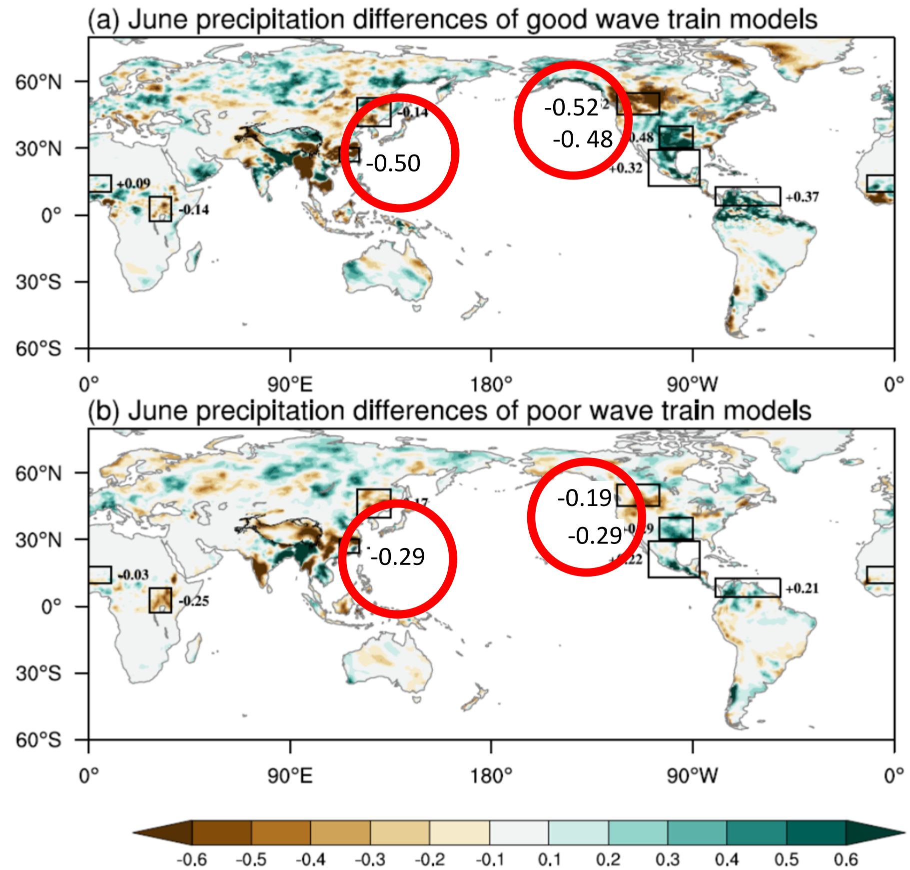
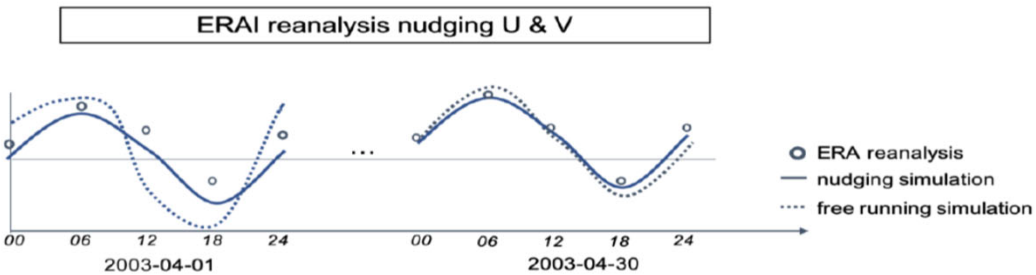
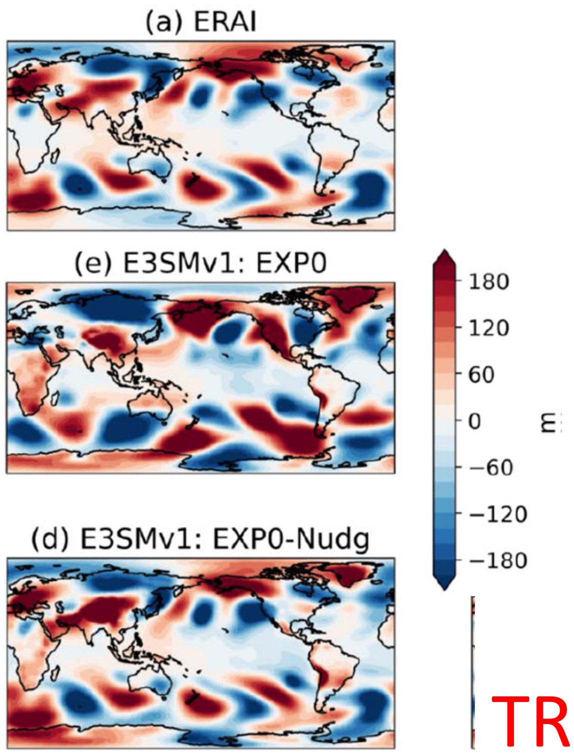


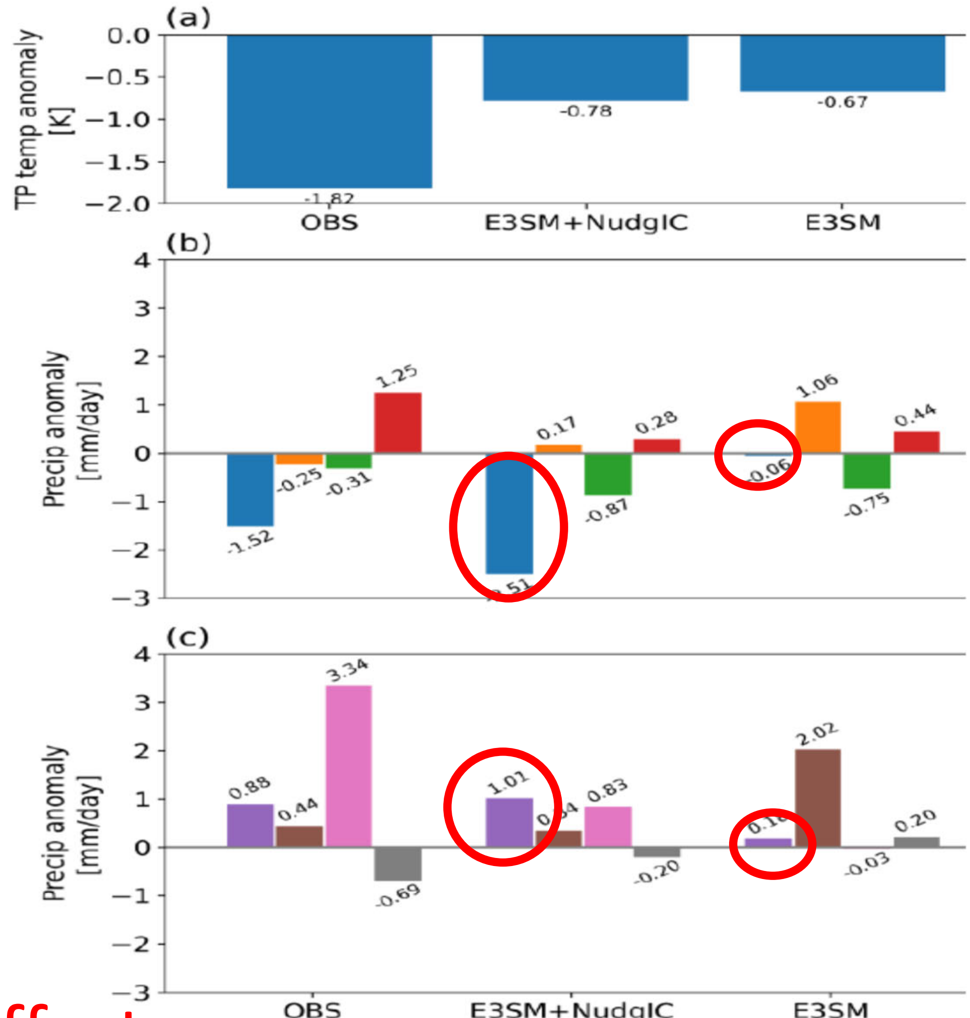
Figure 9. Ensemble mean of May geopotential height (m) differences due to the TP LST/SUBT effect (a) for the 5 models with best TRC wave train simulations and (b) for the 5 models with relatively poor TRC wave train simulations.



Zhang Y. et al., 2024, Climate Dynamics







TRC Wave Train Effects

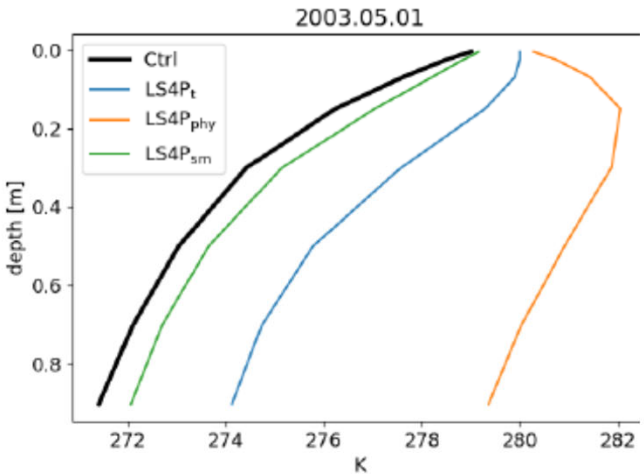
Figure 5. Non-zonal geopotential height at 200 hPa (m) from (a) ERAI, (b) CIESM EXP0-Nudg, (c) CIESM EXP0, (d) E3SMv1 EXP0-Nudg, and (e) E3SMv1 EXP0 on April 30th, 2003.

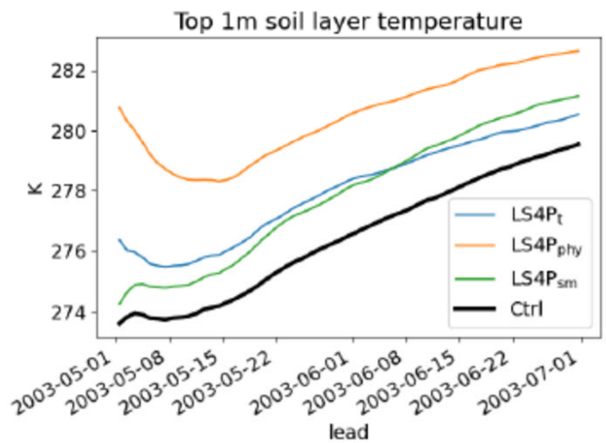
Qin Y, Q. Tang et al., Climate Dynamics 2023

Initializing soil condition with a thermally and hydrologically balanced Approach (Enthalpy)

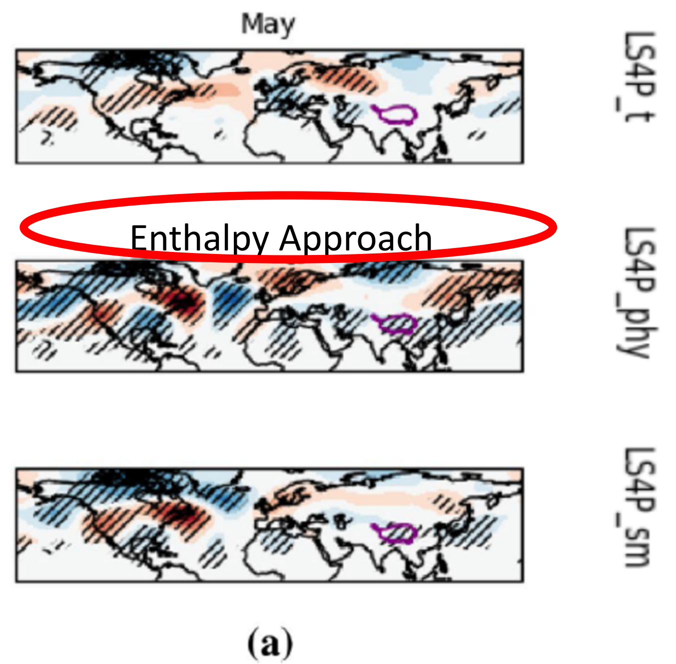
The enthalpy for a soil layer (J m^{-2}) can be defined following as:

$$h = [\rho_s c_s (1 - w_{sat}) + \rho_l c_l w_l + \rho_i c_i w_i] (T - T_f) - \rho_i L_f w_i$$





Black: CTL; Green: Soil moisture; Blue: LST/SUBT only; Orange LST/SUBT+Enthalpy



500 hPa Geopotential Difference

Ardilouze and Boone, 2023, Climate Dynamics

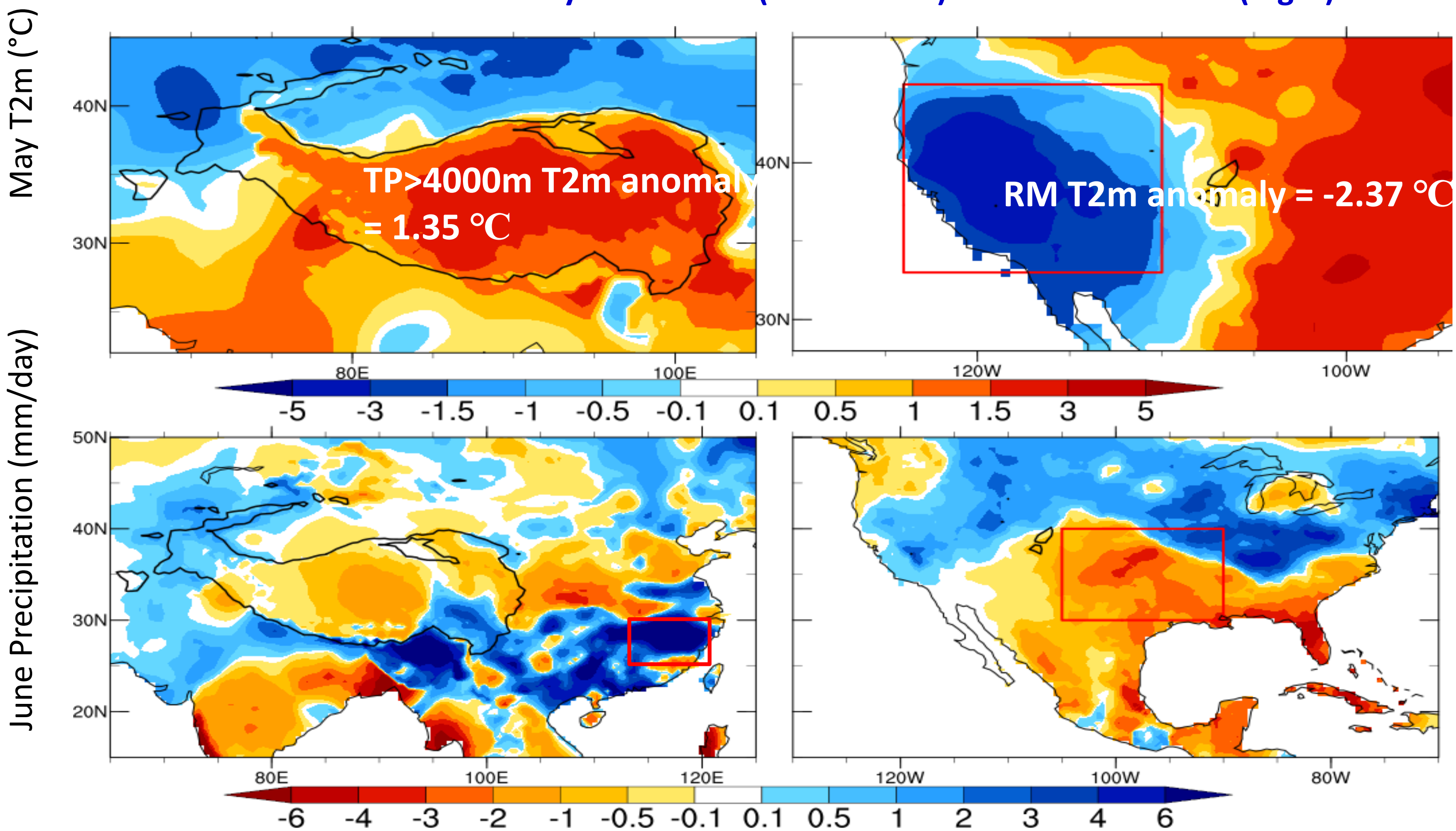
LS4P-II Experiments: Preliminary Results and Issues

WECS, Nepal

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

LS4P Phase II Major focus: Rocky Mountain & Tibetan Plateau LST/SUBT Effect with the June-Aug. 1998 (flood & drought) case

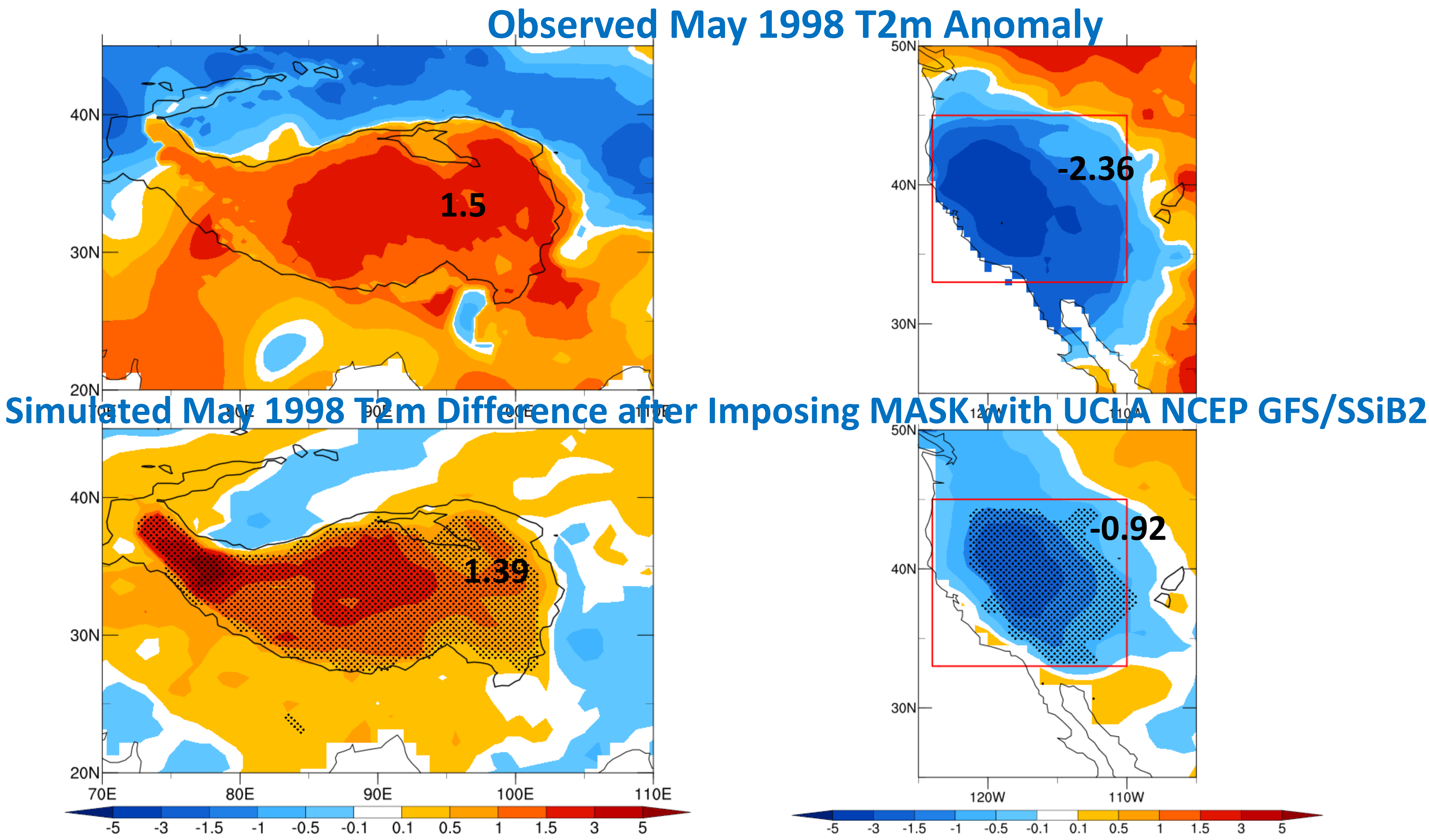
Observed 1998 Anomaly in East Asia (left Column) and North America (Right)



LS4P-II ESM Experimental Design

Experiments	Description
Case CTL (a normal S2S run)	Ocean boundary conditions for AMIP-type run: Observed May-August 1998 daily SST and sea-ice. Atmospheric and land initial conditions, such as soil moisture, snow from reanalysis for the year 1998. The initial LST/SUBT over the Western U.S and TP will be based on a reference, such as your model's normal S2S run as did in LS4P-I, climatology, or imposing a mask, such as -ΔT or +ΔT.
Case TPI	Same as Case CTL, except for an initial LST/SUBT mask will be imposed over the Western U.S. based on observed T2m anomaly and model bias over the Western U.S.
Case RMI	Same as Case CTL, except for an initial LST/SUBT mask imposed over the TP based on the observed T2m anomaly and model bias over the TP
Case SST	Same as Case CTL, except that climatological SST will be applied (instead of 1998 SST)
Case TPI + RMI	Case TPI + Cast RMI . optional

Integration period: Late April 1998 through August 1998 with a minimum 6 members
Model output requirement same as LS4P-I: See Xue et al. (GMD)


Observed May 1998 T2m Anomaly
Simulated May 1998 T2m Difference after Imposing MASK with UCLA NCEP GFS/SSiB2
1.5
-2.36
1.39
-0.92
20N
30N
40N
50N
70E
80E
90E
100E
110E
120W
110W
-5
-3
-1.5
-1
-0.5
-0.1
0.1
0.5
1
1.5
3
5

Possible Topics for Investigation in addition to RM Effects (Modeling, Data Analyses, Mechanism Diagnosis)

(1)Improve initialization procedure (methodology/modeling) of LST/SUBT and develop methodology for transition to operational applications.

(2) The LS4P research on other years and seasons, such as late summer and winter, and other regions.

(3) The combined remote and local effect on flood, drought, and heat wave.

(4). RCM Protocol

(5). High resolution coupled model prediction

(6) Other mountain regions and highlands' roles in S2S prediction.

(7) The causes of the LST/SUBT anomaly.

(8) Effect of snow and aerosols in snow.

(9) Deficiencies in some regions, such as in the Eurasian continent and India; Uncertainties in other regions, such as in coastal West Africa, S.E. Tibet, & western Europe.

LS4P-II Time Frame

1). Team Meetings and LS4P-II Second Workshop in December 10 and a Session in 2023 Fall AGU. The groups who need help for the mask for initialization, please contact Hara Nayak (hpnayak@g.ucla.edu)

2). In the October of 2024, most groups will complete the experiments and the results analyses will start.

By the spring 2025, the LS4P –II experiments will complete

3). A possible team meeting during the 2024 GEWEX Open Science Conference.

Other meetings/Workshop TBD

4). LS4P papers will be published in 2025/2026. Except the major papers for the LS4P-II, we **will have no LS4P special issue. We encourage each group write their LS4P related papers for various journals during 2024 - 2026.**

5). Phase III Preparation will start in later 2025 (205 AGU?)/2026