SILK ROAD FORUM
(2nd Session) **CUG**

China Meteorological Assimilation Datasets for the SWAT model (CMADS) and its worldwide influence

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CMADS
The China Meteorological Assimilation Driving Datasets for The SWAT model (CMADS)

CMADS Developer

Hao Wang

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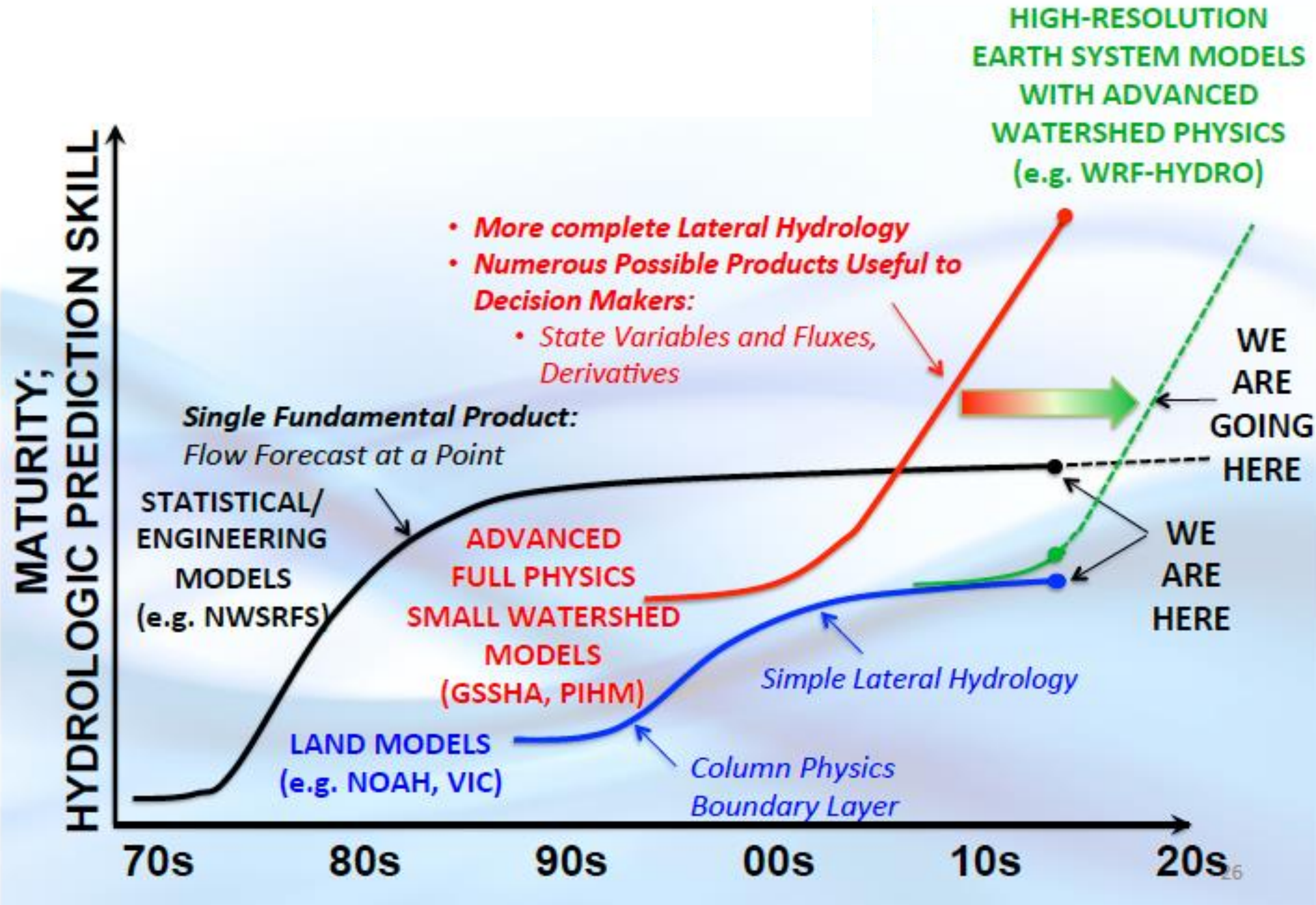
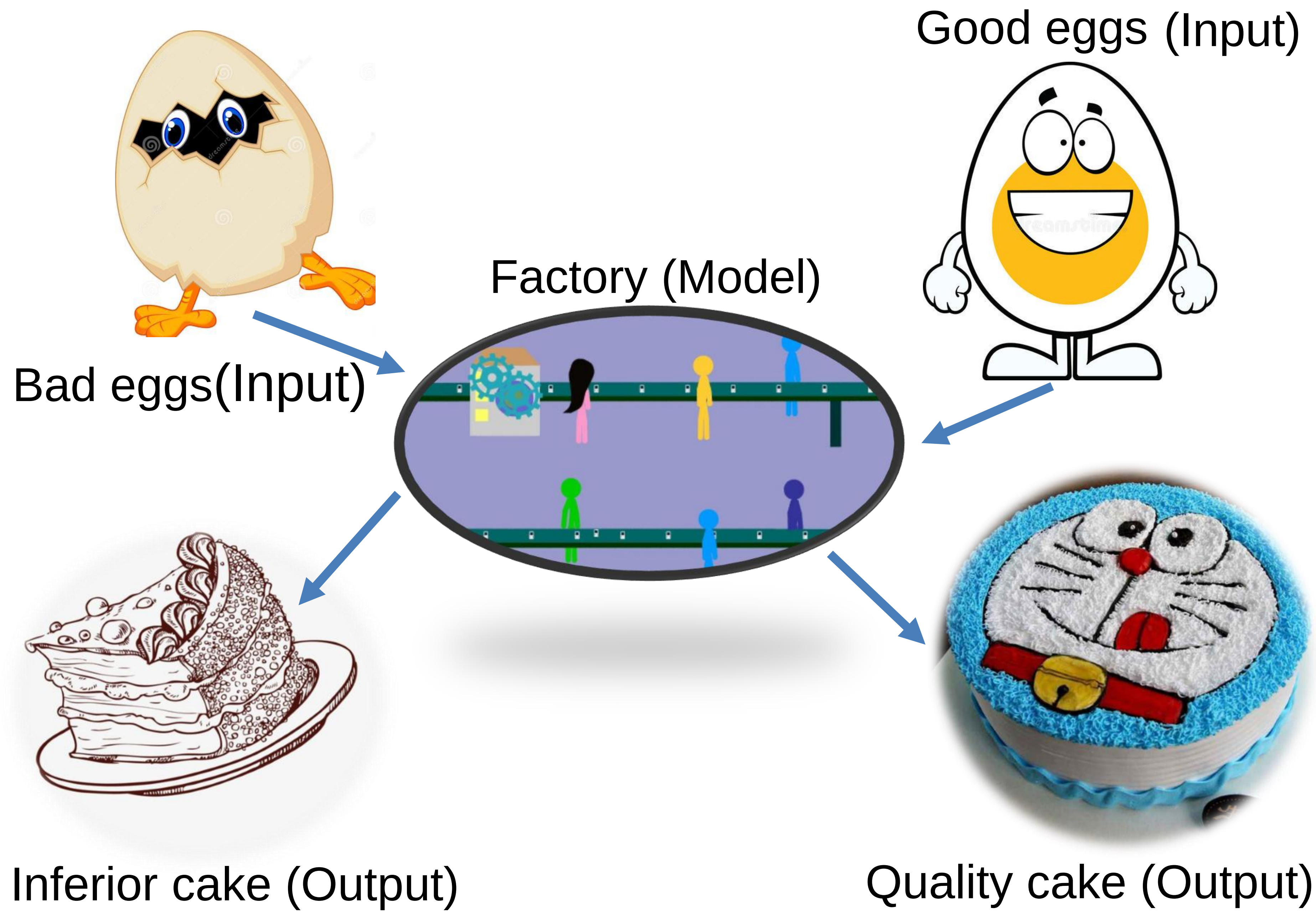
Outline

- C Research Background and Scientific Problems
- M Establishment Method and Data Introduction
- A Validation and Application of the CMADS over East Asia
- D Worldwide influence of the CMADS
- S Next plan

Modelling Evolution



Importance of Meteorological Input to Model Output

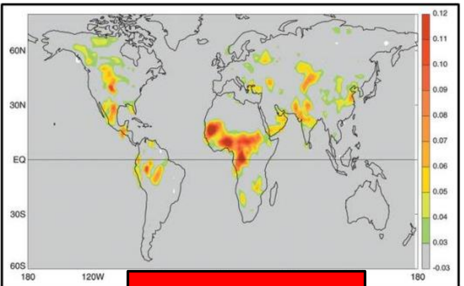


Importance of Meteorological Input to Model Output

Effects of Climate Change on Soil Moisture

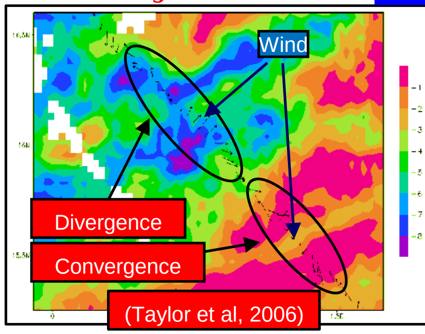
Shuttleworth (2011)

Global scale



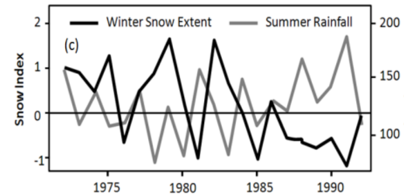
(Koster et al, 2006)

Regional scale



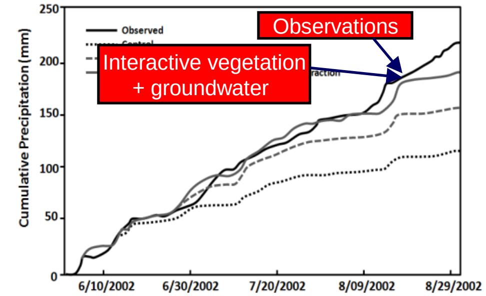
(Taylor et al, 2006)

Frozen Rain under Climate Change

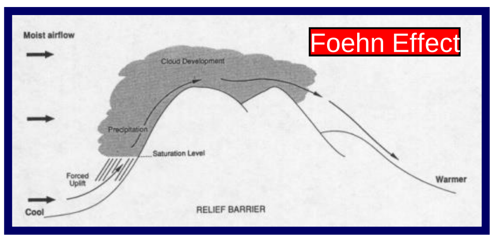


Gutzler & Preston (1997)

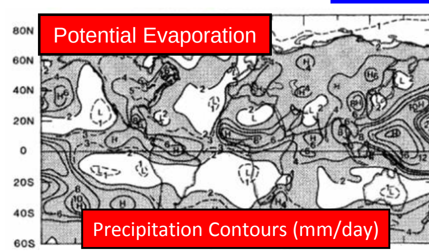
Seasonal Climate and Vegetation Change

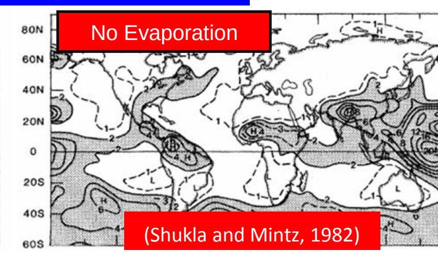


Meteorology and Topography



Humidity Recycling

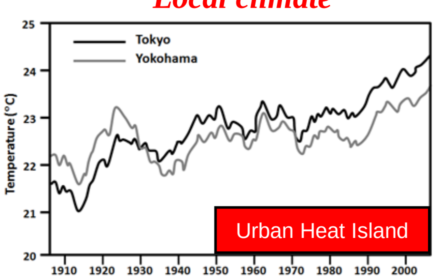




(Shukla and Mintz, 1982)

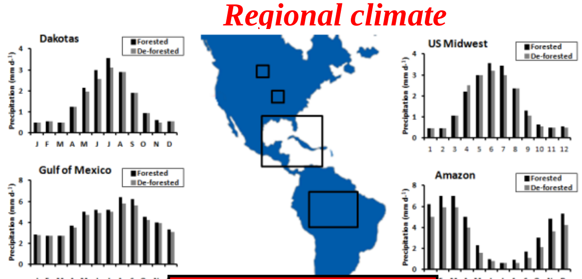
Impact of Climate on Land Use Change

Local climate



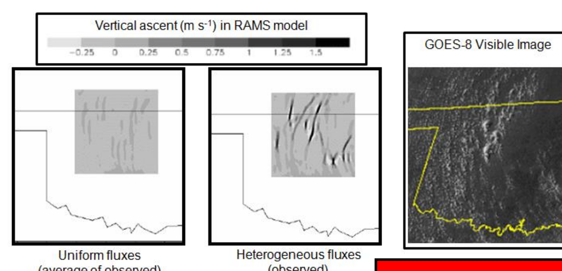
Urban Heat Island

Regional climate



Werth & Avissar (2002)

Heterogeneity



Weaver & Avissar (2002)

Meteorological plays a decisive role in model accuracy

Meng,X.Y.,Wang, H.; Shi, C.; Wu, Y.(2018) Water 10,1555. Meng,X.Y.,Wang, H.(2017) Scientific Reports. 7, 13286. doi:10.1038/s41598-017-10665-8. Meng,X.Y.,Wang, H. (2017) Water. 9, (10),765. doi:10.3390/w9100765.Teuling, A.J., Seneviratne, S.I., Williams, C. and Troch, P.A. (2006) Geophys. Res. Lett. 33. L23403. doi:10.1029/2006GL028178. Meng,X.Y.,Dan, L.Y. & Liu, Z.-H. (2015) J. Mt. Sci. 12(2), 368-381.Meng,X.Y.,Wang,H.,Lei,X.H.,Cai,S.Y.,Wu,H.J.(2017)Teh. Vjesn. 24,(2),525-534.doi: 10.17559/TV-20170108133334.Tucker, D.F. and Crook, N.A. (1999) Mon. Weather Rev. 127, 1259-1273. Ueda, H. and Yasunari, T. (1998) J. Meteorological Society of Japan 76, 1-12. Weaver, C.P., and Avissar, R. (2001) Bull. Amer. Meteor. Soc. 82, 269–281. Werth, D., and Avissar, R. (2002) J. Geophys. Res. 107, D20, 8087, doi:10.1029/2001JD000717.N. (2006)，Avissar, R., and Liu, Y.Q. (1996) J. Geophys. Res. 101(D3), 7499-7518. Barnett, T.P., Adams, J.C., and Lettenmaier, D.P. (2005) Nature 438(17), 303-309. 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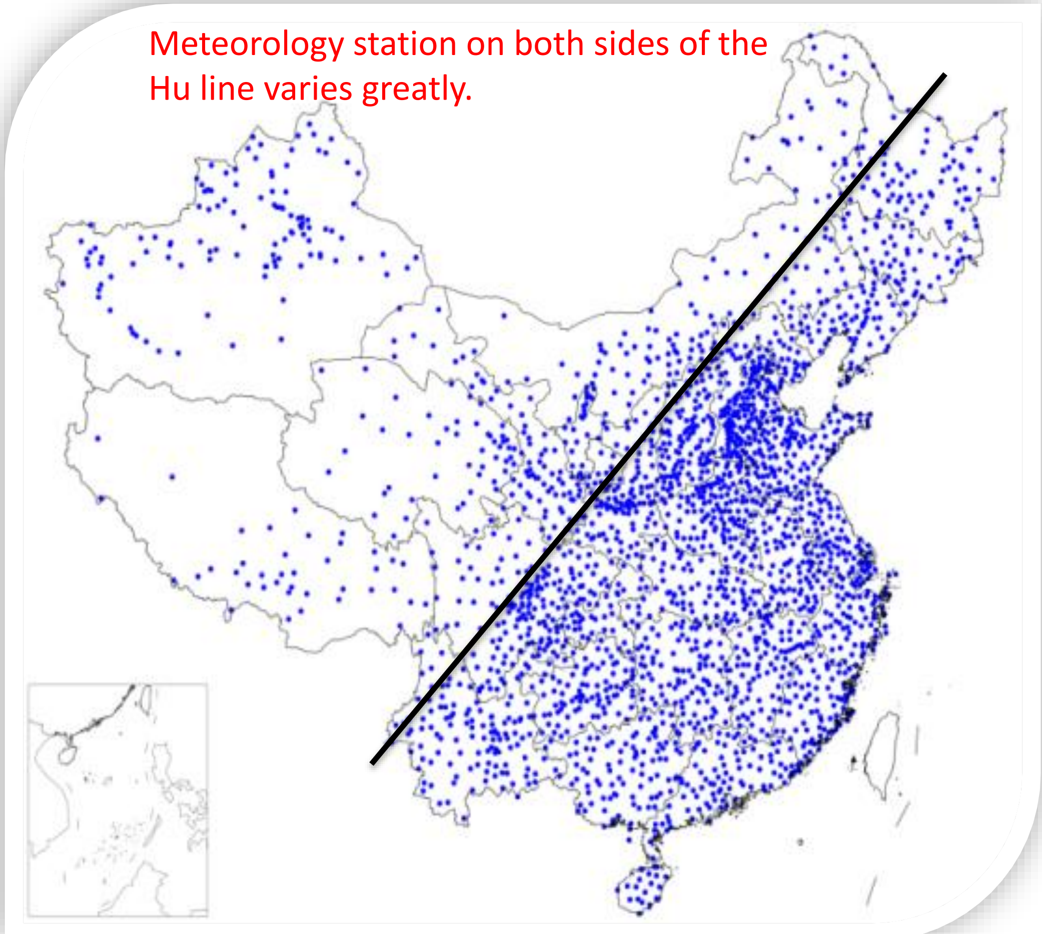
Problems in Scientific Research in East Asia

1) Uncertainty in hydrological processes is largely due to uncertainty in atmospheric driving data.

2) Meteorological stations in East Asia: Scarce station, Low spatial representation, Data sequence discontinuity, No solar radiation.



Take China as an example

Restricted by many objective factors: such as economy and geology, the distribution density of traditional observational meteorological stations in East Asia (such as precipitation, temperature, humidity, wind speed, soil temperature and soil moisture) is relatively scarce on the whole.

We believe that: There is a lack of a unified grid data at present, this data can assimilate more data sources using meteorological observe data or others (such as satellites or radars).

CMADS solves the above problems, Most importantly, we're going to open it up.

Outline

- C Research Background and Scientific Problems
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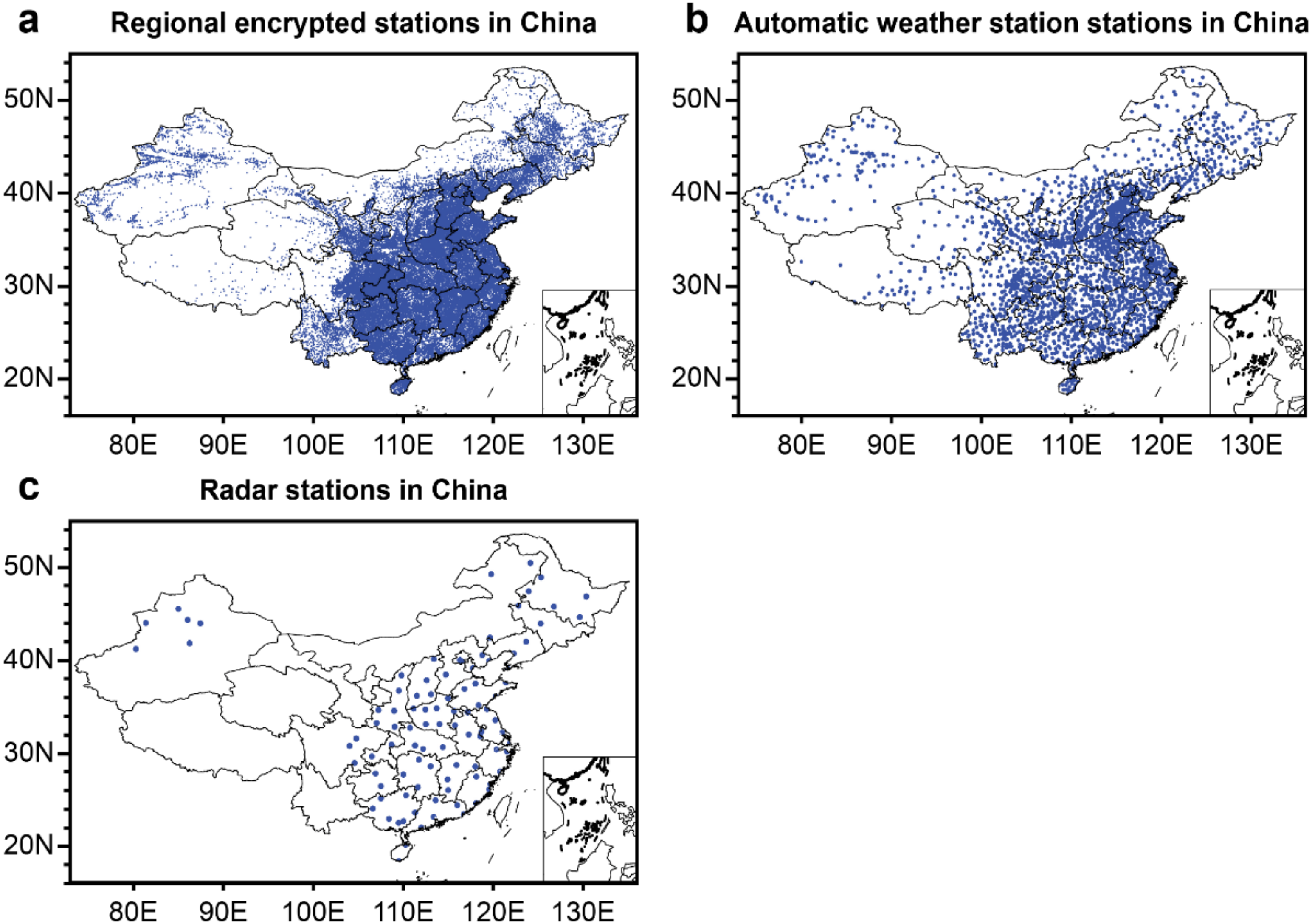
Development Process of CMADS-GRID

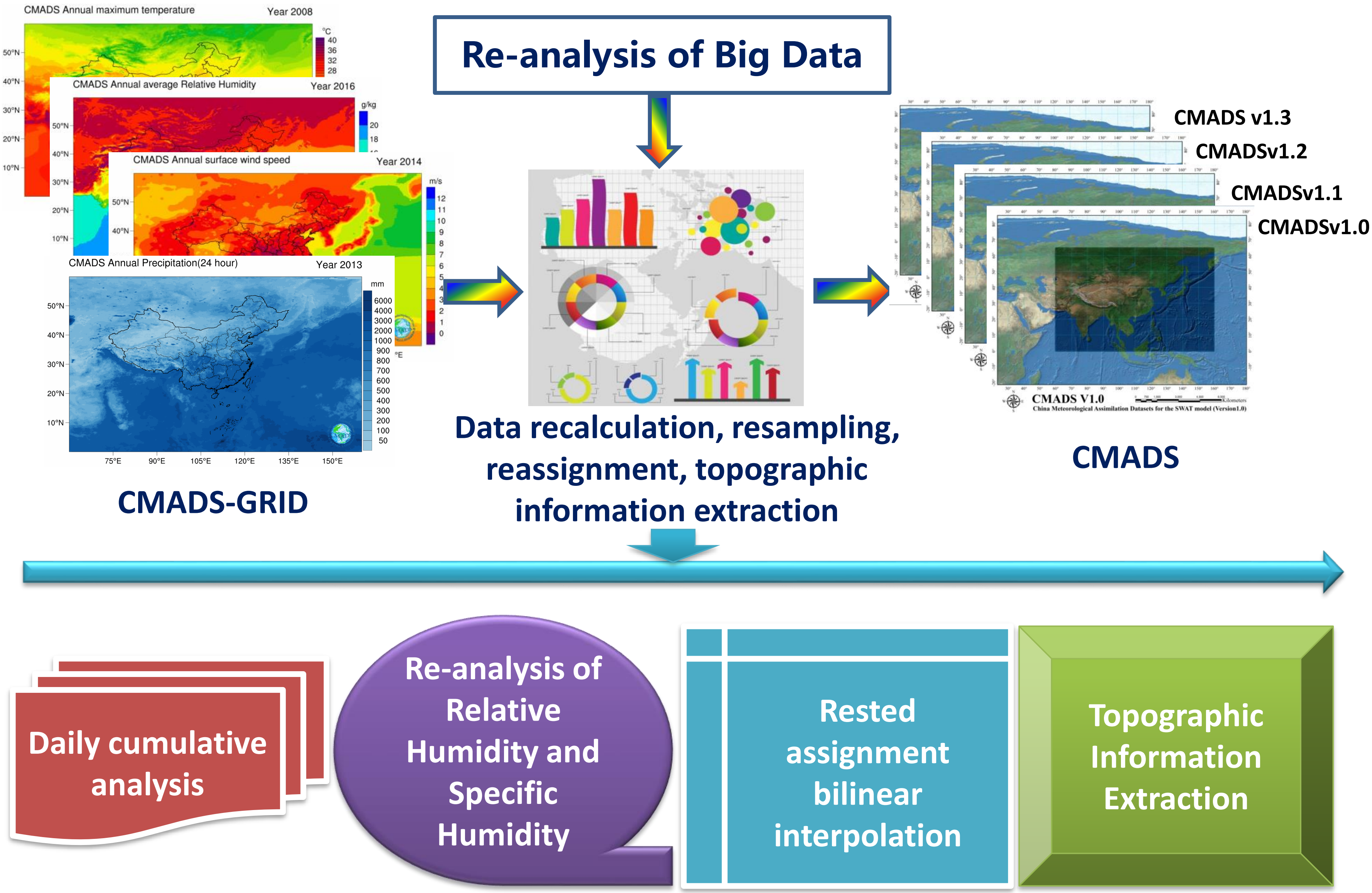


1) Space covers the whole of East Asia (0 N-65 N, 60 E-160 E)

2) Time span : From 1908 to 2018 at Daily scale；(Annual update)

3) Providing elements : Average \ maximum \ minimum 2m temperature, 24-hour precipitation, Solar radiation, Atmospheric pressure, Humidity, Wind speed , Soil temperature and moisture.

Post processing of the CMADS-GRID



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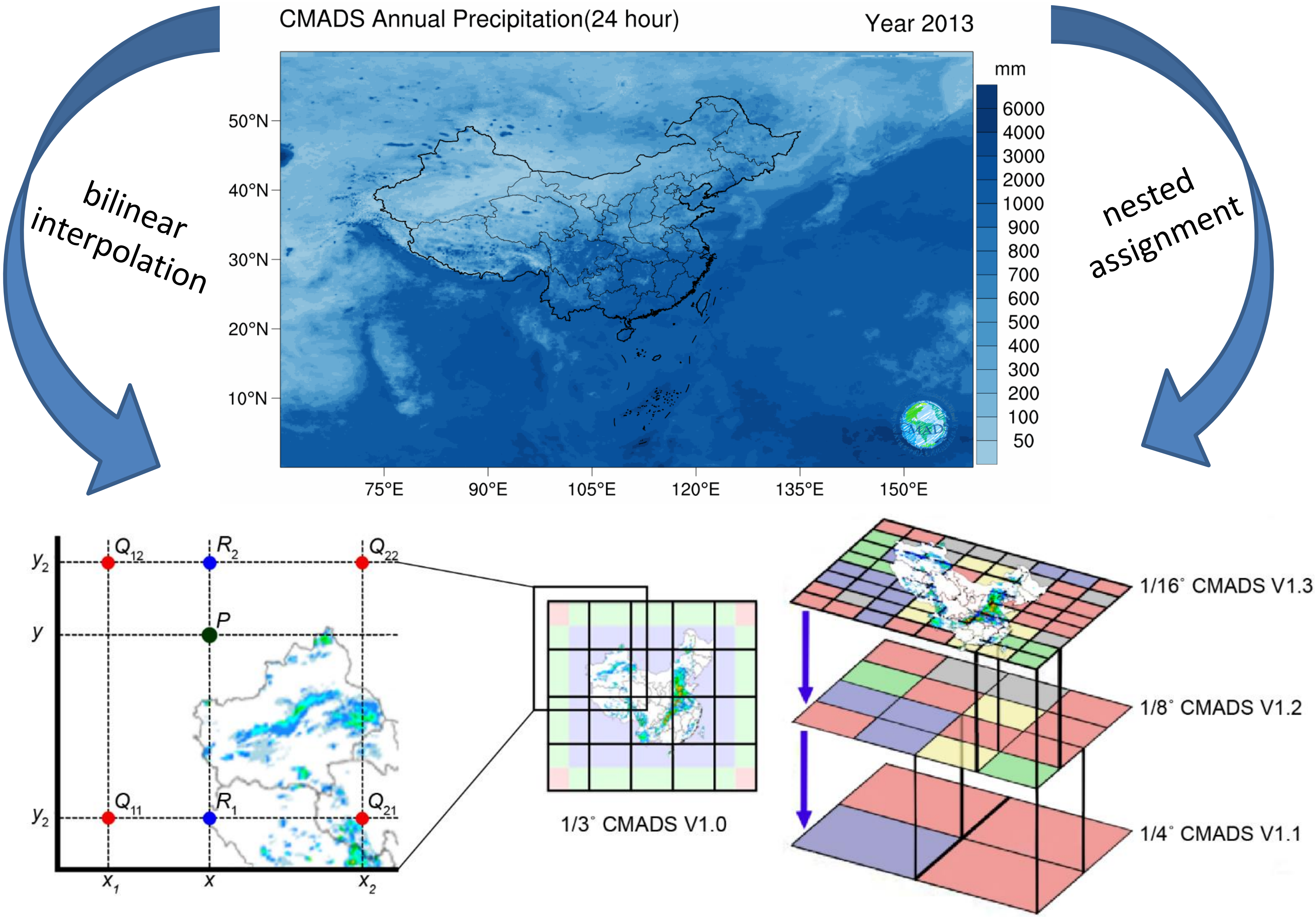

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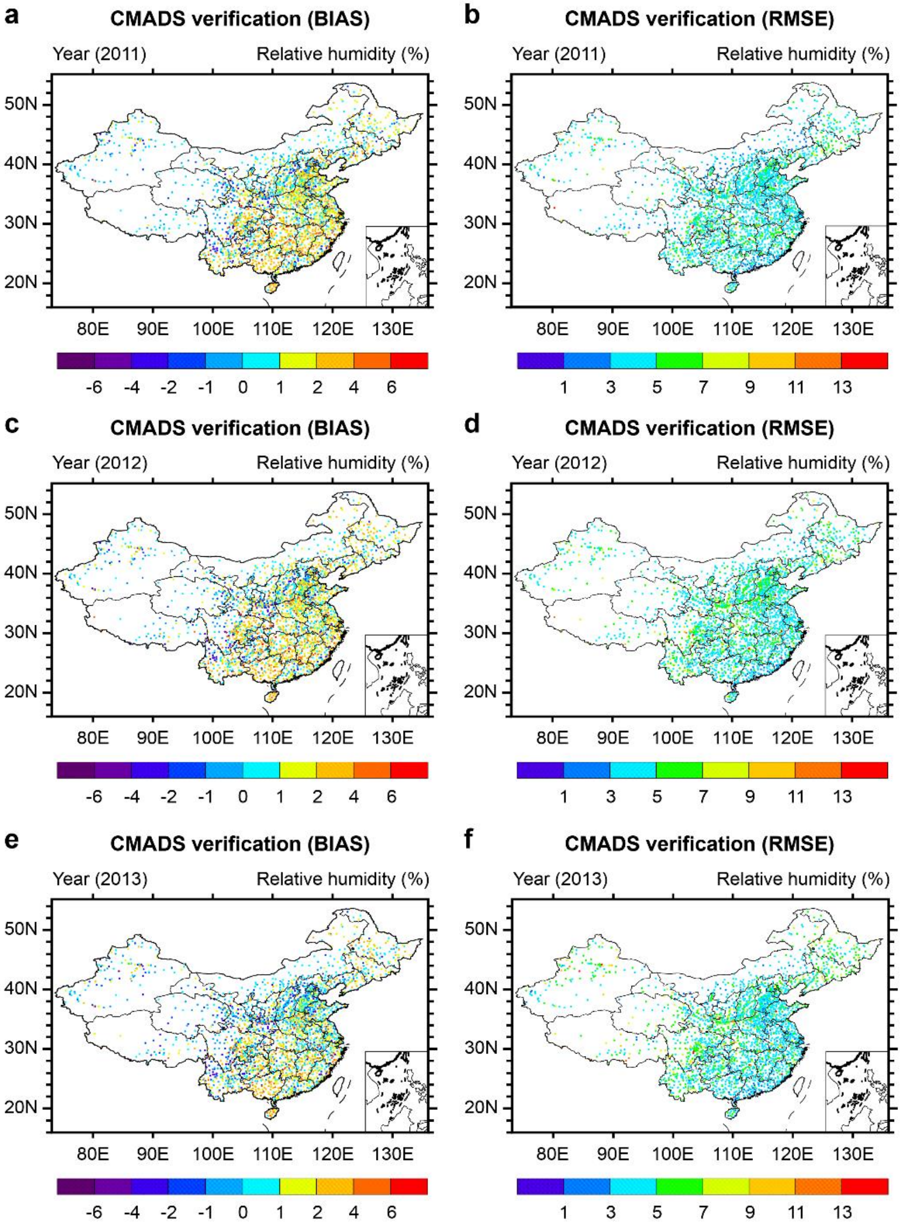
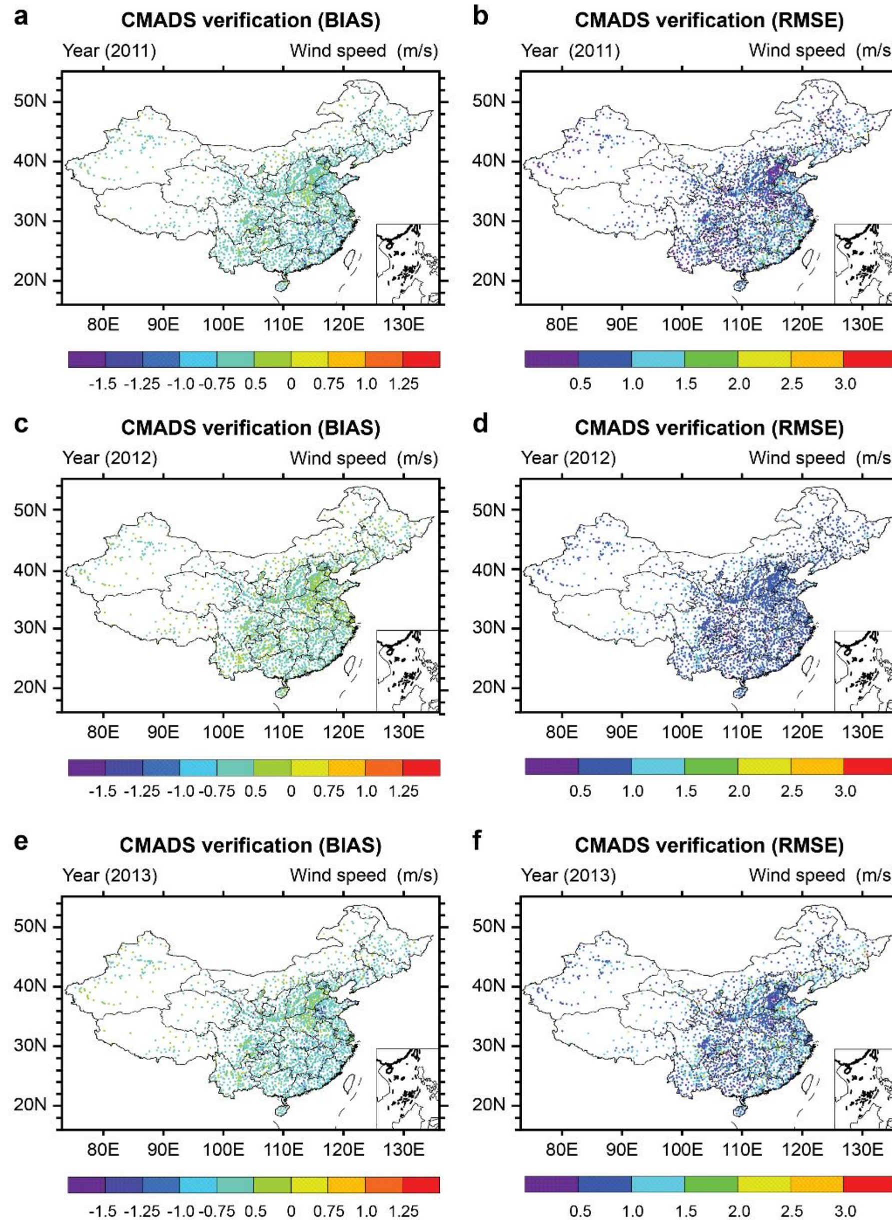
Evaluation of the CMADS

Meng, X.; Wang, H.; Shi, C.; Wu, Y.; Ji, X.(2018).Establishment and Evaluation of the China Meteorological Assimilation Driving Datasets for the SWAT Model (CMADS).***Water***,10,1555.





Meng,X.Y.,Wang, H., et al. Investigating spatiotemporal changes of the land-surface processes in Xinjiang using high-resolution CLM3.5 and CLDAS: Soil temperature. ***Scientific Reports.*** 7, 13286. doi:10.1038/s41598-017-10665-8. (2017a).

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Investigating spatiotemporal changes of the land-surface processes in Xinjiang using high-resolution CLM3.5 and CLDAS: Soil temperature

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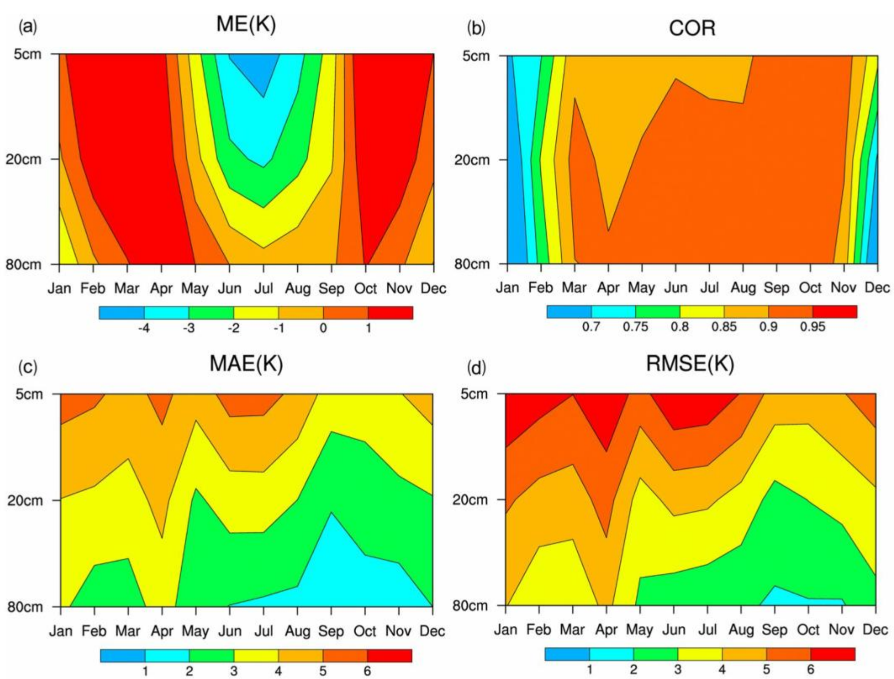

Figure 2. Statistical function graphs of the changes in the temperatures of the soil with season and depth. (**a**) ME, (**b**) Anomaly correlation, (**c**) MAE, and (**d**) RMSE.

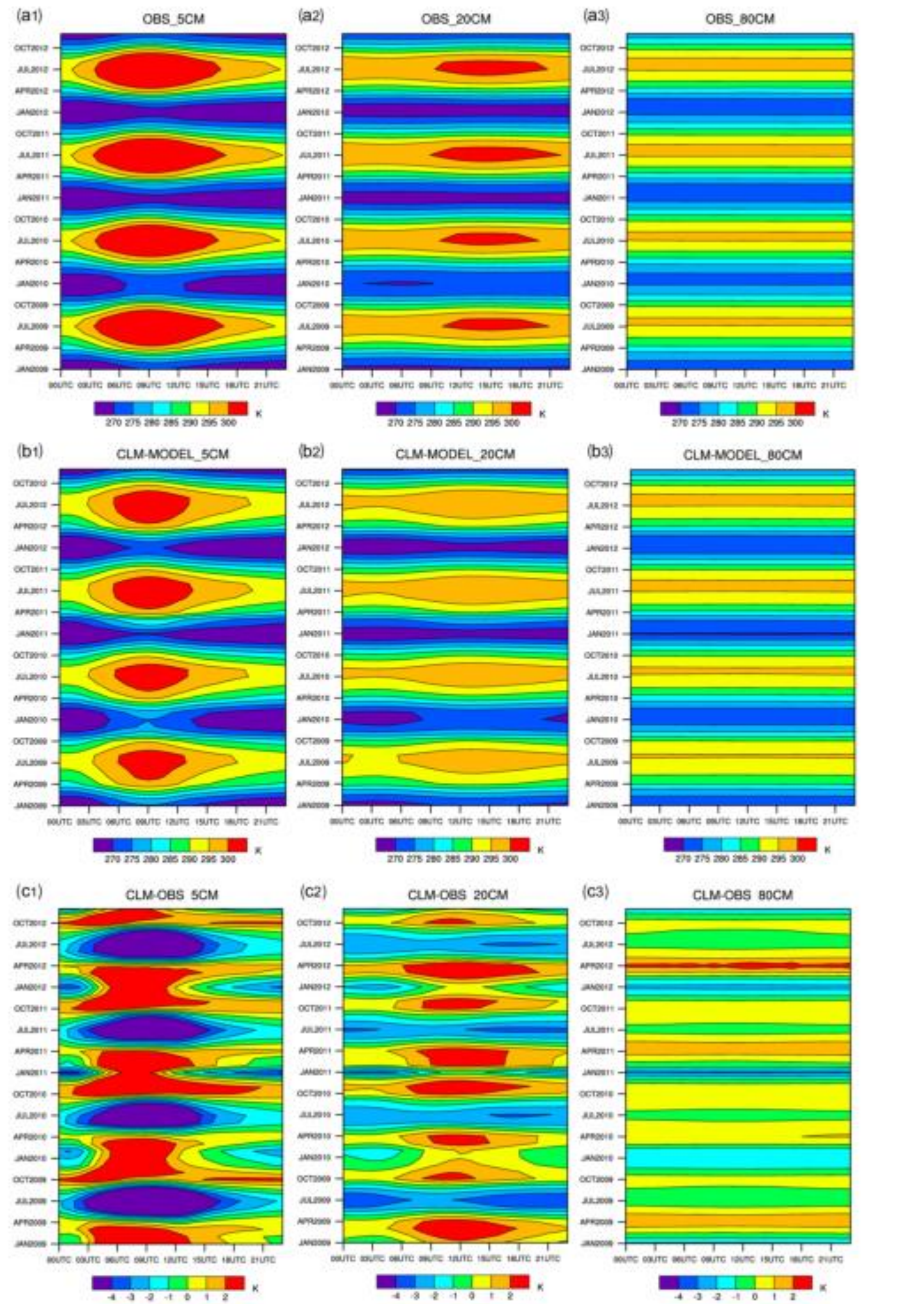

Figure 5. Annual and hourly changes in the observed (**a**) and simulated (**b**) soil temperatures at three depths and their differences (**c**).

CMADS Special journal

ACKNOWLEDGEMENT OF GUEST EDITORSHIP

We certify that

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Application of the China Meteorological Assimilation Driving Datasets for the SWAT Model (CMADS) in East Asia

We acknowledge the hard work involved in inviting and following up with authors, and ensuring the high quality of articles through rigorous editorial checks and making the final acceptance decisions. The work of guest editors is crucial in keeping MDPI journals at the forefront of research in their field.

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IMPACT FACTOR 2.069

Application of the China Meteorological Assimilation Driving Datasets for the SWAT Model (CMADS) in East Asia

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Deadline for manuscript submissions:
31 December 2018

Message from the Guest Editors

Dear Colleagues,

China Meteorological Assimilation Driving Datasets for the SWAT model (CMADS) were developed and provided high resolution and quality meteorological data for the community. Over the past few years, the CMADS data set has received worldwide attention from applicants such as the USA, Germany, Russia, Italy, India, Korea, etc.

This Special Issue on “CMADS in East Asia” invites papers that report recent advances in the modeling of water quality and quantity in watersheds using CMADS and the hydrological model on a wide range of topics. These include, but are not limited to, water resource modeling, hydrological ecology, water ecological footprint, non-point source pollution, meteorological verification, meteorological analysis, atmospheric and hydrological coupling, changes in water resources under climate change, optimal operational of reservoirs, water footprint assessment. We encourage submissions based on theoretical, computational and field studies that involve multiple hydrologic domains and interactions, as well as contributions that demonstrate novel applications.

Prof. Dr. Hao Wang
Dr. Xianyong Meng

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Special Issue

water MDPI

Meng, X., Wang, H. Significance of the China Meteorological Assimilation Driving Datasets for the SWAT Model (CMADS) of East Asia.***Water***. 9, (10),765. doi:10.3390/w9100765. (2017b).

Editorial

Significance of the China Meteorological Assimilation Driving Datasets for the SWAT Model (CMADS) of East Asia

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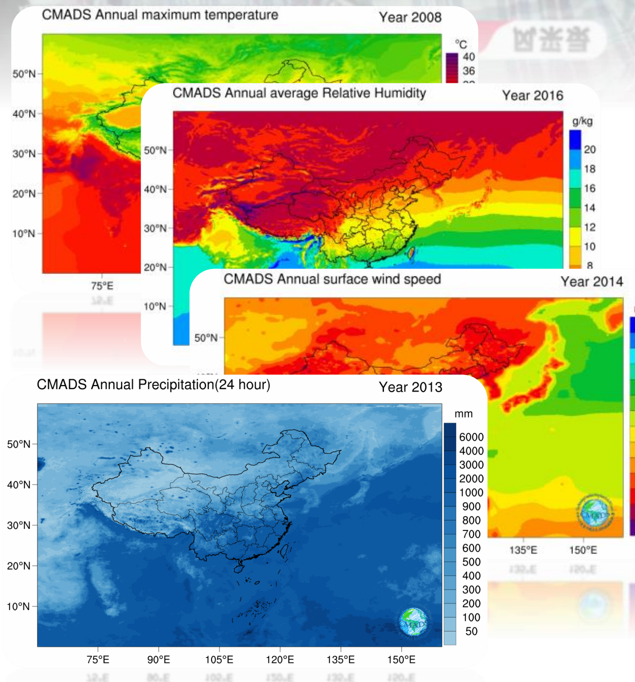
† These authors contributed equally to this work.

East Asia is a part of the largest continent in the world. In addition, it is the world's most densely populated region, with approximately 1.5 billion inhabitants. The underlying geography is complex and highly differentiated, leading to large climate variations. For example, this region contains the Qinghai–Tibet Plateau, the world's highest, which has a unique alpine climate that profoundly influences the climate in East Asian countries and across the globe. Owing to climate change, East Asia's water resources have been facing multiple pressures over recent years, such as uneven distributions of droughts and floods, water pollution, and water shortages. Consistent with the limitations in weather station observations, shortcomings related to economics, terrain, and other objective factors make it difficult to perform large-scale, long-term, high-frequency monitoring studies of water pollution and other related topics (such as floods, droughts, water scarcity, etc.) in East Asia.

high-quality meteorological data for use by the scientific community. Applying CMADS can significantly reduce meteorological input uncertainties and improve the performance of non-point source pollution modelling, since water resources and non-point source pollution can be more accurately localised. In addition, researchers can employ high-resolution time series data from CMADS to perform spatial- and temporal-scale analyses of meteorological data. Over the past few years, the CMADS dataset has received attention from around the world, including researchers in the United States, Germany, Russia, Italy, India, and South Korea, among others. As a developer of CMADS, we have used the CMADS driven SWAT model to simulate the runoff of many watersheds, such as China's Heihe River Basin [26] and Manas River Basin [27], and obtained satisfactory results. We expect researchers around the world to take full advantage of the CMADS owing to its high spatiotemporal resolution, unified procedure (including latitude and longitude, and elevation), and reliable quality. CMADS can be used to carry out studies of various distributed models (e.g., the SWAT and Variable Infiltration Capacity (VIC) models) and high-resolution climate verification and analyses. Given that meteorological data pertaining to East Asia are scarce, the use of CMADS can assist researchers globally to perform more efficient and effective scientific comparisons and in-depth investigations with a standard procedure.



CMADS Peer Review Papers

water

Zhao, F.; Wu, Y.; Qiu, L.; Sun, Y.; Sun, L.; Li, Q.; Niu, J.; Wang, G. Parameter Uncertainty Analysis of the SWAT Model in a Mountain-Loess Transitional Watershed on the Chinese Loess Plateau. *Water* **2018**, *10*, 690.

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Article

Parameter Uncertainty Analysis of the SWAT Model in a Mountain-Loess Transitional Watershed on the Chinese Loess Plateau

Fubo Zhao [1], Yiping Wu [1,*], Linjing Qiu [1], Yuzhu Sun [1], Liqun Sun [2], Qinglan Li [2], Jun Niu [3] and Guoqing Wang [4]

1 Department of Earth and Environmental Science, School of Human Settlements and Civil Engineering, Xi'an Jiaotong University, Xi'an 710049, China; zfubo789@163.com (F.Z.); qiulinjing@mail.xjtu.edu.cn (L.Q.); sunyuzhu12@stu.xjtu.edu.cn (Y.S.)

2 Shenzhen Institutes of Advanced Technology, Chinese Academy of Sciences, Shenzhen 518055, China; lq.sun@siat.ac.cn (L.S.); ql.li@siat.ac.cn (Q.L.)

3 Center for Agricultural Water Research in China, China Agricultural University, Beijing 100083, China; niuj@cau.edu.cn

4 Nanjing Hydraulic Research Institute, Nanjing 210029, China; guoqing_wang@163.com

* Correspondence: rocky.ypwu@gmail.com or yipingwu@xjtu.edu.cn

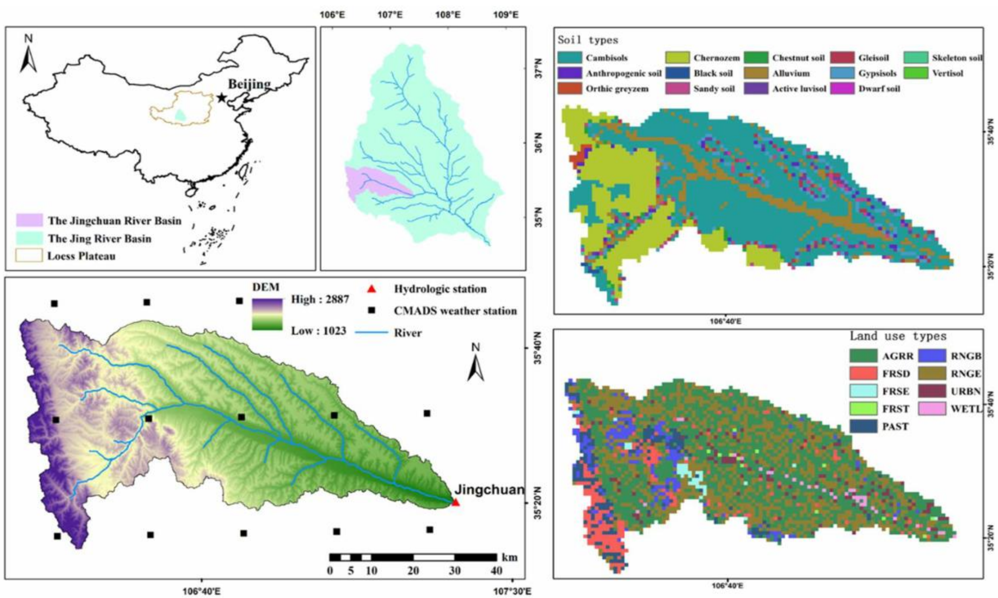

Figure 1. DEM, soil types, and land use types of the Jingchuan River Basin (JCRB).

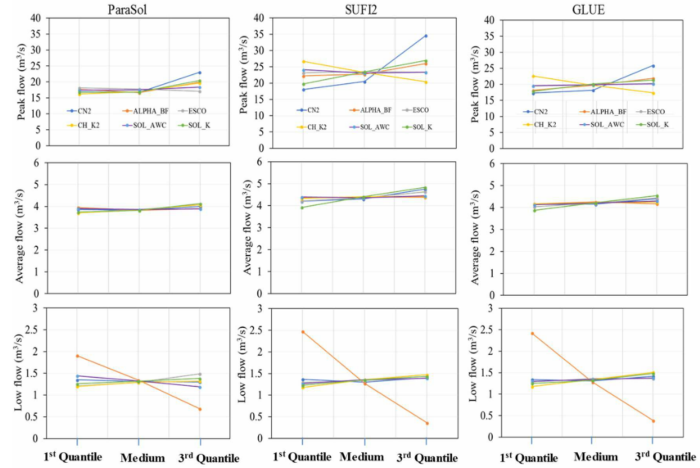

Figure 3. The effect of each parameter generated by the three methods on the peak flow, average flow, and low flow. 1st Quantile, medium, and 3rd Quantile are denoted by 25th, 50th, and 75th percentiles of the parameter distributions, respectively.

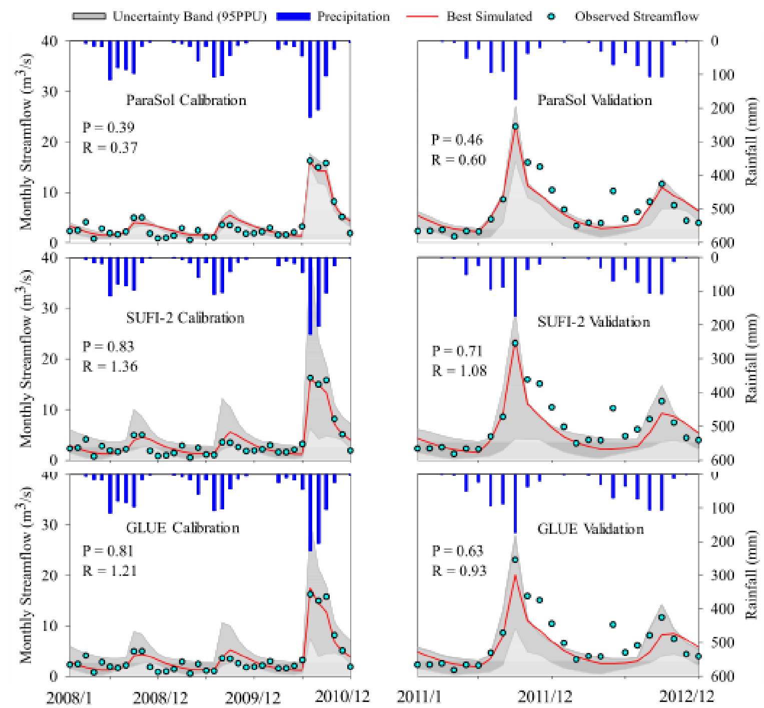

Figure 5. Comparison of best-simulated monthly streamflow with 95PPU against observed streamflow by ParaSol (top), SUFI-2 (middle), and GLUE (bottom). P indicates the percentage of observed data bracketed by 95% prediction uncertainty; R reflects the average thickness of 95PPU band divided by the standard deviation of the measured data.

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Application of SWAT Model with CMADS Data to Estimate Hydrological Elements and Parameter Uncertainty Based on SUFI-2 Algorithm in Lijiang River, China

Yang Cao [1,2,4], Jing Zhang [*1,2], Mingxiang Yang [3], Xiaohui Lei [3], Binbin Guo [1,2], Liu Yang [4], Zhiqiang Zeng [3], Jiashen Qu [5]

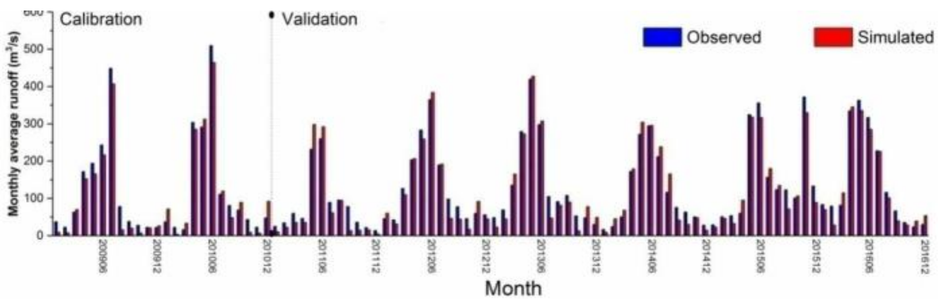

Figure 3. Comparison of monthly runoff using SWAT.

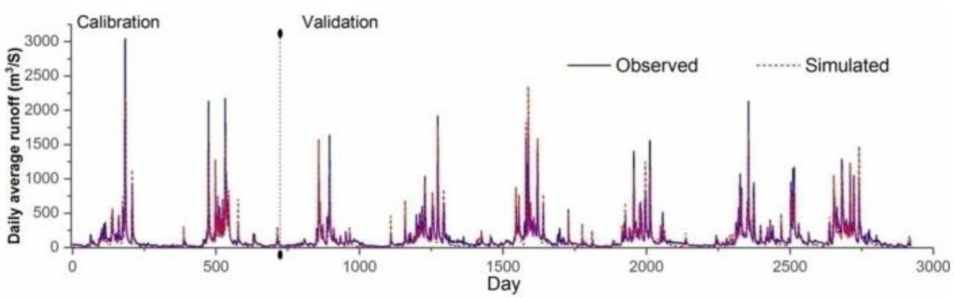

Figure 4. Comparison of daily runoff using SWAT.

Cao, Y.; Zhang, J.; Yang, M.; Lei, X.; Guo, B.; Yang, L.; Zeng, Z.; Qu, J. Application of SWAT Model with CMADS Data to Estimate Hydrological Elements and Parameter Uncertainty Based on SUFI-2 Algorithm in the Lijiang River Basin, China. *Water* **2018**, *10*, 742.

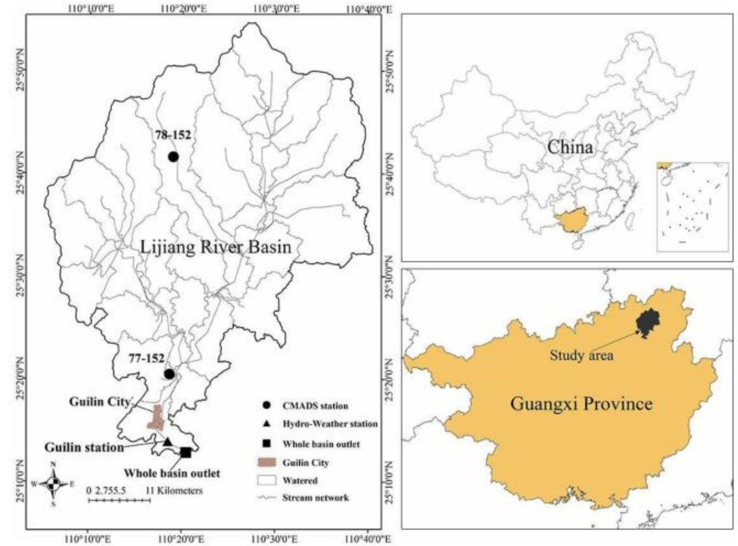

Figure 1. The location of the study area in China.

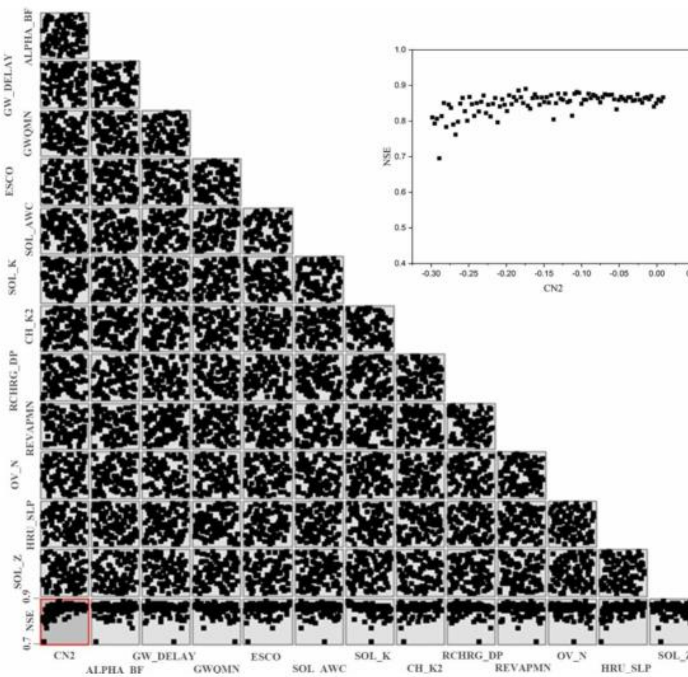

Figure 5. The pair-wise correlations between the parameters and the correlations between parameters and NSE.

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Evaluation of High-Resolution Multi-Satellite Precipitation Products for Streamflow Simulations for the Han River Basin in the Korean Peninsula, East Asia

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vuthom.khtn@gmail.com; lili0809@skku.edu
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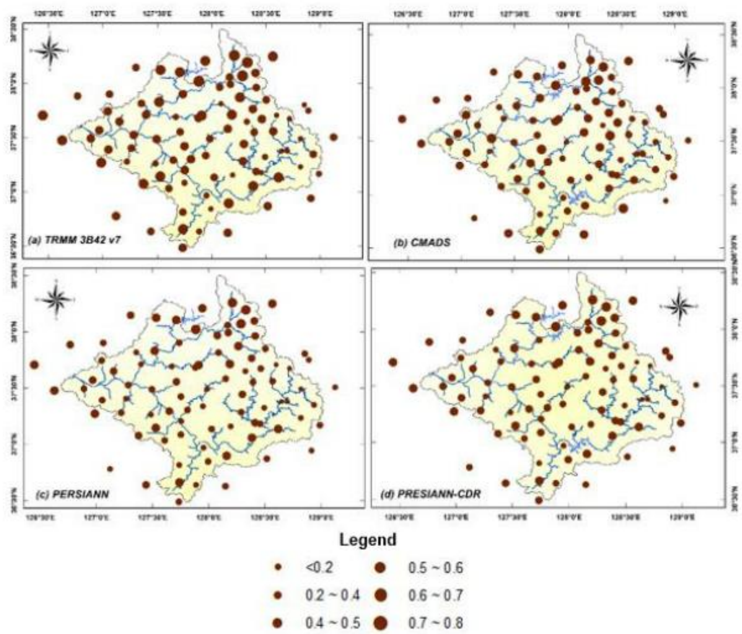

Figure 3. The spatial correlation pattern for ground-based and satellite-derived rainfall during 2008-2013. The circles represent the gauge stations.

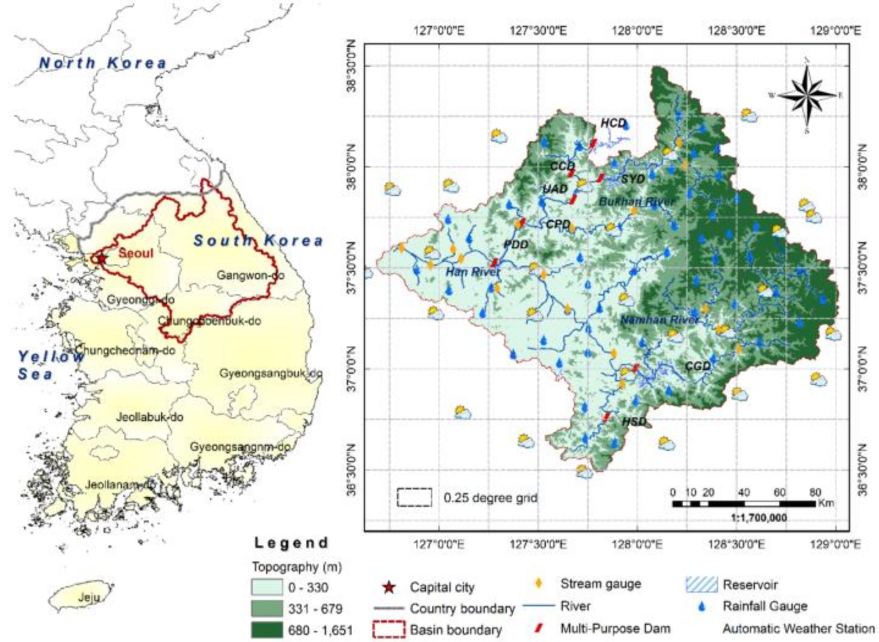

Figure 1. The Han River basin.

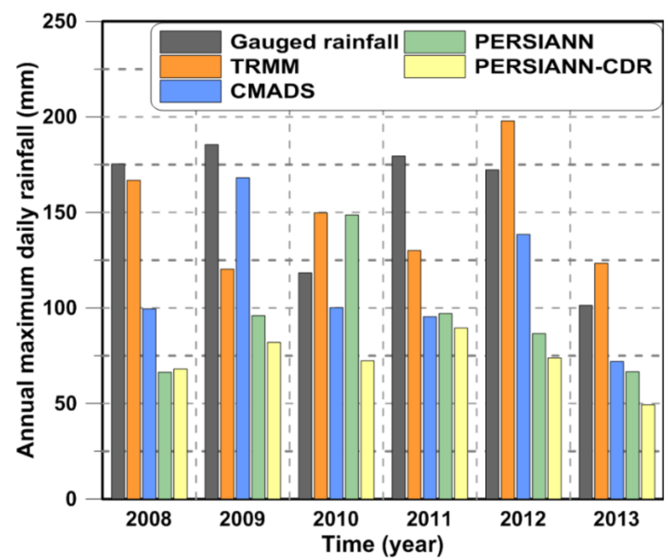

Figure 16. The comparison of annual maximum daily rainfall of different datasets.

Vu, T.T.; Li, L.; Jun, K.S. Evaluation of Multi-Satellite Precipitation Products for Streamflow Simulations: A Case Study for the Han River Basin in the Korean Peninsula, East Asia. *Water* **2018**, *10*, 642.

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Article

Evaluation and Hydrological Simulation of CMADS and CFSR Reanalysis Datasets in the Qinghai-Tibet Plateau

Jun Liu [1,2], Donghui Shanguan [1,*], Shiyin Liu [3] and Yongjian Ding [1]

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* Correspondence: dhguan@lzb.ac.cn; Tel.: +86-13919104740

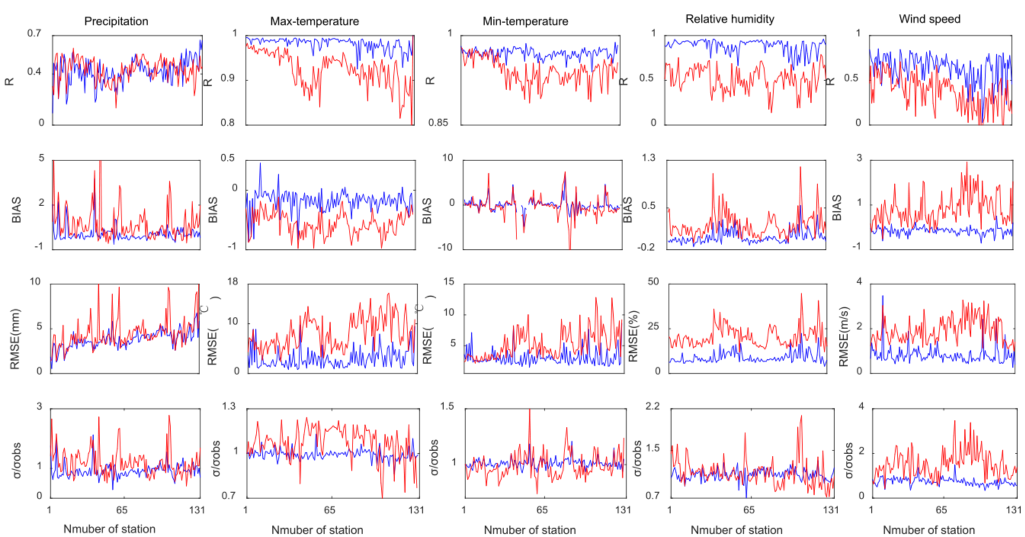

Figure 2. Statistical factors map from CMADS, CFSR compared to 131 observations stations from 2008 to 2013 (Red line is CFSR, blue line is CMADS).

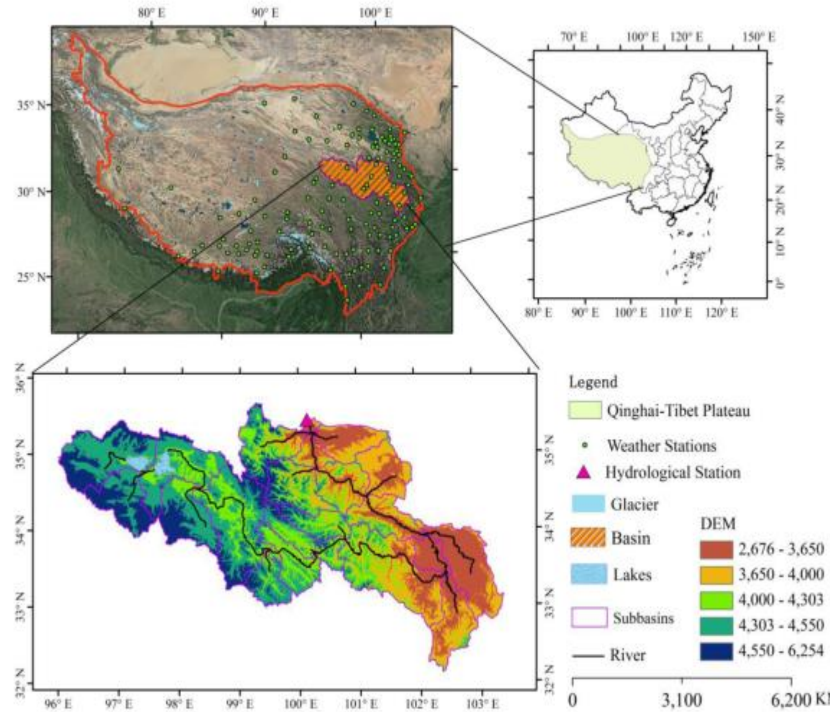

Figure 1. The Locations of TP and the Digital Elevation Model of Yellow River Source Basin.

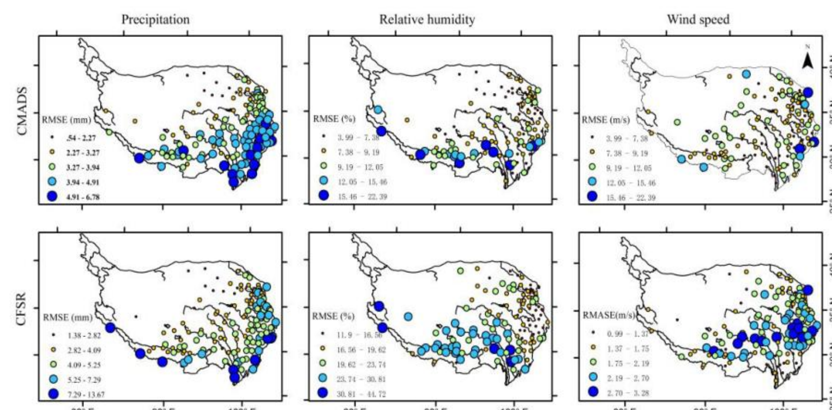

Figure 3. RMSE distribution at daily scales, precipitation(a), temperature(b)

Liu, J.; Shanguan, D.; Liu, S.; Ding, Y. Evaluation and Hydrological Simulation of CMADS and CFSR Reanalysis Datasets in the Qinghai-Tibet Plateau. *Water* **2018**, *10*, 513.

CMADS Peer Review Papers

Tian, Y.; Zhang, K.; Xu, Y.-P.; Gao, X.; Wang, J. Evaluation of Potential Evapotranspiration Based on CMADS Reanalysis Dataset over China. *Water* **2018**, *10*, 1126.

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Article

Evaluation of potential evapotranspiration based on CMADS reanalysis dataset over China

Ye Tian[1*], Kejun Zhang[1], Yueping Xu[2], Xichao Gao[3], Jie Wang[1]

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[2] Institute of Hydrology and Water Resources, Department of Civil Engineering, Zhejiang University, Hangzhou 310058, China; yuepingxu@zju.edu.cn (Y. X.)

[3] China Institute of Water Resources and Hydropower Research; Beijing 100038, China; 999gaoxichao@163.com (X. G.)

* Correspondence: tianye@nuist.edu.cn

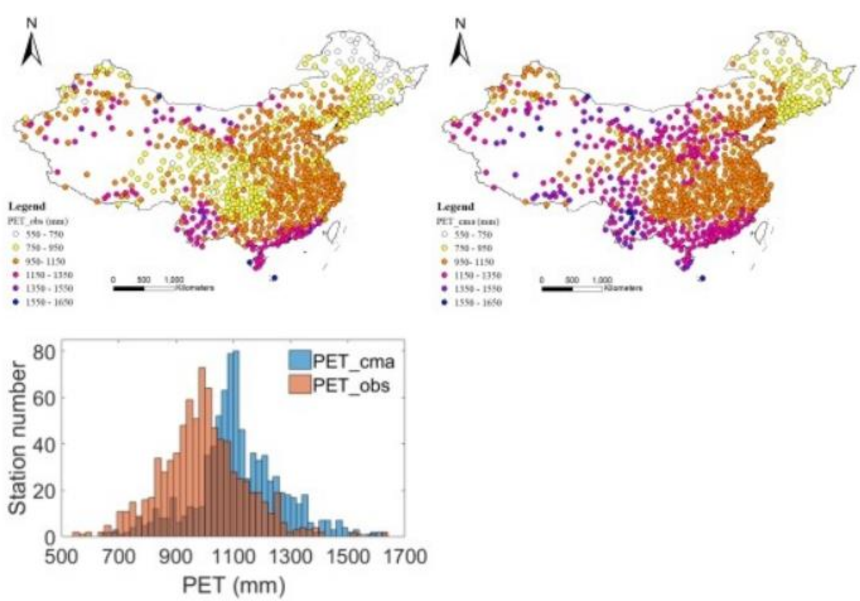

Figure 2. Average annual PET_obs and PET_cma across China, with their histograms.

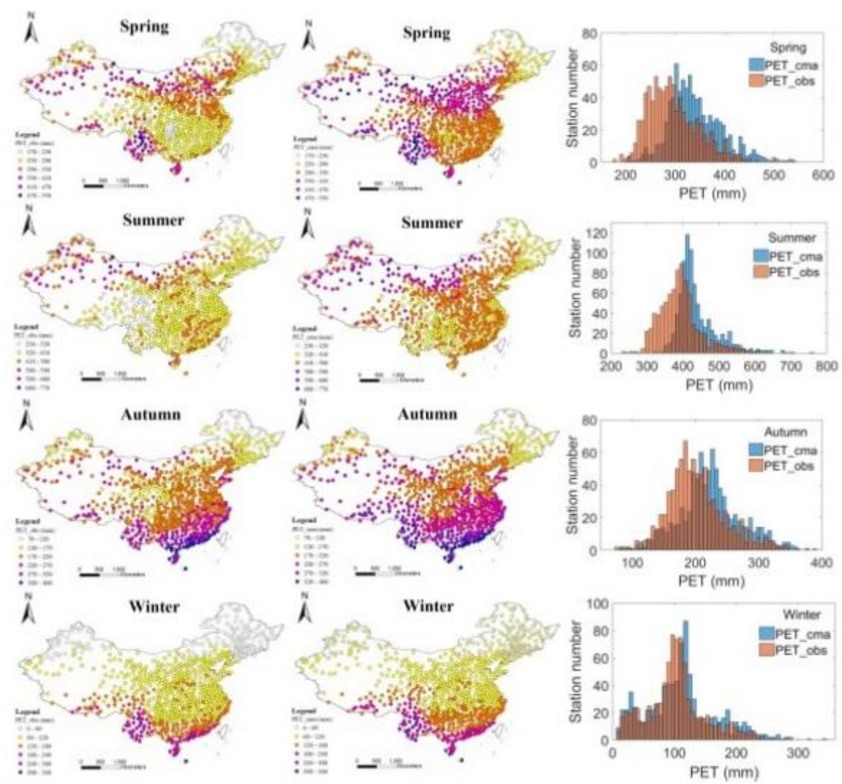

Figure 3. Mean seasonal potential evapotranspiration estimated from weather station data (PET_obs,

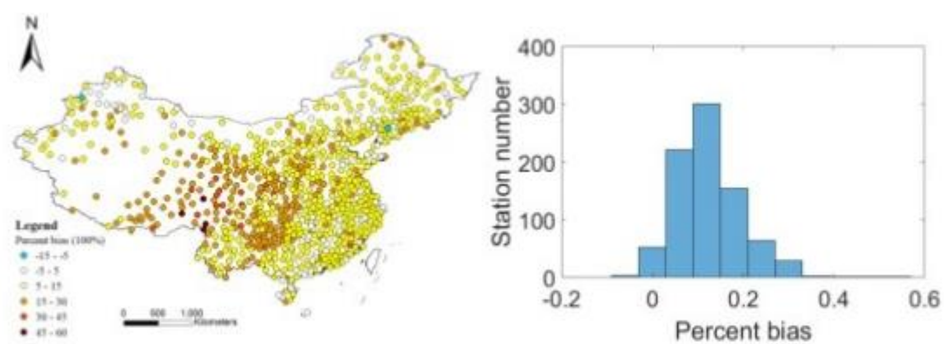

Figure 4. Spatial distribution of percentage bias, indicating the accuracy of average annual PET_cma values (left), and frequency distribution of percentage bias (right.)

CMADS Peer Review Papers

Zhou, S.; Wang, Y.; Chang, J.; Guo, A.; Li, Z. Investigating the Dynamic Influence of Hydrological Model Parameters on Runoff Simulation Using Sequential Uncertainty Fitting-2-Based Multilevel-Factorial-Analysis Method. *Water* **2018**, *10*, 1177.

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Article

Investigating the Dynamic Influence of Hydrological Model Parameters on Runoff Simulation Using Sequential Uncertainty Fitting-2-Based Multilevel-Factorial-Analysis Method

Shuai Zhou, Yimin Wang *, Jianxia Chang, Aijun Guo and Ziyan Li

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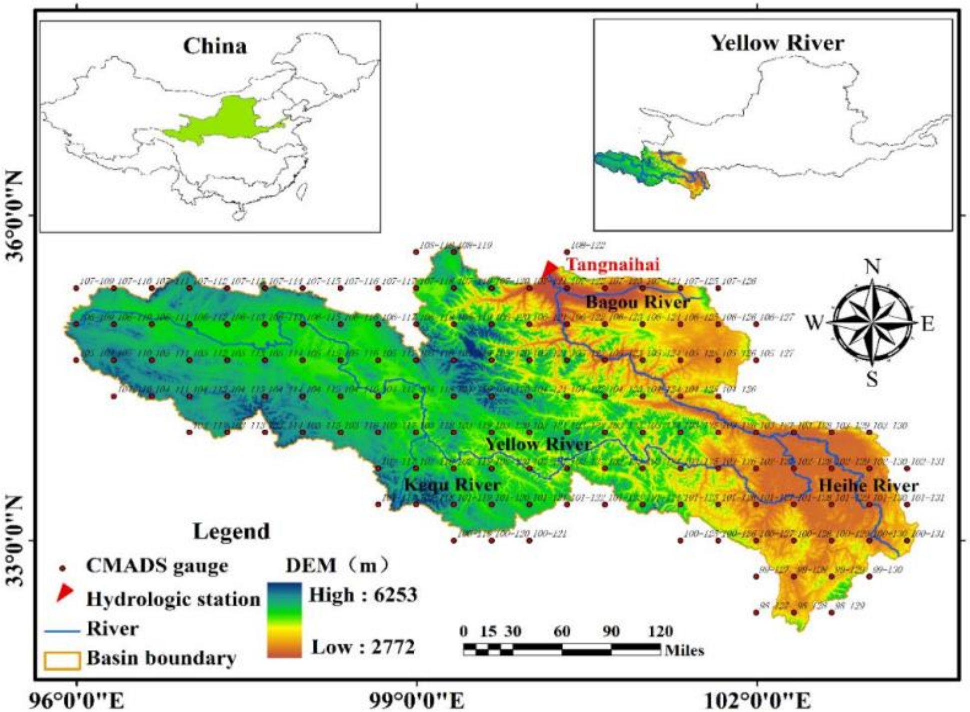
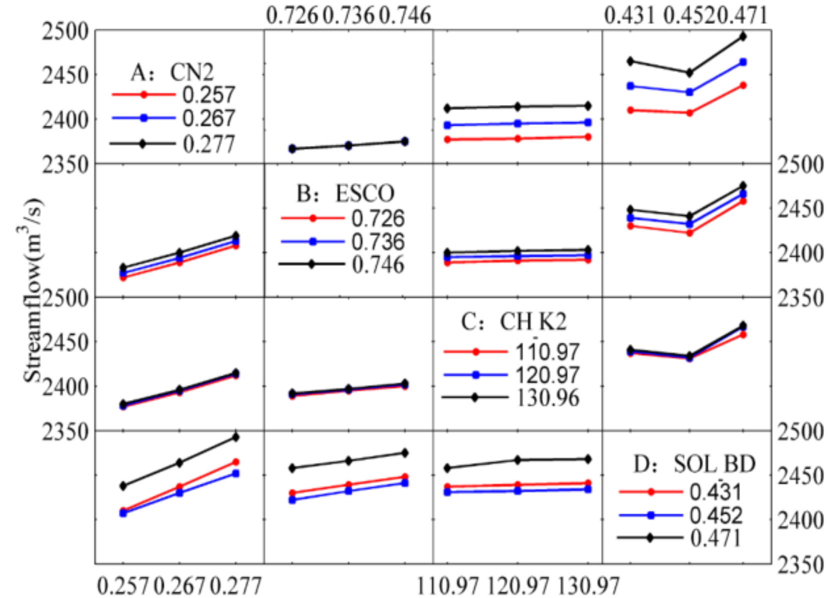


Figure 1. Locations of the Yellow River source region.



Interaction effects of parameters in the flood period.

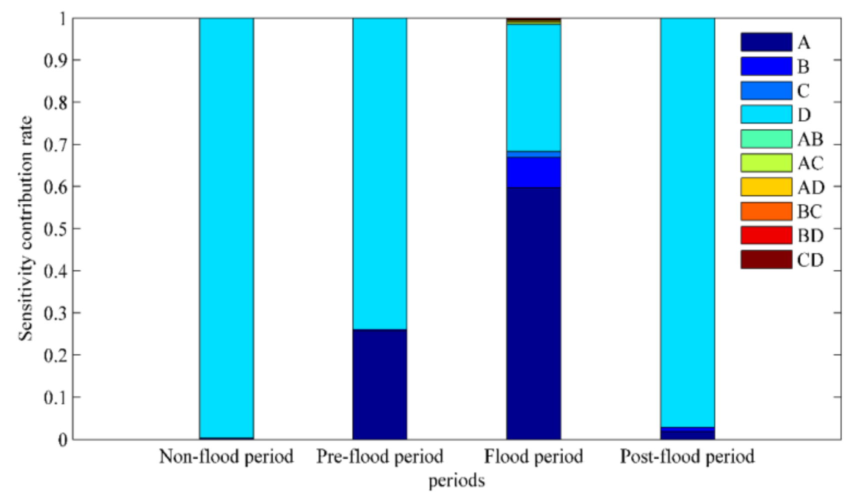


Figure 14. Contribution of individual and interaction parameters to the runoff simulation in different periods.

CMADS Peer Review Papers

Shao, G.; Guan, Y.; Zhang, D.; Yu, B.; Zhu, J. The Impacts of Climate Variability and Land Use Change on Streamflow in the Hailiutu River Basin. *Water* **2018**, *10*, 814.

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Article

The Impacts of Climate Variability and Land Use Change on Streamflow in the Hailiutu River Basin

Guangwen Shao, Yiqing Guan, Danrong Zhang *, Baikui Yu and Jie Zhu

College of Hydrology and Water Resources, Hohai University, Nanjing 210098, China; guangwenshao@hhu.edu.cn (G.S.); yiqingguan@hhu.edu.cn (Y.G.); yubaikui@126.com (B.Y.); zhujie58603586@163.com (J.Z.)

* Correspondence: danrong_zhang@hhu.edu.cn; Tel.: +86-177-6172-4730

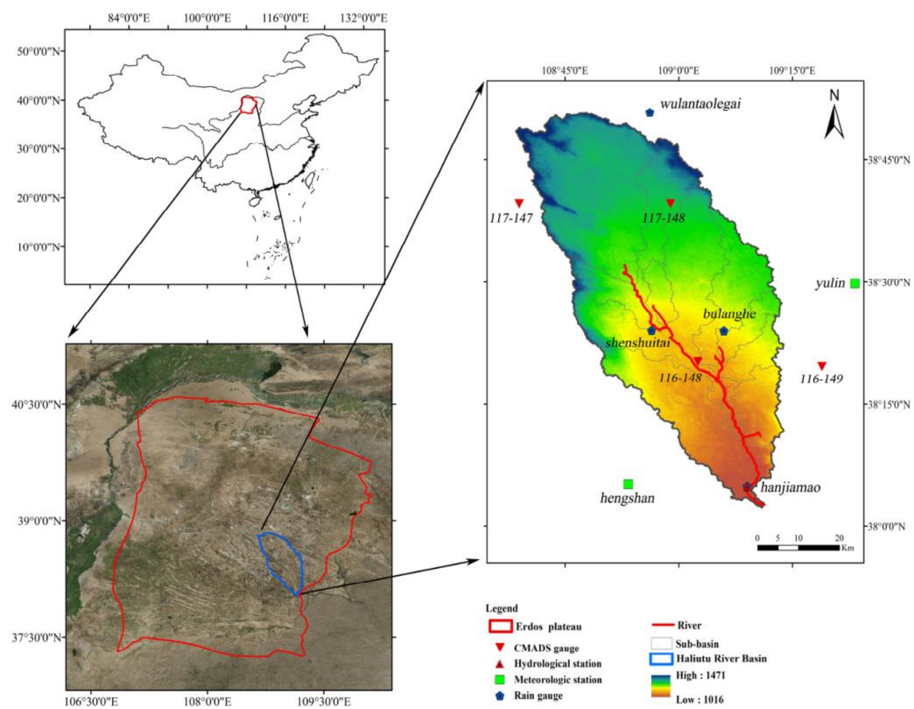

Figure 1. The location of the Hailiutu River basin and its digital elevation model with hydrometeorological stations.

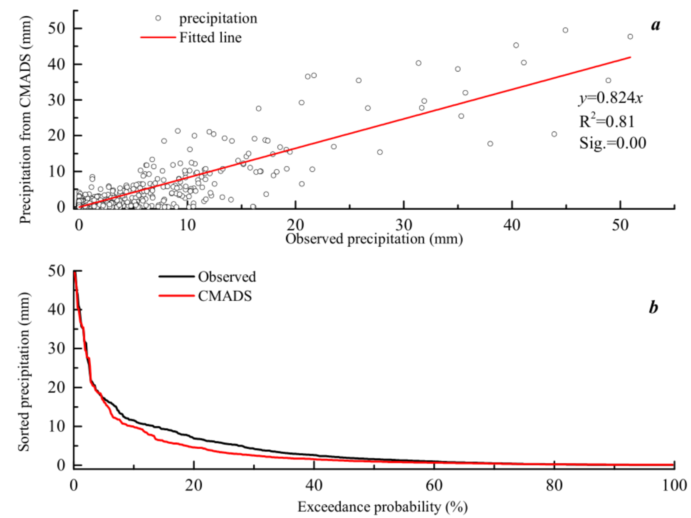

Figure 9. The evaluation of precipitation from CMADS. (**a**) A scattered plot of observed precipitation and CMADS precipitation; (**b**) the duration curve of observed precipitation and CMADS precipitation.

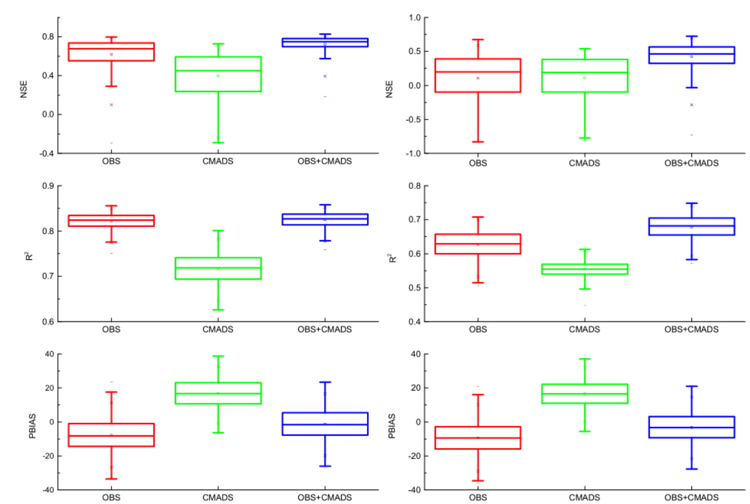

Figure 12. The box plots for the criteria of NSE (**top**), R^2 (**medium**) and PBIAS (**bottom**) during calibration period (**left**) and validation period (**right**). The square symbol and middle line in the box represent the mean value and median value, respectively. Each box ranges from the lower (25th) to upper quartile (75th). PBIAS: percent bias.

CMADS Peer Review Papers

Gao, X.; Zhu, Q.; Yang, Z.; Wang, H. Evaluation and Hydrological Application of CMADS against TRMM 3B42V7, PERSIANN-CDR, NCEP-CFSR, and Gauge-Based Datasets in Xiang River Basin of China. *Water* **2018**, *10*, 1225.

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Article

Evaluation and Hydrological Application of CMADS against TRMM 3B42V7, PERSIANN-CDR, NCEP-CFSR, and Gauge-based Datasets in Xiang River Basin of China

Xichao Gao [1,2], Qian Zhu [3], Zhiyong Yang [1,2,*] and Hao Wang [1,2]

1 China Institute of Water Resources and Hydropower Research, Beijing, 100038, China; pandagxc@zju.edu.cn (X.G.); wanghao@iwhr.com (H.W.)
2 State Key Laboratory of Simulation and Regulation of Water Cycle in River Basin, Beijing, 100038, China
3 School of Civil Engineering, Southeast University, Nanjing, 211189, China; zhuqian@seu.edu.cn (Q.Z.)

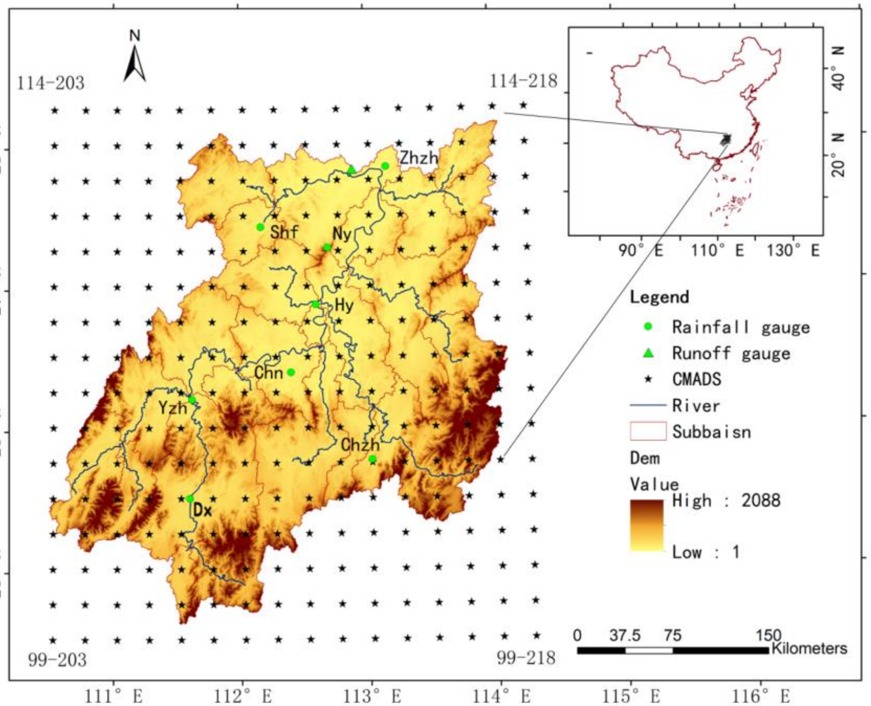


Figure 1. Spatial distribution of CMADS, precipitation gauge stations, and runoff stations in the Xiang River basin with elevations and subbasin divisions (Zhzh represents Zhuzhou site, Shf represents Shuangfeng site, Ny represents Nanyue site, Hy represents Hengyang site, Chn represents Changning site, Yzh represents Yongzhou site, Chzh represents Chenzhou site, and Dx represents Daoxian site, the site after is denoted by the above abbreviation.).

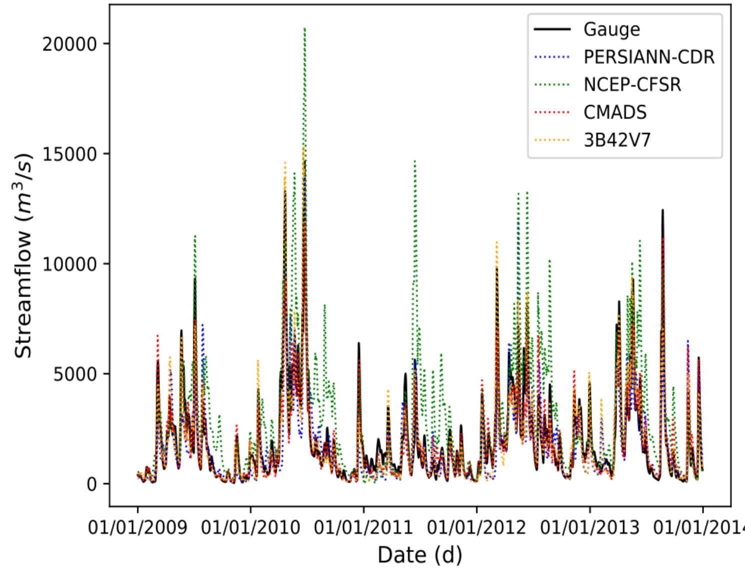
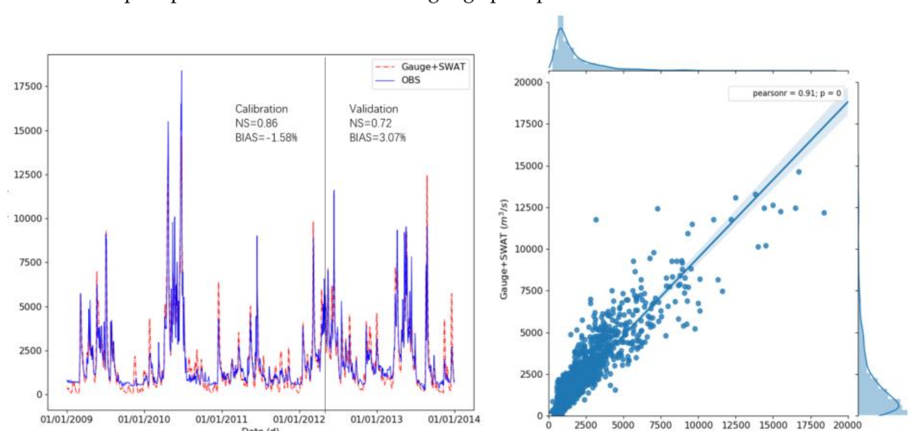


Figure 8. Comparison of simulated streamflow based on PERSIANN-CDR, NCEP-CFSR, CMADS, and 3B42V7 precipitation with that based on gauge precipitation.



(b) Daily simulated streamflow with CMADS estimates

CMADS Peer Review Papers

Qin, G.; Liu, J.; Wang, T.; Xu, S.; Su, G. An Integrated Methodology to Analyze the Total Nitrogen Accumulation in a Drinking Water Reservoir Based on the SWAT Model Driven by CMADS: A Case Study of the Biliuhe Reservoir in Northeast China. *Water* **2018**, *10*, 1535.

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Article

An Integrated Methodology to Analyze the Total Nitrogen Accumulation in a Drinking Water Reservoir Based on the SWAT Model Driven by CMADS: A Case Study of the Biliuhe Reservoir in Northeast China

Guoshuai Qin [1], Jianwei Liu [1], Tianxiang Wang [1,2,*], Shiguo Xu [1] and Guangyu Su [1]

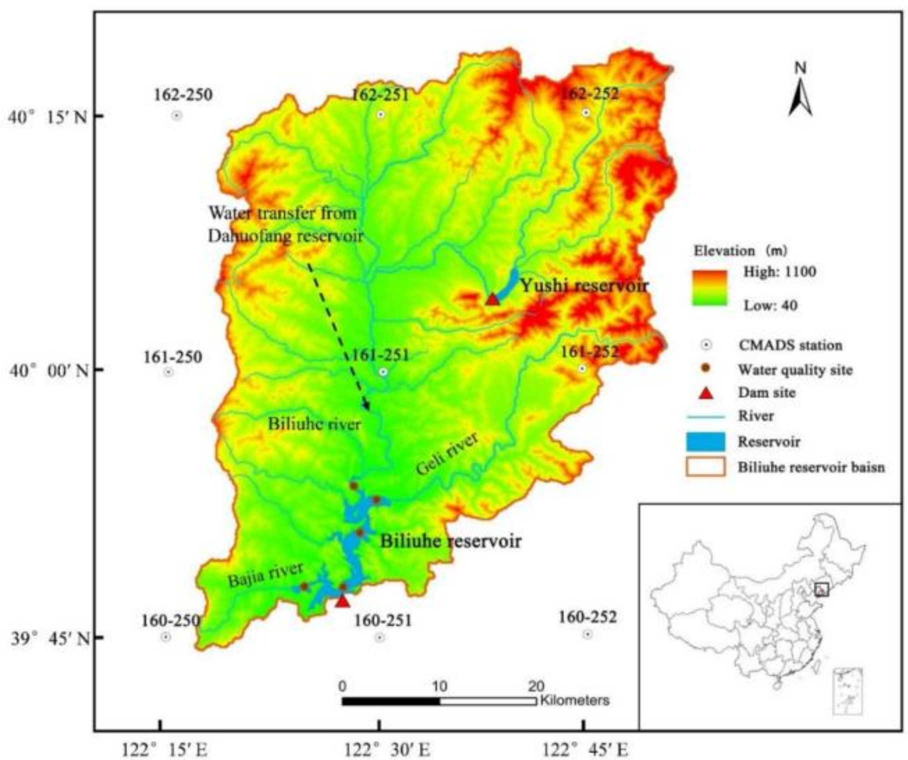

Figure 1. Geography of the Biliuhe reservoir basin.

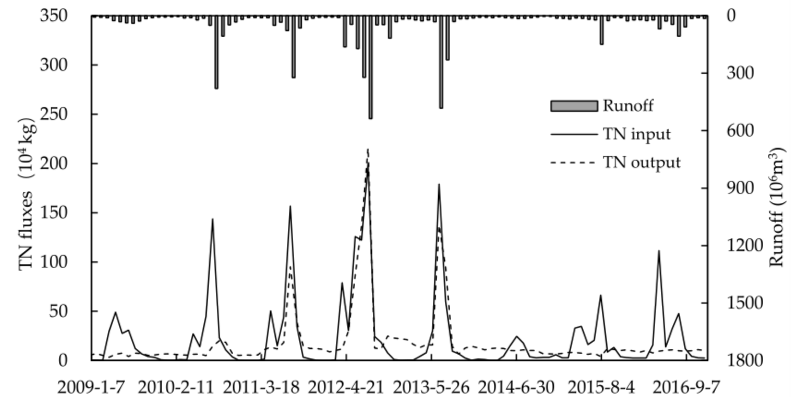

Figure 4. The runoff and TN fluxes of Biliuhe reservoir.

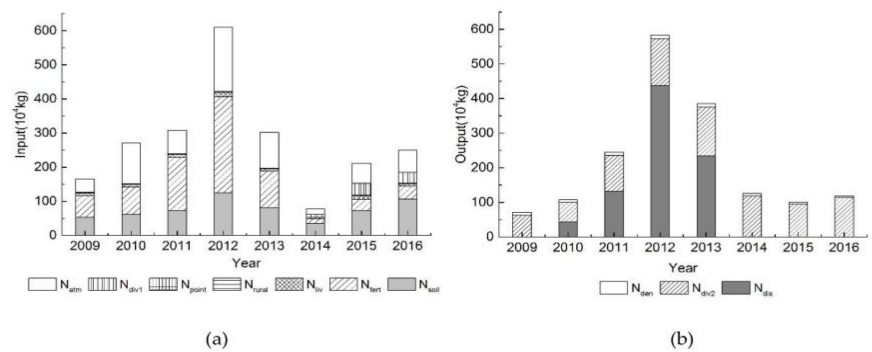

Figure 6. The composition of annual TN input(a) and output(b) fluxes of Biliuhe reservoir from 2009 to 2016.

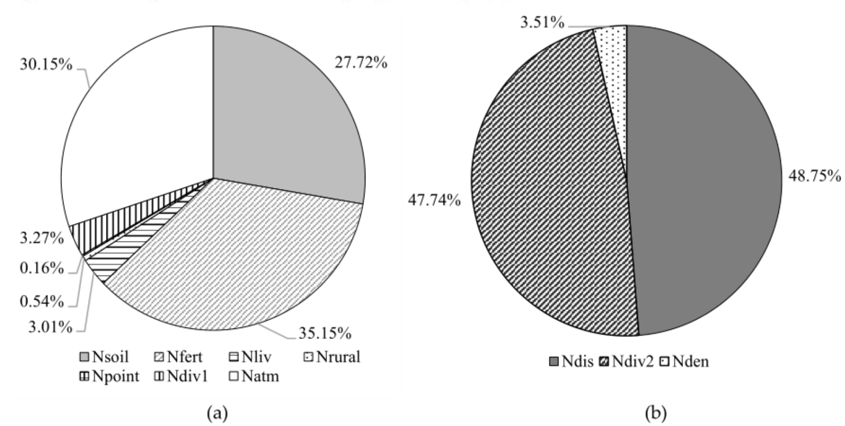

Figure 7. The average composition ratio of TN input (a) and output (b) fluxes of Biliuhe reservoir from 2009 to 2016.

CMADS Peer Review Papers

Guo, B.; Zhang, J.; Xu, T.; Croke, B.; Jakeman, A.; Song, Y.; Yang, Q.; Lei, X.; Liao, W. Applicability Assessment and Uncertainty Analysis of Multi-Precipitation Datasets for the Simulation of Hydrologic Models. *Water* **2018**, *10*, 1611.

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Article

Applicability Assessment and Uncertainty Analysis of Multi-Precipitation Datasets for the Simulation of Hydrologic Models

Binbin Guo [1,2], Jing Zhang [1,*], Tingbao Xu [3], Barry Croke [3,4], Anthony Jakeman [3], Yongyu Song [1], Qin Yang [1,2], Xiaohui Lei [5] and Weihong Liao [5]

[1] Beijing Key Laboratory of Resource Environment and Geographic Information System, Capital Normal University, Beijing 100048, China; guobinbin@126.com (B.G.); songdy1006@gmail.com (Y.S.);

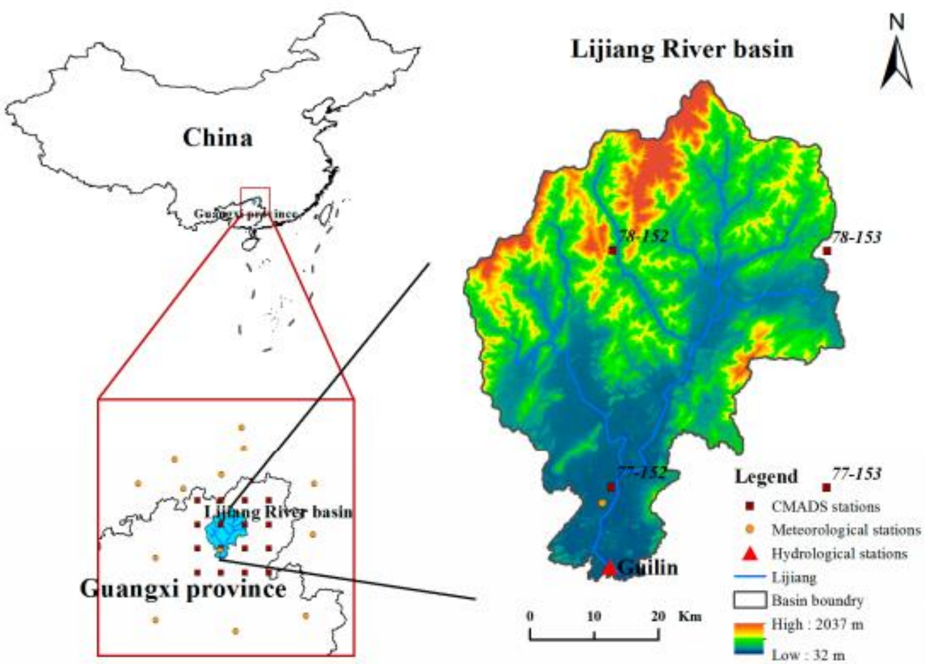
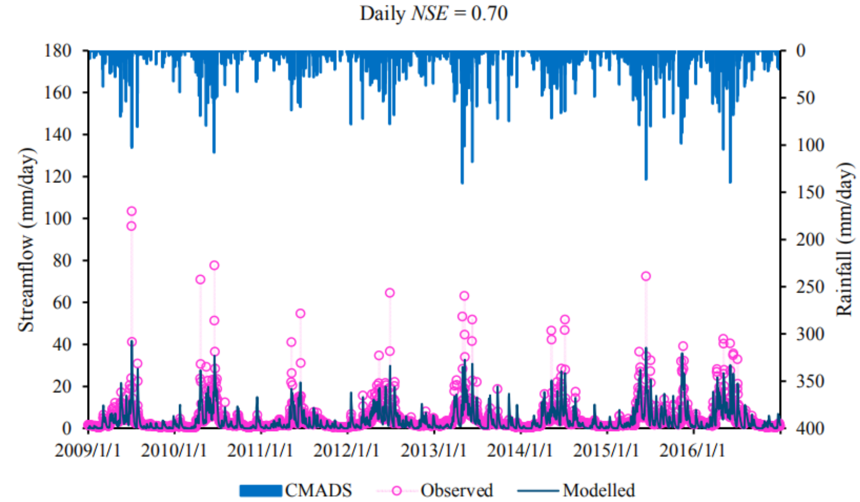


Figure 1. Location of Lijiang River basin, China and meteorological stations for the ANUSPLIN interpolation technique.



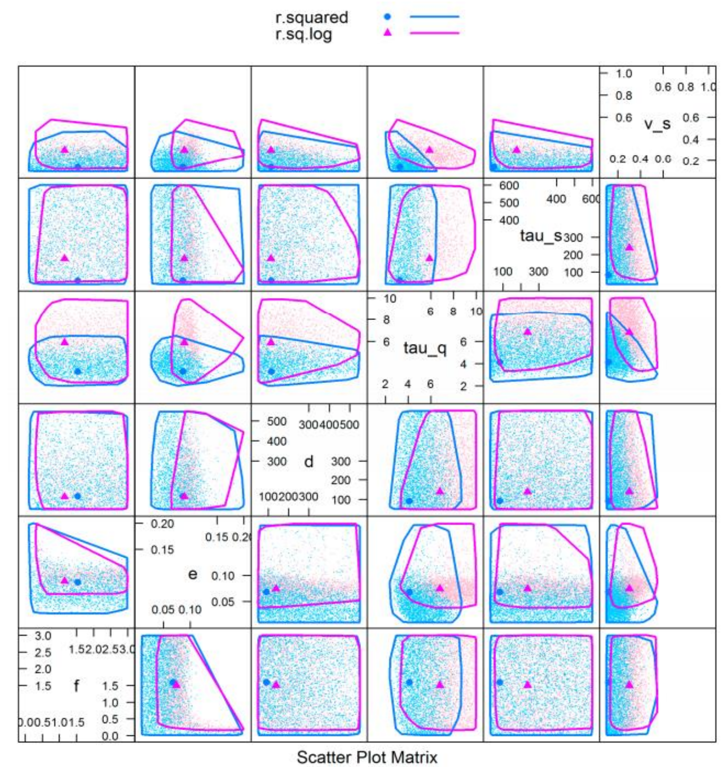


Figure 6. Two-dimensional projections of pairwise correlation of behavioral parameters for the IHACRES model using the CMADS (above diagonal) and TMPA-3B42V7 (below diagonal) precipitation datasets. The heavy dots represent the location of the best objective function value obtained from the GLUE sample.

CMADS Peer Review Papers

Dong, N.; Yang, M.; Meng, X.; Liu, X.; Wang, Z.; Wang, H.; Yang, C. CMADS-Driven Simulation and Analysis of Reservoir Impacts on the Streamflow with a Simple Statistical Approach. *Water* **2019**, *11*, 178.

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Article

CMADS-Driven Simulation and Analysis of Reservoir Impacts on the Streamflow with a Simple Statistical Approach

Ningpeng Dong [1], Mingxiang Yang [2,*], Xianyong Meng [3,4,*], Xuan Liu [5], Zhaokai Wang [6], Hao Wang [2] and Chuanguo Yang [1]

1 State Key Laboratory of Hydrology-Water Resources and Hydraulic Engineering, Hohai University, Nanjing 210098, China; dongningpeng@hhu.edu.cn (N.D.); cgyang@hhu.edu.cn (C.Y.)

2 Department of Water Resources, China Institute of Water Resource and Hydropower Research, Beijing 100044, China; wanghao@iwhr.com

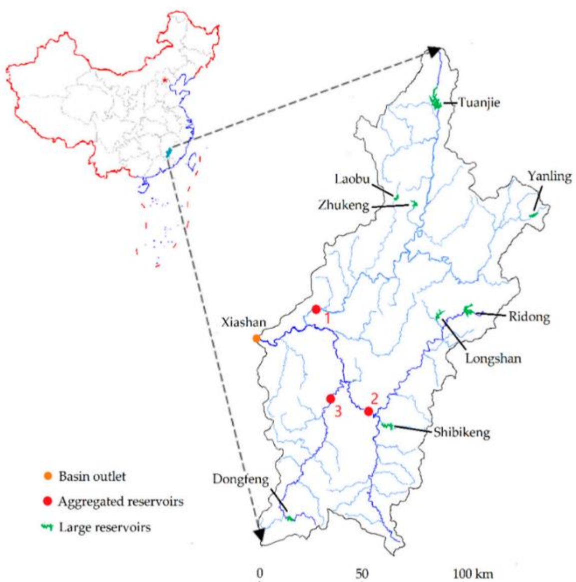

Figure 3. The upper Gan River basin. Eight large reservoirs are marked in green. Three red round markers with number 1, 2, 3 indicate aggregated reservoirs, which divide the basin into three sub-basins.

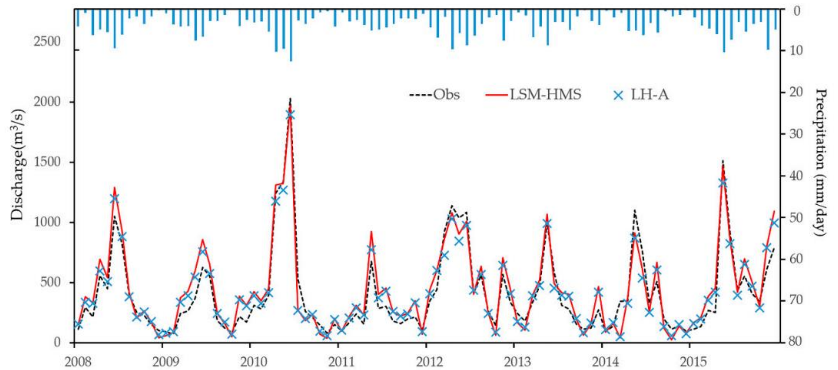

Figure 5. Monthly observed discharge and simulated discharge of China Meteorological Assimilation Driving Datasets for the SWAT model (CMADS)-driven LSM-HMS and all-reservoir condition (LH-A) in Xiashan during 2008–2015.

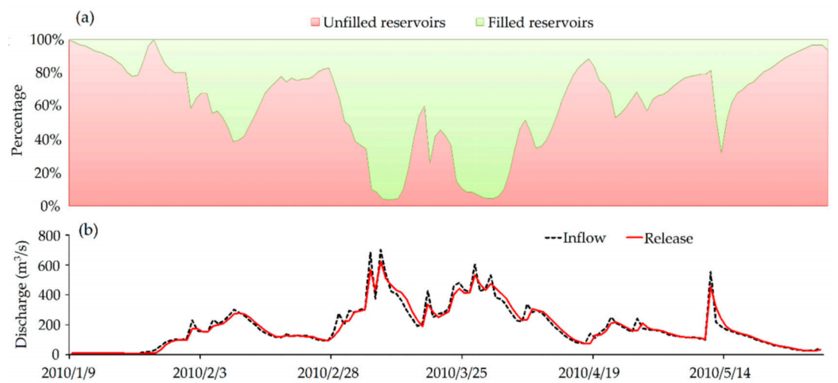

Figure 8. For small reservoirs represented by aggregated reservoir 3, (**a**) the daily simulated percentage of unfilled and filled small reservoirs, and (**b**) the corresponding simulated inflow and release of the aggregated reservoir 3 during January and May 2010.

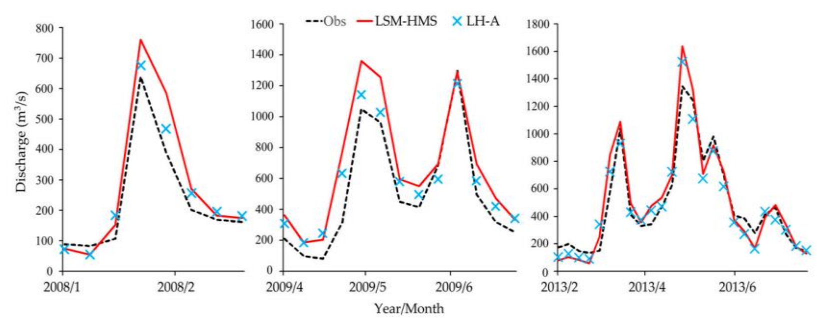

Figure 9. Comparison of weekly mean observed downstream streamflow in Xiashan and simulated streamflow of LH-A and LSM-HMS for three selected periods.

CMADS Peer Review Papers

Dong, N.; Yang, M.; Meng, X.; Liu, X.; Wang, Z.; Wang, H.; Yang, C. CMADS-Driven Simulation and Analysis of Reservoir Impacts on the Streamflow with a Simple Statistical Approach. *Water* **2019**, *11*, 178.

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Article

Evaluation and Analysis of Grid Precipitation Fusion Products in Jinsha River Basin Based on China Meteorological Assimilation Datasets for the SWAT Model

Dandan Guo [1,2], Hantao Wang [3], Xiaoxiao Zhang [1] and Guodong Liu [1,*]

1 State Key Laboratory of Hydraulics and Mountain River Engineering, College of Water Resource and Hydropower, Sichuan University, Chengdu 610065, China; jingyugdd@126.com (D.G.); zolazxx@126.com (X.Z.)
2 School of Civil Engineering, Architecture and Environment, Xihua University, Chengdu 610039, China
3 Three Gorges Cascade Dispatching & Communication Centre, Yichang 443133, China; hantaow@126.com
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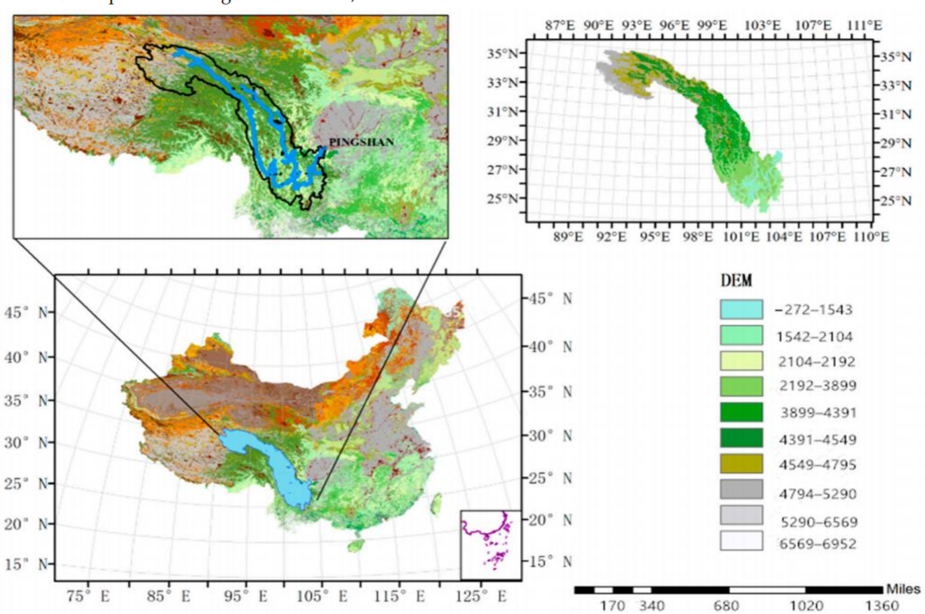

Figure 2. The Jinsha River Basin.

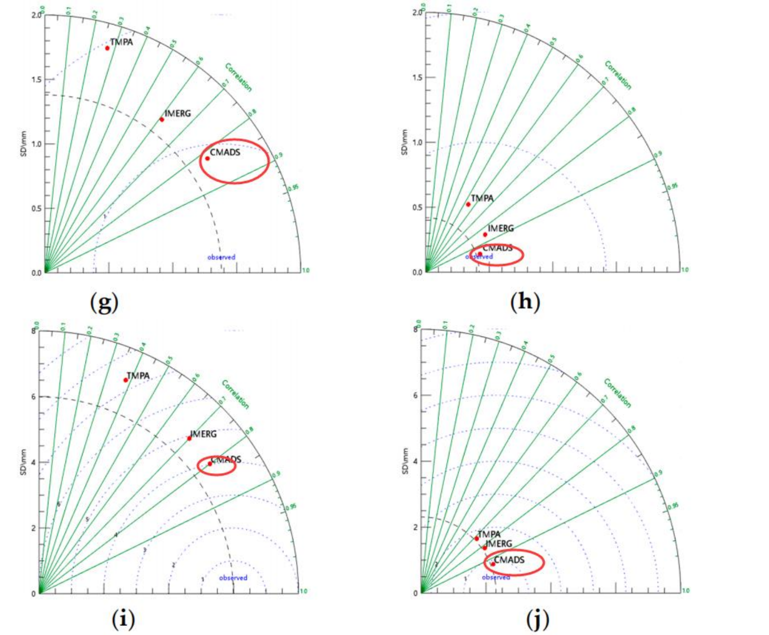

Figure 5. Accuracy assessment Taylor diagrams for satellite precipitation products: (**a**,**b**) full 2014–2016 cycle; (**c**,**d**) first dry season; (**e**,**f**) first rainy season; (**g**,**h**) second dry season; (**i**,**j**) second rainy season.

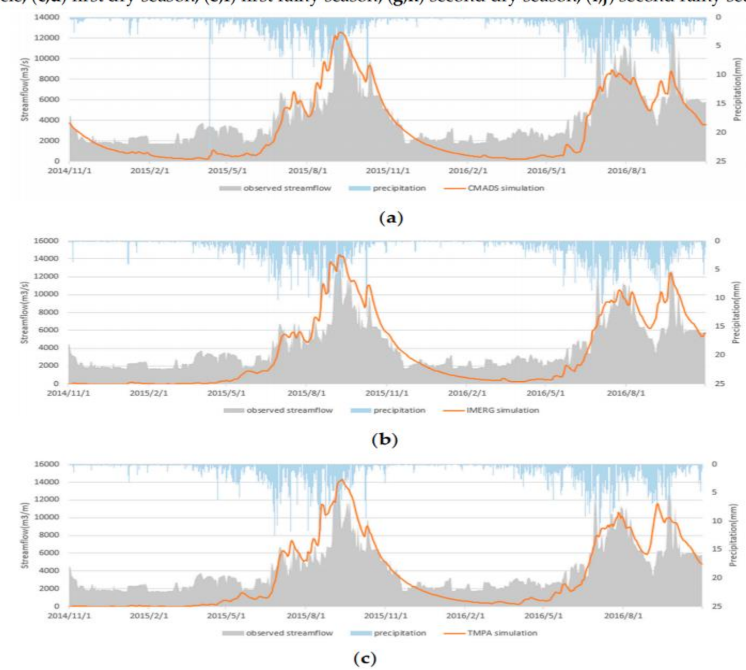

Figure 8. Comparison of runoff results from hydrological model simulation of the Jinsha River Basin from November 2014–October 2016: (**a**) TMPA; (**b**) IMERG; (**c**) CMADS.

CMADS Peer Review Papers

Yuan, Z.; Xu, J.; Meng, X.; Wang, Y.; Yan, B.; Hong, X. Impact of Climate Variability on Blue and Green Water Flows in the Erhai Lake Basin of Southwest China. *Water* **2019**, *11*, 424.

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Article

Impact of Climate Variability on Blue and Green Water Flows in the Erhai Lake Basin of Southwest China

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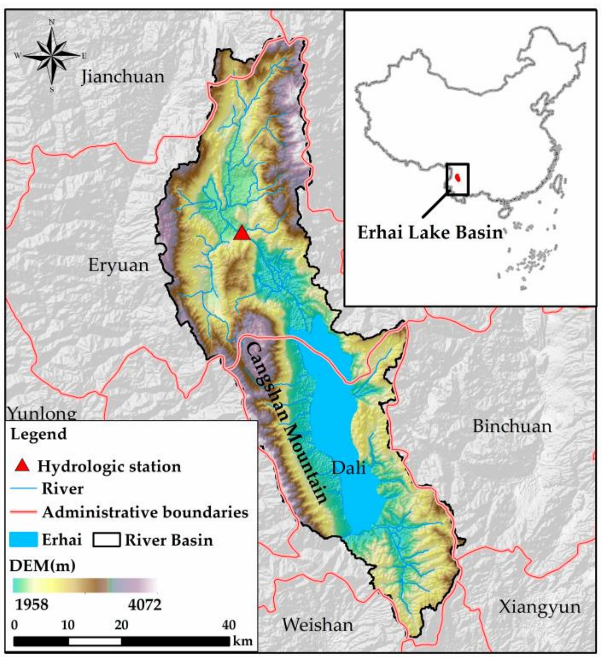

Figure 1. Location of the Erhai Lake Basin (ELB), Southwest China.

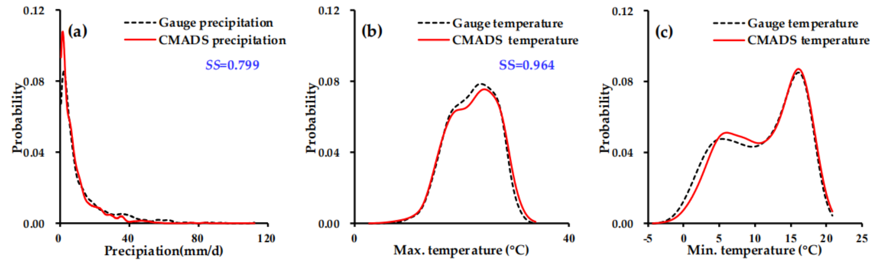

Figure 5. PDFs for the daily CMADS reanalysis data and gauge observations: (**a**) Precipitation; (**b**) Maximum temperature; (**c**) Minimum temperature.

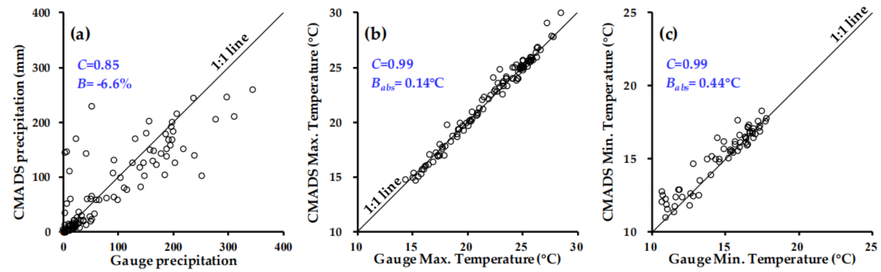

Figure 6. Scatter plots of the monthly CMADS reanalysis data and gauge observations: (**a**) Precipitation; (**b**) Maximum temperature; (**c**) Minimum temperature.

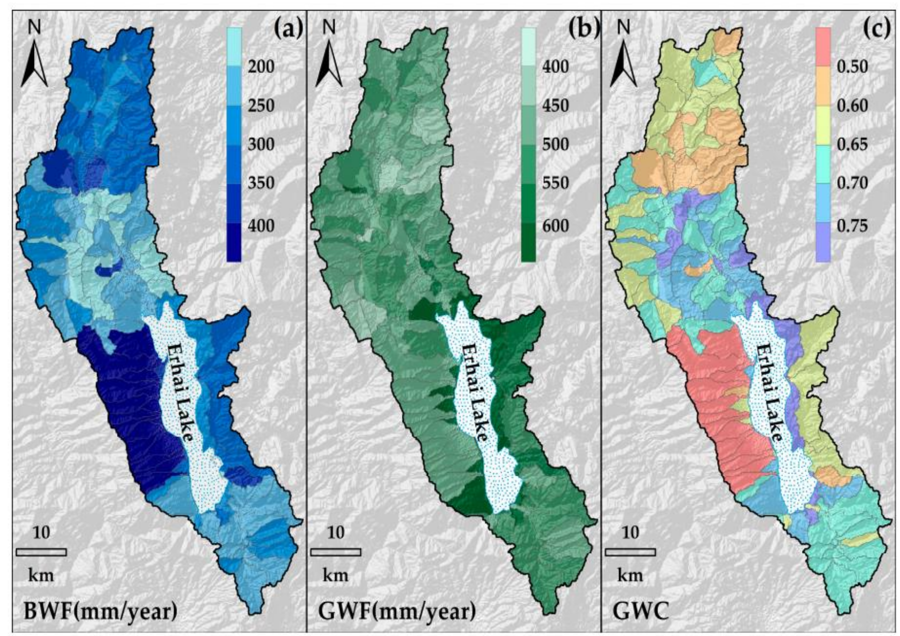

Figure 10. The spatial distribution of annual average BWF (**a**) GWF (**b**), and GWC (**c**) (2009 to 2016).

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Article

Investigating Spatial and Temporal Variation of Hydrological Processes in Western China Driven by CMADS

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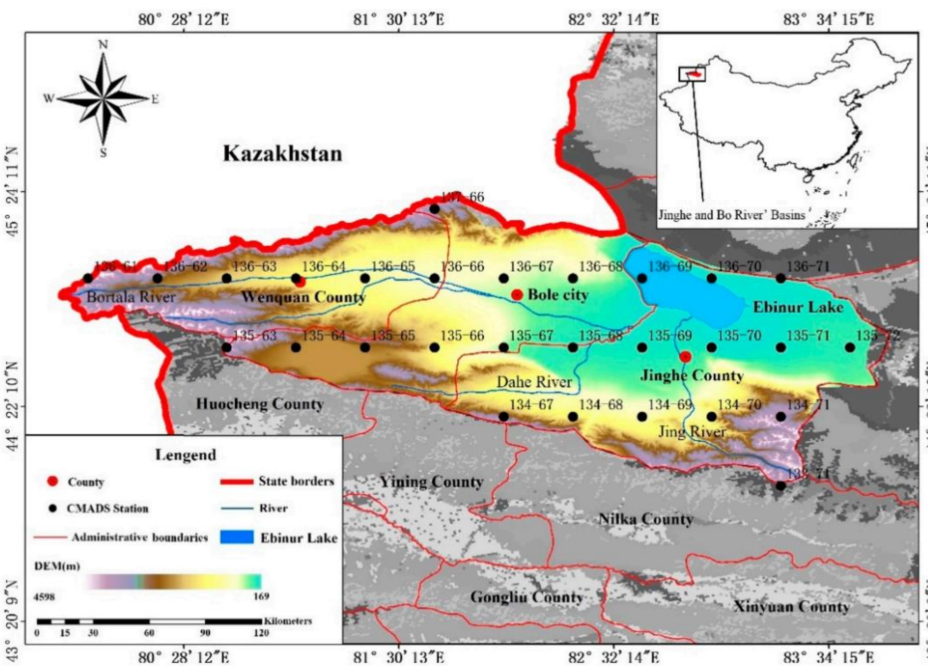

Figure 1. Location of Jinghe and Bortala River Basins (JBR).

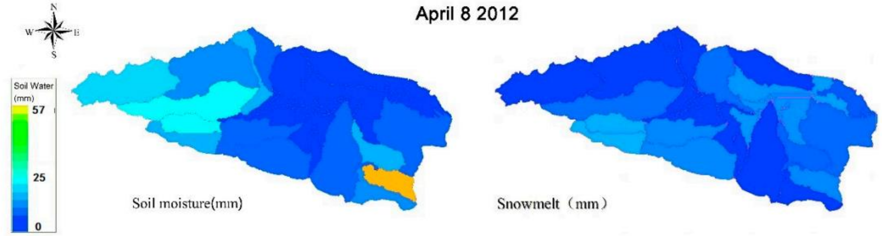

Figure 11. Spatial distribution of soil moisture and snowmelt rateof the JBR.

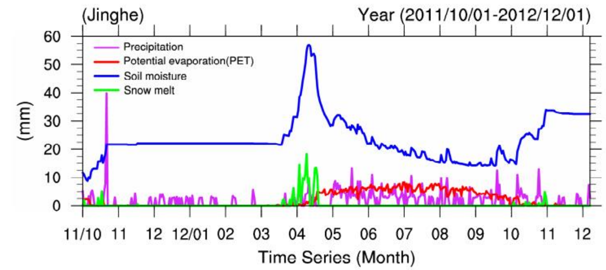

Figure 12. Time series of the parameters of the JBR (take the Jinghe mountain station as an example).

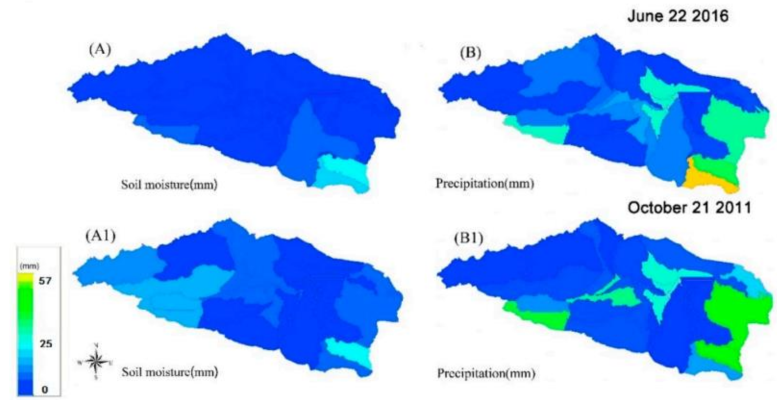

Figure 13. Correlation analysis of the soil moisture and precipitation in the JBR.

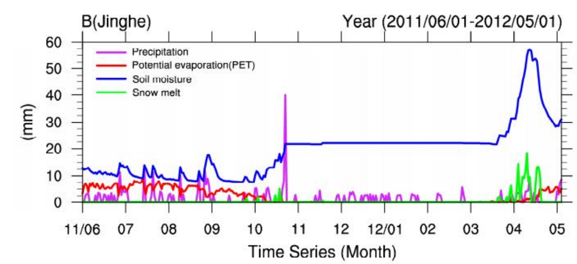

Figure 14. Time series of the soil moisture and precipitation in the JBR (Take the Jinghe Mountain station as an example).

CMADS Peer Review Papers

Zhao, X.; Xu, S.; Liu, T.; Qiu, P.; Qin, G. Moisture Distribution in Sloping Black Soil Farmland during the Freeze–Thaw Period in Northeastern China. *Water* **2019**, *11*, 536.

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Article

Moisture Distribution in Sloping Black Soil Farmland during the Freeze–Thaw Period in Northeastern China

Xianbo Zhao [1,2], Shiguo Xu [1,*], Tiejun Liu [3], Pengpeng Qiu [2] and Guoshuai Qin [1]

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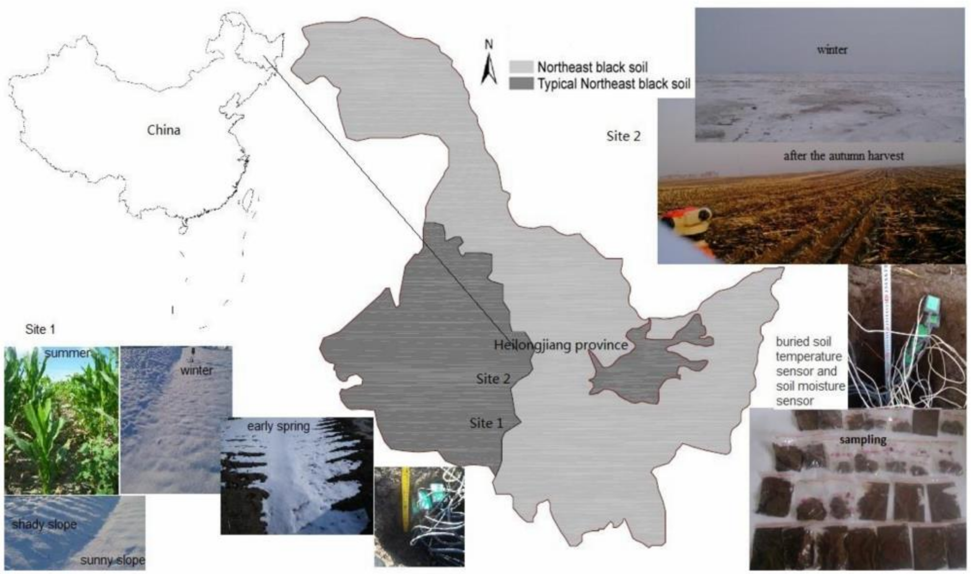

Figure 1. Map of the observation point locations and site case diagram, Heilongjiang Province, Northeastern China. Light gray indicates the northeast black soil zone and dark gray indicates the typical northeast black soil zone. Site 1—corn is grown in summer, snow cover in winter, shady slope and sunny slope obvious, early spring snowmelt. Site 2—using the level gauge to measure the height of black soil slope farmland after autumn harvest, buried soil temperature sensor and soil moisture sensor, snow in winter, black soil sampling.

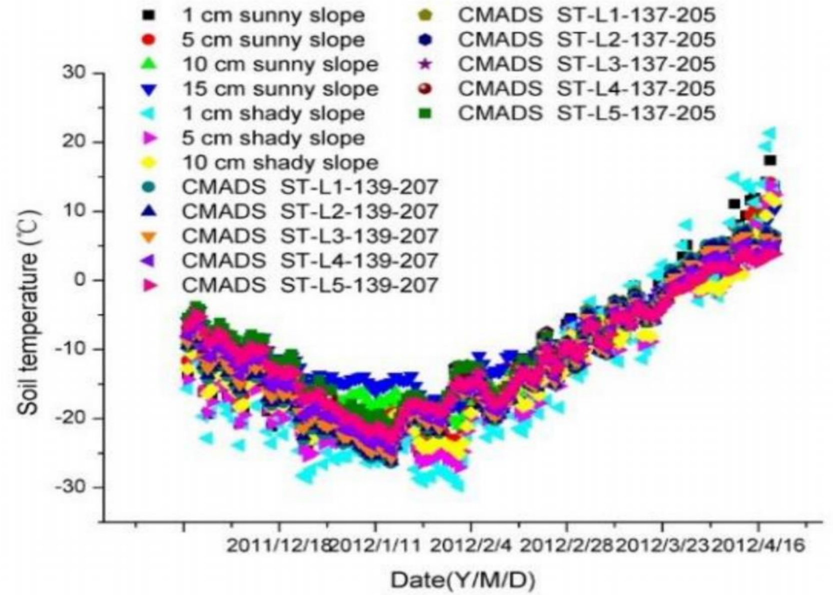

Figure 11. Comparison of observed soil temperature with the China meteorological assimilation driving datasets for the soil and water assessment tool (SWAT) model–soil temperature (CMADS-ST) (November 2011 to mid-April 2012).

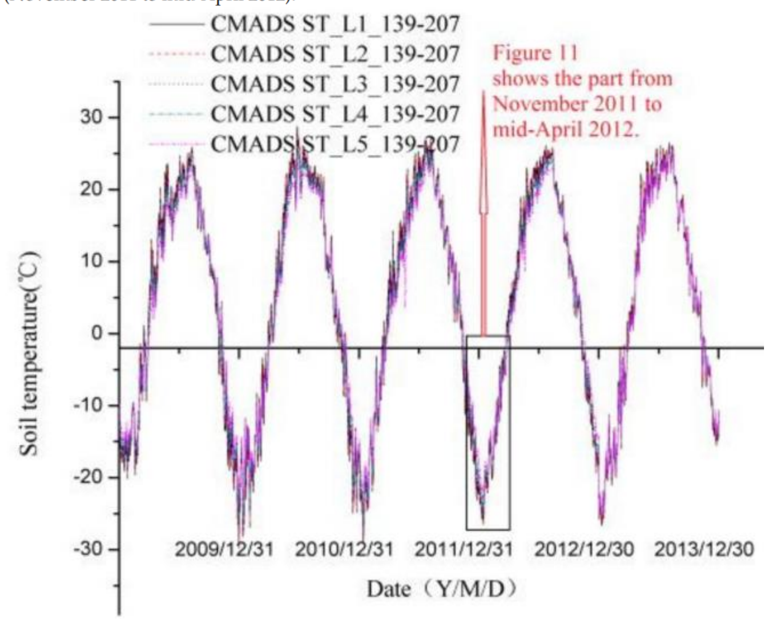

Figure 12. Seasonal variation of soil layer temperature with the CMADS-ST in seasonally frozen ground zone between 1 January 2009 and 31 December 2013 for CMADS-ST locations 139–207. The black box section shows some soil layer temperature data from November 2011 to mid-April 2012, as shown in Figure 11.

CMADS Peer Review Papers

Liu, X.; Yang, M.; Meng, X.; Wen, F.; Sun, G. Assessing the Impact of Reservoir Parameters on Runoff in the Yalong River Basin using the SWAT Model. Water 2019, 11, 643.

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Article

Assessing the Impact of Reservoir Parameters on Runoff in the Yalong River Basin using the SWAT Model

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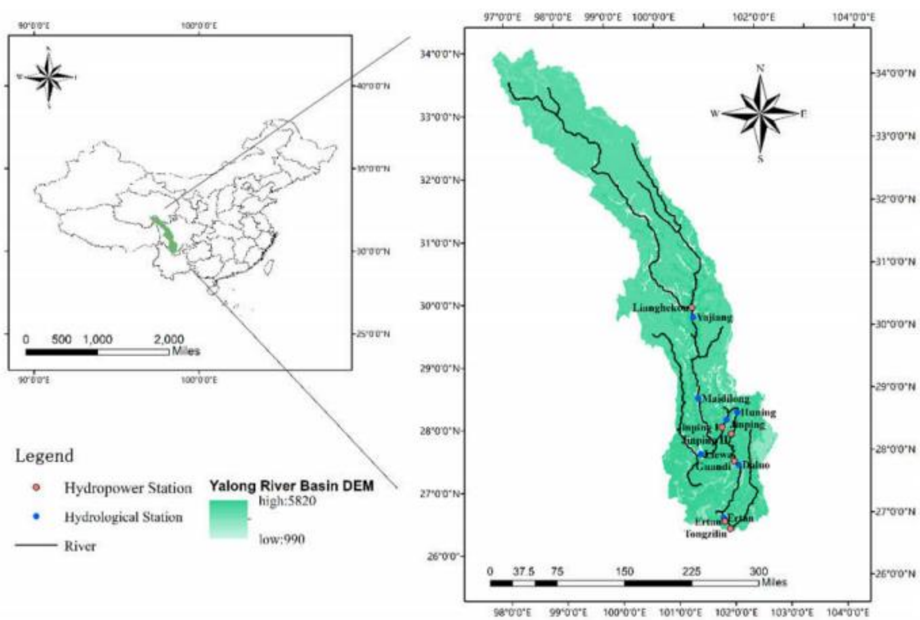

Figure 1. The Yalong River basin.

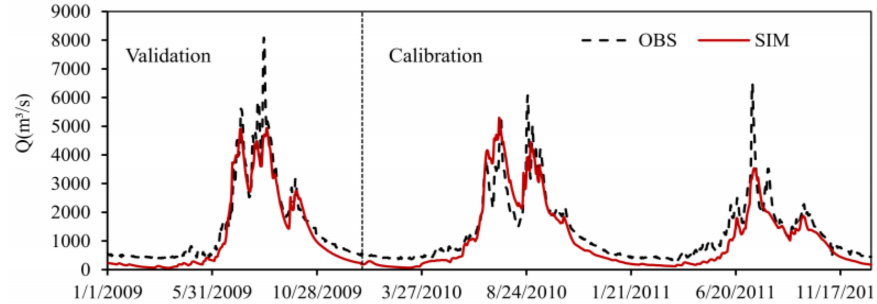

Figure 2. The daily simulation results for runoff (2009–2011) at Ertan control station. (OBS represents the observation data, and SIM represents the simulation data.).

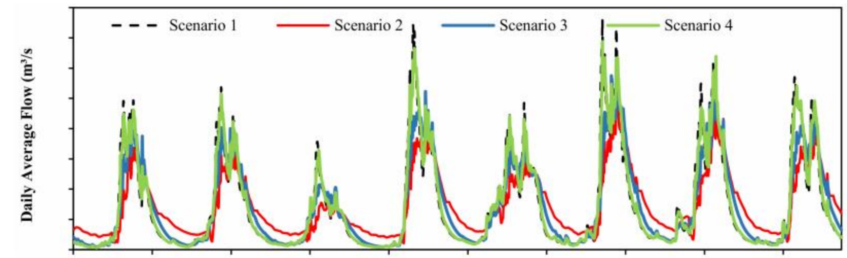

Figure 5. The daily simulation results of runoff (2009–2016) at Ertan station (Scenarios 1–4).

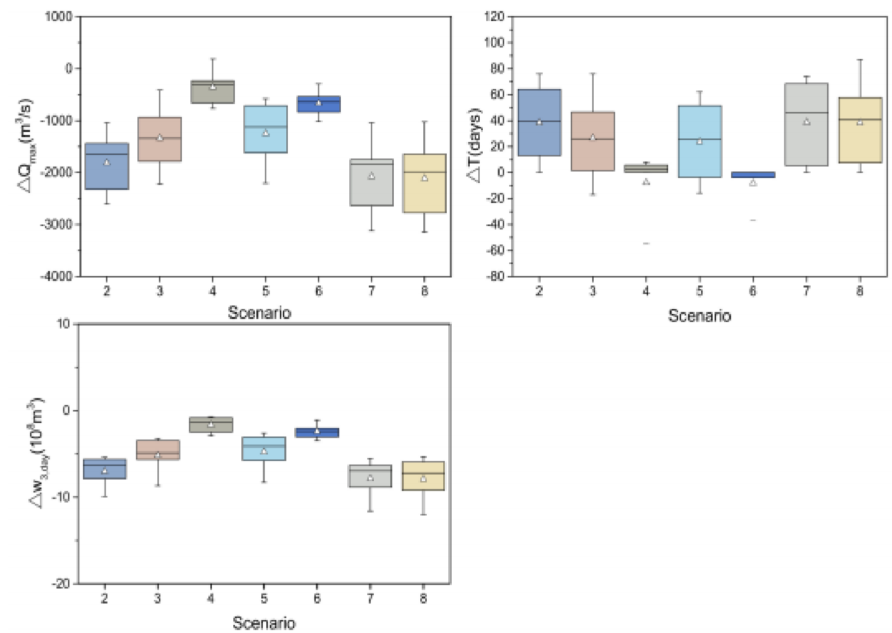

Figure 10. Boxplot of the annual outputs of flood characteristics in 7 Scenarios (2009–2016), where △ represents the mean, and the horizontal lines of the box, from top to bottom, represent the maximum, upper quartile, median, lower quartile, and minimum.

CMADS Peer Review Papers

Zhang, L.; Meng, X.; Wang, H.; Yang, M. Simulated Runoff and Sediment Yield Responses to Land-Use Change Using the SWAT Model in Northeast China. Water 2019, 11, 915.

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Article

Simulated Runoff and Sediment Yield Responses to Land-Use Change Using the SWAT Model in Northeast China

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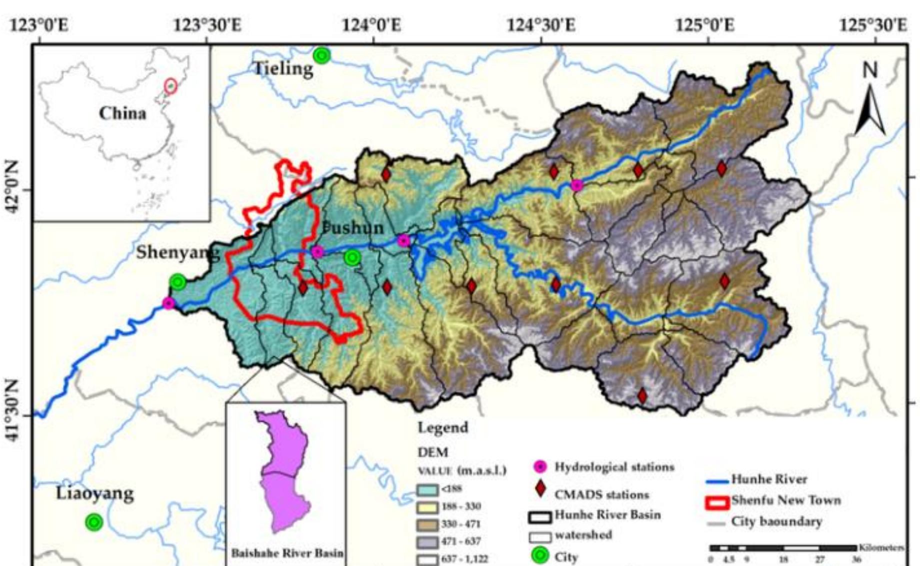

Figure 1. The range and location of the study region in China.

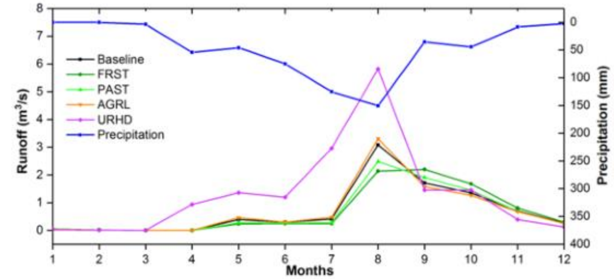

Figure 10. Responses of different land-use scenarios to average monthly runoff. Remarks: FRST—Forestland; PAST—Grassland; AGRL—Cropland; URHD—Urban land.

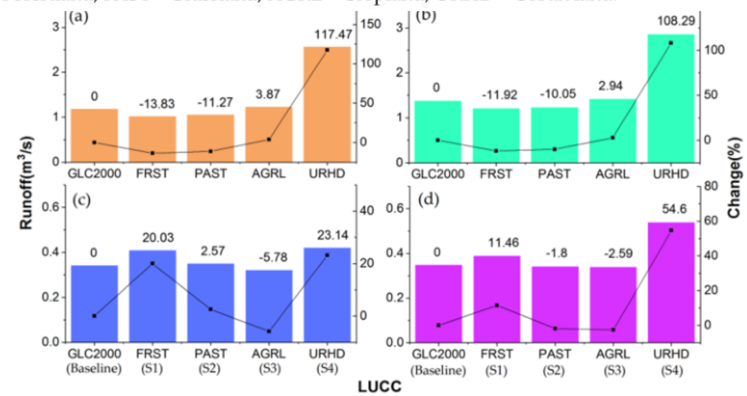

Figure 11. Runoff responses of different land-use scenarios during the wet season (W1 and W2) and dry season (D1 and D2): (**a**) refers to "W1"; (**b**) refers to "W2"; (**c**) refers to "D1"; and (**d**) refers to "D2". FRST—Forestland; PAST—Grassland; AGRL—Cropland; URHD—Urban land.

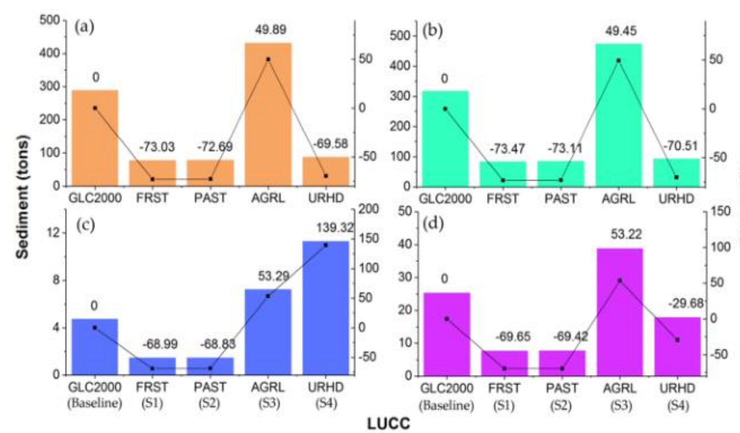

Figure 13. Sediment yield responses to different land-use scenarios during the wet season (W1 and W2) and dry season (D1 and D2): (**a**) refers to "W1"; (**b**) refers to "W2"; (**c**) refers to "D1"; and (**d**) refers to "D2". FRST—Forestland; PAST—Grassland; AGRL—Cropland; URHD—Urban land.

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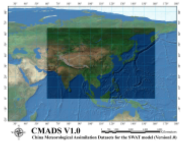
Outline

- **C** Research Background and Scientific Problems
- **M** Establishment Method and Data Introduction
- **A** Validation and Application of the CMADS over East Asia
- **D** Worldwide influence of the CMADS
- **S** Next plan

SWAT模型中国大气同化驱动数据集(CMADS V1.0)

China Meteorological Assimilation Driving Datasets for the SWAT model Version 1.0



CMADS(The China Meteorological Assimilation Driving Datasets for the SWAT model) 系列数据集引入世界各类再分析场及中国气象局大气同化系统(CLDAS)技术,利用数据循环嵌套、重采样,模式推算及双线性插值等多种技术手段而建立。CMADS数据集按照SWAT模型输入驱动数据格式进行了格式整理与修正,使SWAT模型可直接使用该数据集而不需要任何格式转换。CMADS系列数据集同时建立了两种格式的数据(.dbf和.txt),方便其他它模型应用人员及气象分析人员调用与分析。CMADS数据源介绍：气温、气压、比湿、风速驱动数据采用了2421个国家级自动站和业务考核的39439个区域自动站2008年1月以来地面基本气象要素逐小时观测数据以及相应时期的台站信息(台站经纬度、海拔高度),利用多重网格三维变分方法(STMAS),在NCEP/GFS背景场基础上制作地面基本要素分析场；其中,中国区域以外,只对NCEP/GFS背景数据做地形调整、变量诊断,并插值到分析格点；中国区域以内,利用STMAS算法,将经过前处理的NCEP/GFS背景数据和自动站观测融合,并与中国区域以外的数据进行拼接。降水：由多卫星与地面自动站降水融合而成。其中,中国区域以外采用NCEP-CPC制作的CMORPH卫星融合降水产品,中国区域采用CMORPH产品为背景场融合中国降水自动站观测制作的中国区域小时降水量融合产品。辐射：基于DISSORT辐射传输模型,获取来自FY2E卫星一级产品实时反演太阳短波辐射产品。主要以ISCCP资料为背景数据,利用大气辐射传输模式DISORT对FY2D/E标称图数据进行反演,计算出分析格点上的地面入射太阳总辐射辐照度。CMADSV1.0系列数据集空间覆盖整个东亚(0°N-65°N,60°E-160°E), 空间分辨率分别为CMADS V1.0版本: 1/3°,CMADS V1.1版本: 1/4°,CMADS V1.2版本: 1/8°及CMADS V1.3版本: 1/16°,以上分辨率均为逐日(CLDAS同化场基本分辨率为1/16°,保证了CMADS数据集最高分辨率达1/16°),时间尺度为2008-2016年。

本页发布的数据集为CMADSV1.0版本数据集(空间分辨率:1/3°。时间分辨率:逐日。空间覆盖范围:东亚(0°N-65°N,60°E-160°E)。提供要素:日平均2米温度,日最高\低2米温度,日累计24时降水量,日平均太阳辐射,日平均气压,日比湿度,日相对湿度,日平均10米风速,提供数据格式:dbf及txt。该驱动数据已在我国多个流域进行了驱动验证,效果表现良好。

数据集元数据介绍

CMADS--SWAT驱动数据总体存放路径说明：

类别： 气候气象大气

学科 地理信息系统 气象学 水文学

地点 East & South East Asia 东亚区域

时间词 2008-2016

主题 气象水文 SWAT 大气数据同化 大气驱动数据集

数据细节

文件列表

格式：数字文档 **大小：**35200MB **下载：**742次
浏览：26017次
数据时间范围：2008-01-01 至 2016-12-31

SWAT模型中国大气同化驱动数据集(CMADS V1.1)

China Meteorological Assimilation Driving Datas

CMADS V1.1(The China Meteorological Assimilation Driving Datasets for the SWAT model Version 1.1) 版本数据集引入中国气象局大气同化系统(CLDAS),利用数据循环嵌套,模式推算等多种技术手段而建立。CMADS V1.1数据集按照SWAT模型输入驱动数据格式进行了格式整理与修正,使SWAT模型可直接使用该数据集而不需要任何格式转换。CMADS V1.1数据集同时建立了两种格式的数据(.dbf和.txt),方便其他它模型应用人员及气象分析人员调用与分析。CMADS数据源介绍：气温、气压、比湿、风速驱动数据采用了2421个国家级自动站和业务考核的29452个区域自动站2009年1月以来地面基本气象要素逐小时观测数据以及相应时期的台站信息（台站经纬度、海拔高度）,利用多重网格三维变分方法（STMAS）,在NCEP/GFS背景场基础上制作地面基本要素分析场；其中,中国区域以外,只对NCEP/GFS背景数据做地形调整、变量诊断,并插值到分析格点；中国区域以内,利用STMAS算法,将经过前处理的NCEP/GFS背景数据和自动站观测融合,并与中国区域以外的数据进行拼接。降水：由多卫星与地面自动站降水融合而成。其中,中国区域以外采用NCEP-CPC制作的CMORPH卫星融合降水产品,中国区域采用CMORPH产品为背景场融合中国降水自动站观测制作的中国区域小时降水量融合产品。辐射：基于DISSORT辐射传输模型,获取来自FY2E卫星一级产品实时反演太阳短波辐射产品。主要以ISCCP资料为背景数据,利用大气辐射传输模式DISORT对FY2D/E标称图数据进行反演,计算出分析格点上的地面入射太阳总辐射辐照度。本页发布的数据集为CMADS V1.1版本空间分辨率: 1/4°,时间分辨率:逐日，时间尺度为2008-2016年。空间覆盖范围:东亚(0°N-65°N,60°E-160°E)。提供要素:日平均2米温度,日最高\低2米温度,日累计24时降水量,日平均太阳辐射,日平均气压,日比湿度,日相对湿度,日平均10米风速,提供数据格式:dbf及txt。

CMADS V1.1元数据介绍

CMADS V1.1--SWAT驱动数据总体存放路径说明：

数据集分为专门驱动SWAT模型的子数据驱动集与其他模型使用的数据驱动集

1)专门驱动SWAT模型的子数据集路径为：CMADS-V1.1\For-swat\

2)专门其他模型使用的子数据集路径为：CMADS-V1.1\For-other-model\

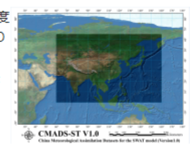
CMADS V1.1--SWAT驱动数据各子集文件路径及名说明

CMADS V1.1--SWAT驱动数据子集路径

格式：数字文档 **大小：**50000MB **下载：**1072次
浏览：22528次
数据时间范围：2008-01-01 至 2016-12-31
相关文档：
数据共享方式：在线（可直接下载）

SWAT模型中国大气同化驱动集-土壤温度(CMADS-ST V1.0)

China Meteorological Assimilation Datasets for the SWAT model - Soil Temperature Version 1.0



CMADS(The China Meteorological Assimilation Driving Datasets for the SWAT model)土壤温度分量(以下简称CMADS-ST)利用中国大气同化系统(China Meteorological Administration Land Data Assimilation System [CLDAS])强迫公用陆面模式 (Community Land model 3.5 [CLM3.5]),进行陆面数值模拟实验，循环10次进行spin-up模拟，得到基本稳定的模式初始场，获取高时空分辨率的土壤温度数据集，最终利用数据模式分层提取、质量控制、循环嵌套、重采样,及双线性插值等多种技术手段最终建立。

CMADS-ST系列数据集空间覆盖整个东亚(0°N-65°N, 60°E-160°E), 空间分辨率分别为CMADS-ST V1.0版本: 1/3°, CMADS-ST V1.1版本: 1/4°, CMADS-ST V1.2版本: 1/8°及CMADS-ST V1.3版本: 1/16°, 以上分辨率均为逐日(CLM3.5模式输出土壤温度分量基本分辨率为1/16°,保证了CMADS-ST数据集最高分辨率达1/16°),时间尺度为2009-2013年。本页发布的数据集为CMADS-ST V1.0版本数据集(空间分辨率:1/3°。时间分辨率:逐日。空间覆盖范围:东亚(0°N-65°N,60°E-160°E)。站点数量:58500站。提供要素:日平均10层土壤温度 (节点层次深度依次为, 第一层:0.00710063521m, 第二层:0.0279249996m, 第三层:0.0622585751m, 第四层:0.118865065m, 第五层:0.2121934m, 第六层:0.3660658m, 第七层:0.619758487m, 第八层:1.03802705m, 第九层:1.72763526m, 第十层:2.8646071m)。提供数据格式: txt。

CMADS-ST V1.0 土壤温度数据集路径为:

CMADS-ST-V1.0\2009\layer1 至CMADS-ST V1.0\2009\layer10

CMADS-ST-V1.0\2010\layer1 至CMADS-ST V1.0\2010\layer10

CMADS-ST-V1.0\2011\layer1 至CMADS-ST V1.0\2011\layer10

CMADS-ST-V1.0\2012\layer1 至CMADS-ST V1.0\2012\layer10

CMADS-ST-V1.0\2013\layer1 至CMADS-ST V1.0\2013\layer10

CMADS-ST V1.0子集文件路径及文件名说明

其中layer1-layer10\目录下为逐日土壤温度(十层)。分别位于以下目录(以2009年为例):

\2009\layer1\ 2009年第一层(0.00710063521m)土壤温度目录

类别：

学科 地理信息系统 气象学 土壤学

地点 East & South East Asia 东亚区域

时间词 2009-2013

主题 气象水文 SWAT 大气数据同化 大气驱动数据集 土壤温度

数据DOI：10.3972/westdc.004.2017.db

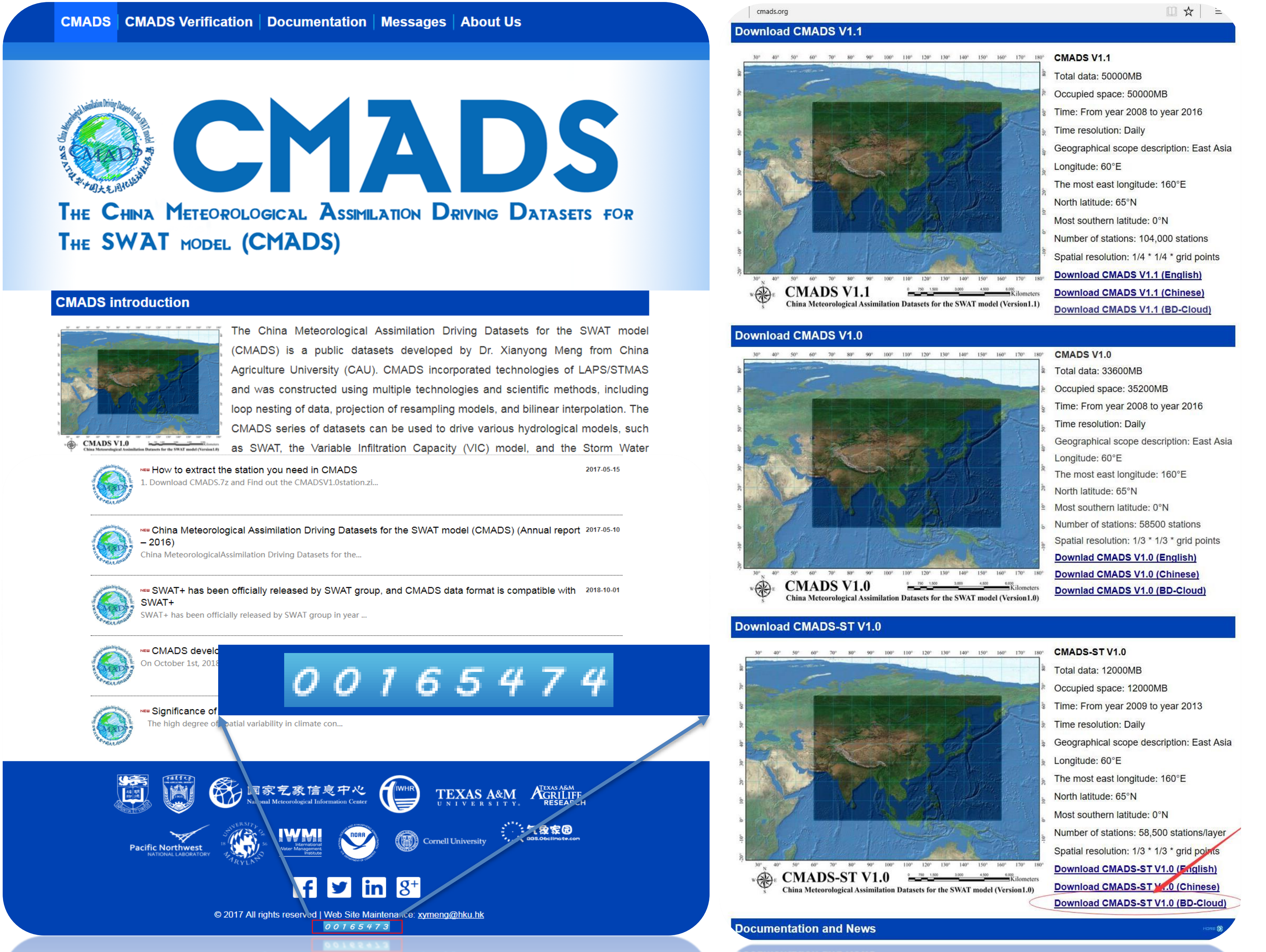
数据细节

文件列表

格式：数字文档 **大小：**12000MB **下载：**88次
浏览：4980次
数据时间范围：2009-01-01 至 2013-12-31
数据共享方式：在线（可直接下载）

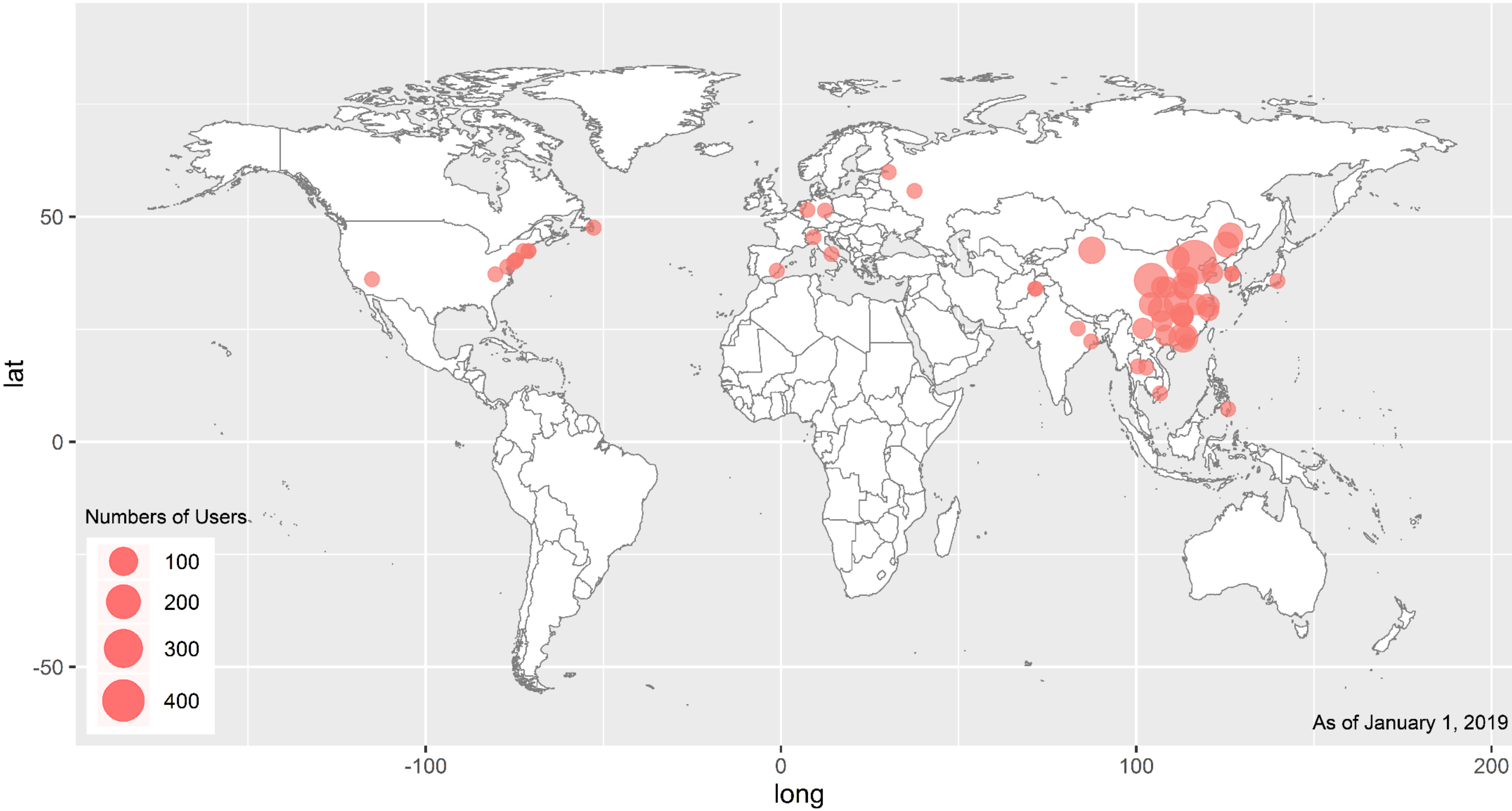
CMADS will also release at least three variables (soil moisture, snow fall and CMADS-WRF) corresponding to three versions (CMADSV1.0-V1.3).

Download: more than 2000 times
Visit: 83,525 times



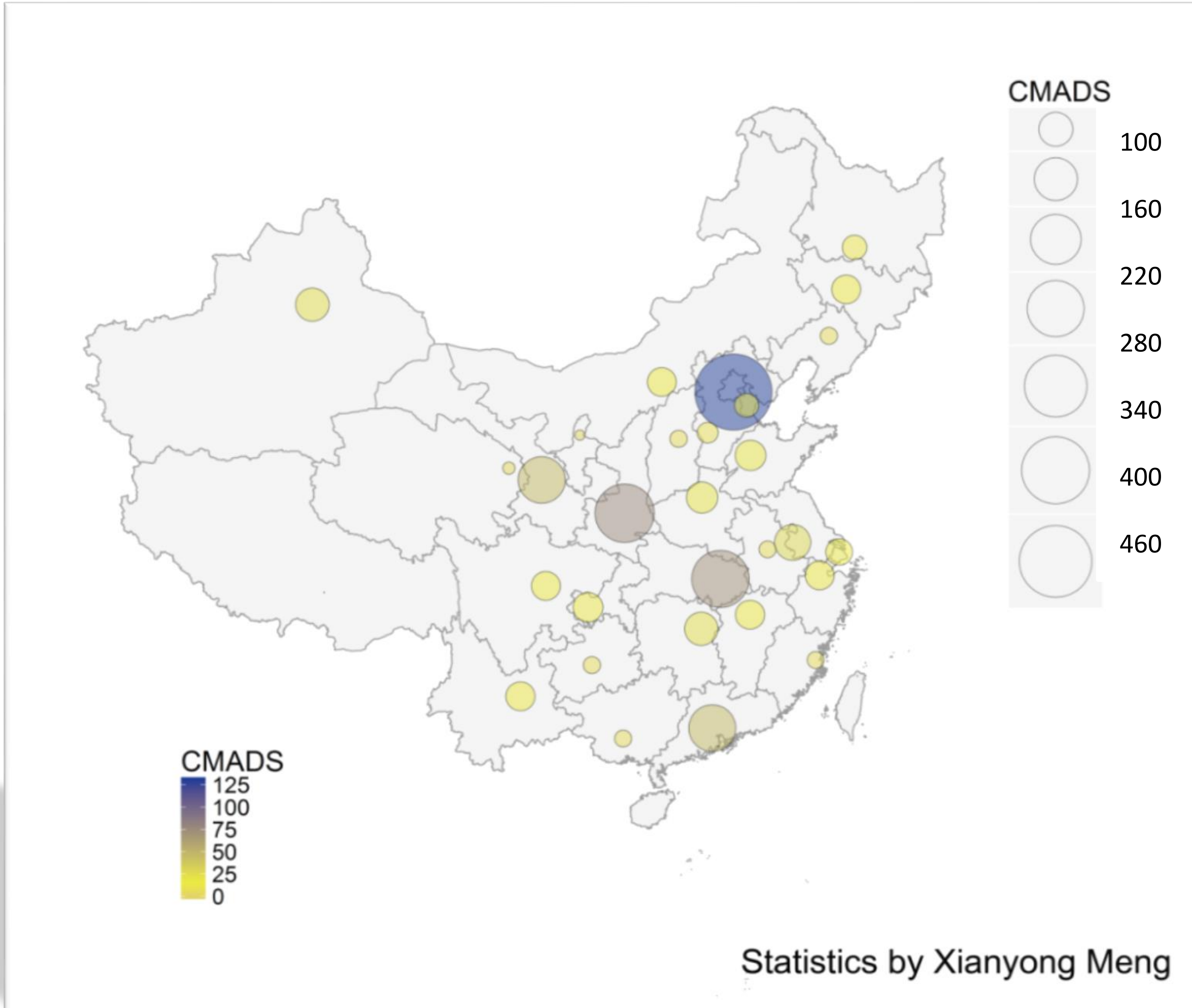
CMADS
CMADS Verification
Documentation
Messages
About Us
CMADS
THE CHINA METEOROLOGICAL ASSIMILATION DRIVING DATASETS FOR THE SWAT MODEL (CMADS)
CMADS introduction
The China Meteorological Assimilation Driving Datasets for the SWAT model (CMADS) is a public datasets developed by Dr. Xianyong Meng from China Agriculture University (CAU). CMADS incorporated technologies of LAPS/STMAS and was constructed using multiple technologies and scientific methods, including loop nesting of data, projection of resampling models, and bilinear interpolation. The CMADS series of datasets can be used to drive various hydrological models, such as SWAT, the Variable Infiltration Capacity (VIC) model, and the Storm Water
How to extract the station you need in CMADS
2017-05-15
1. Download CMADS.7z and Find out the CMADSV1.0station.zi...
China Meteorological Assimilation Driving Datasets for the SWAT model (CMADS) (Annual report – 2016)
2017-05-10
China MeteorologicalAssimilation Driving Datasets for the...
SWAT+ has been officially released by SWAT group, and CMADS data format is compatible with SWAT+
2018-10-01
SWAT+ has been officially released by SWAT group in year ...
CMADS develo
On October 1st, 2018
Significance of
The high degree of spatial variability in climate con...
00165474
Texas A&M University
Texas A&M AgriLife Research
National Meteorological Information Center
IWHR
Pacific Northwest National Laboratory
University of Maryland
IWMI International Water Management Institute
NOAA
Cornell University
© 2017 All rights reserved | Web Site Maintenance: xymeng@hku.hk
00165473
cmads.org
Download CMADS V1.1
CMADS V1.1
China Meteorological Assimilation Datasets for the SWAT model (Version1.1)
CMADS V1.1
Total data: 50000MB
Occupied space: 50000MB
Time: From year 2008 to year 2016
Time resolution: Daily
Geographical scope description: East Asia
Longitude: 60°E
The most east longitude: 160°E
North latitude: 65°N
Most southern latitude: 0°N
Number of stations: 104,000 stations
Spatial resolution: 1/4 * 1/4 * grid points
Download CMADS V1.1 (English)
Download CMADS V1.1 (Chinese)
Download CMADS V1.1 (BD-Cloud)
Download CMADS V1.0
CMADS V1.0
China Meteorological Assimilation Datasets for the SWAT model (Version1.0)
CMADS V1.0
Total data: 33600MB
Occupied space: 35200MB
Time: From year 2008 to year 2016
Time resolution: Daily
Geographical scope description: East Asia
Longitude: 60°E
The most east longitude: 160°E
North latitude: 65°N
Most southern latitude: 0°N
Number of stations: 58500 stations
Spatial resolution: 1/3 * 1/3 * grid points
Download CMADS V1.0 (English)
Download CMADS V1.0 (Chinese)
Download CMADS V1.0 (BD-Cloud)
Download CMADS-ST V1.0
CMADS-ST V1.0
China Meteorological Assimilation Datasets for the SWAT model (Version1.0)
CMADS-ST V1.0
Total data: 12000MB
Occupied space: 12000MB
Time: From year 2009 to year 2013
Time resolution: Daily
Geographical scope description: East Asia
Longitude: 60°E
The most east longitude: 160°E
North latitude: 65°N
Most southern latitude: 0°N
Number of stations: 58,500 stations/layer
Spatial resolution: 1/3 * 1/3 * grid points
Download CMADS-ST V1.0 (English)
Download CMADS-ST V1.0 (Chinese)
Download CMADS-ST V1.0 (BD-Cloud)
Documentation and News

User distribution of the CMADS

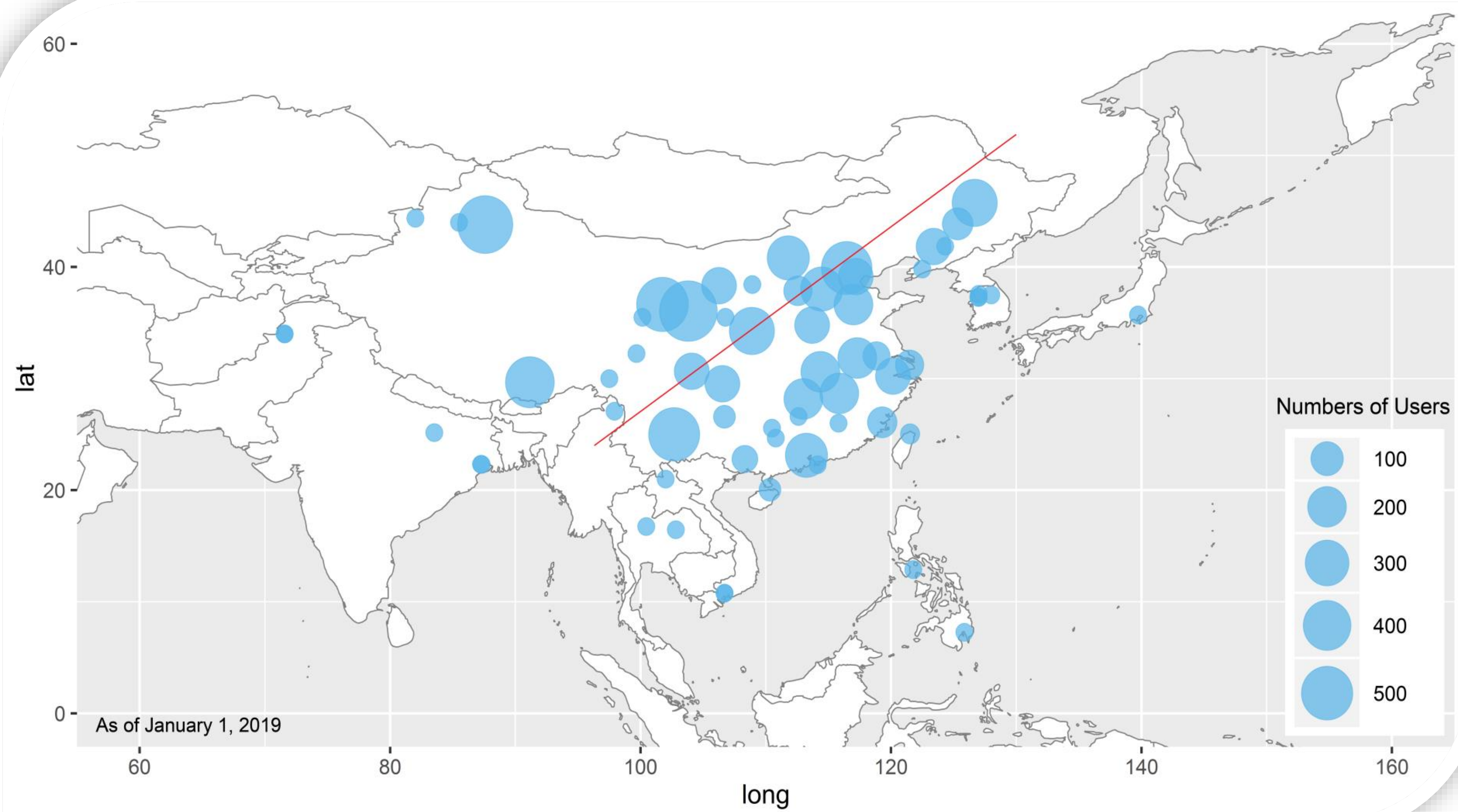


Meng,X.Y.; Wang, H.; Chen, J. Profound Impacts of the China Meteorological Assimilation Datasets for the SWAT model (CMADS). ***Water***, 11, 832. (2019).

CMADS User in China

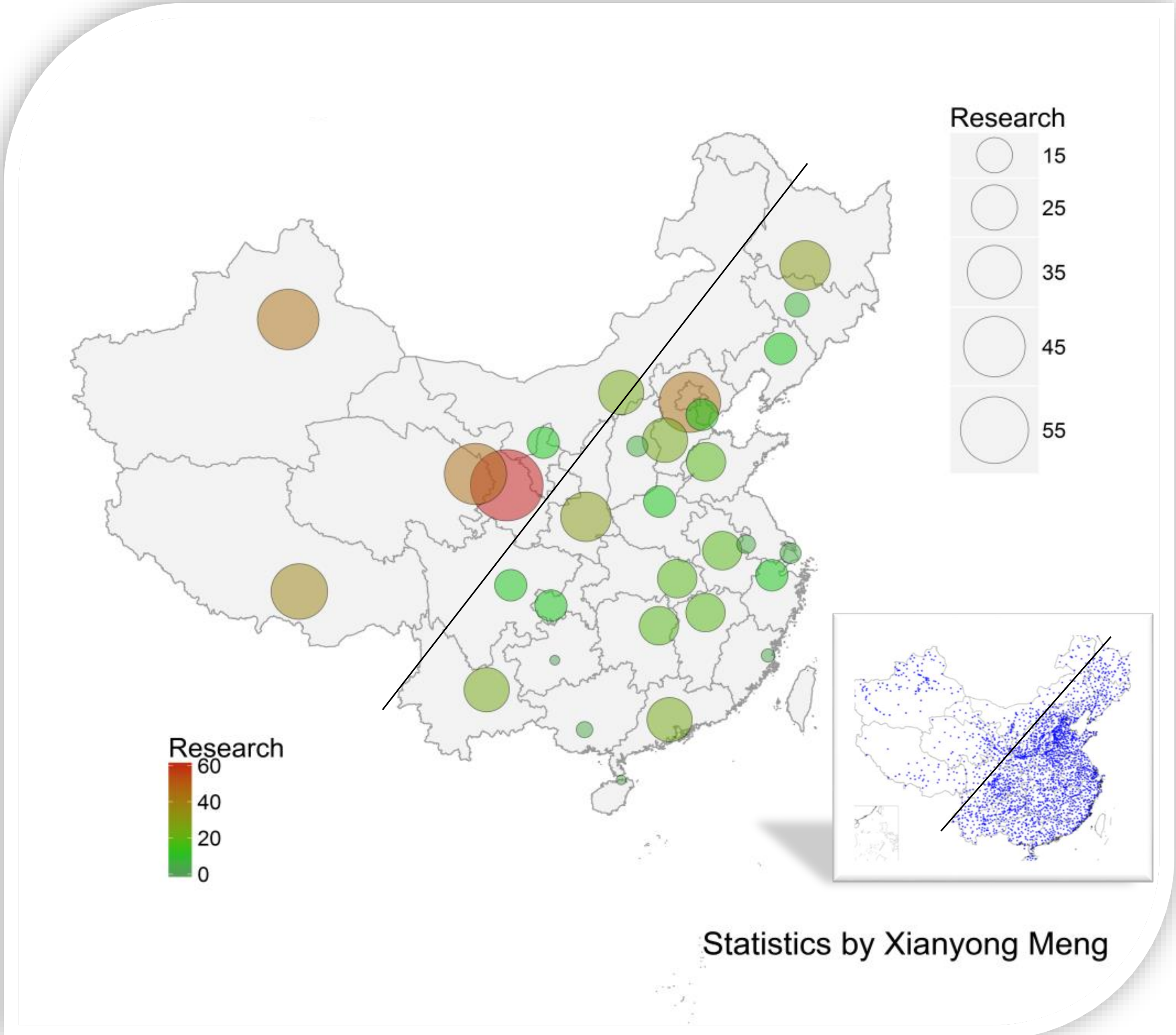


Research hotspot areas of East Asia employing CMADS

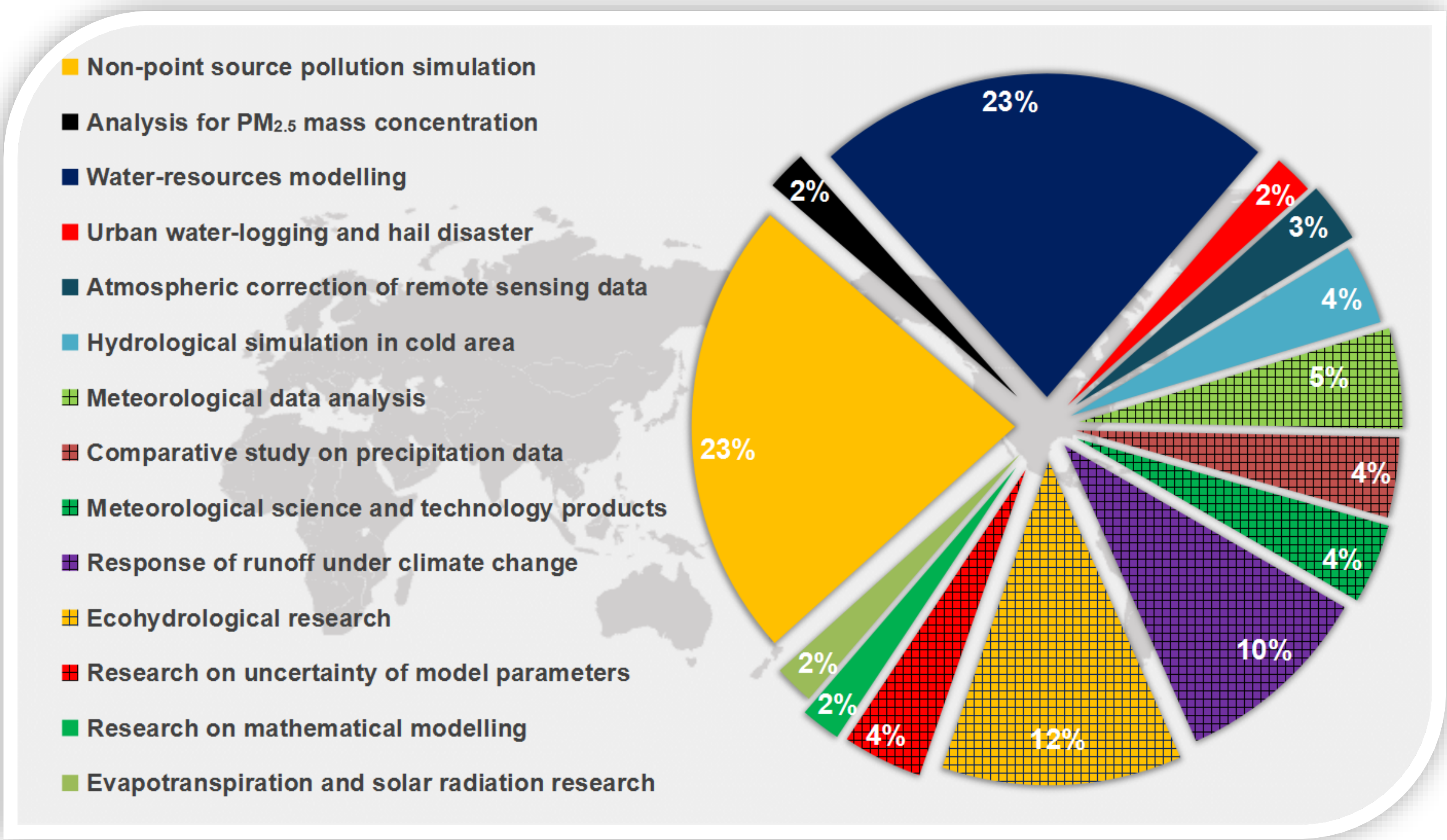


Meng,X.Y.; Wang, H.; Chen, J. Profound Impacts of the China Meteorological Assimilation Datasets for the SWAT model (CMADS). ***Water***, 11, 832. (2019).

Research hotspot areas of East Asia employing CMADS



Hotspot application directions of CMADS



Meng,X.Y.; Wang, H.; Chen, J. Profound Impacts of the China Meteorological Assimilation Datasets for the SWAT model (CMADS). ***Water***, 11, 832. (2019).

Prof. Wang Hao :

The CMADS has been included in the second contamination censuses, national water resources assessment and other countries.

The application of CMADS will play a certain role in promoting environmental protection over East Asia. We expect researchers around the world to make good use of CMADS.

Prof. Xianyong Meng:

The application of CMADS datasets in East Asia will be effective improve the credibility of the data, the accuracy of the data sources will greatly reduce the security risks implemented by downstream programmes, such as pollution censuses, Evaluation of water resources.

Our public release of the CMADS will also benefit more researchers.

中华人民共和国生态环境部

应用证明

由中国水利水电科学院王浩院士及孟现勇博士后研发的SWAT模型中国大气同化驱动数据集(CMADS)被应用于第二次全国污染源普查“农业源污染物入水体系数及负荷核算”，该数据精度高，应用效果好，为我国第二次全国污染源普查提供了重要的基础气象数据保障。

特此证明！

生态环境部

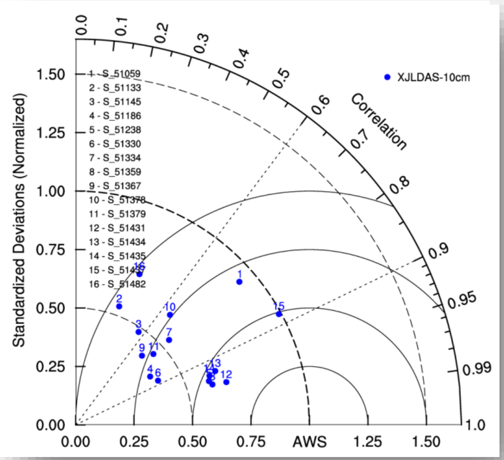
第二次全国污染源普查工作办公室

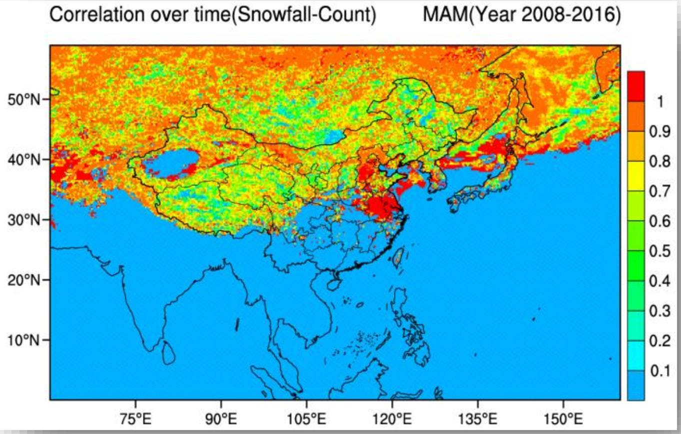
二〇一九年三月十一日

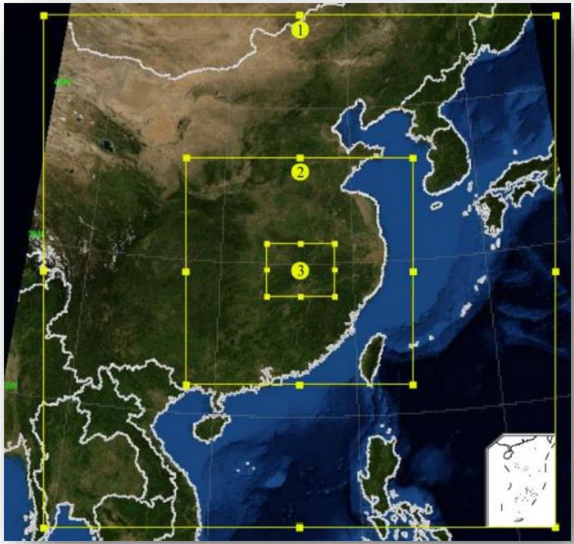
Outline

- **C** Research Background and Scientific Problems
- **M** Establishment Method and Data Introduction
- **A** Validation and Application of the CMADS over East Asia
- **D** Worldwide influence of the CMADS
- **S** Next plan

Next plan of the CMADS







1) Expand CMADS Time Span ：Extended from 2008-2016 to 1980-2018;

2) Develop CMADS-Soil Moisture （CMADS-SM）: Soil temperature (10 layers, Daily scale) (First Layer: 0.00710063521m, Second Layer: 0.0279249996m, Third Layer: 0.0622585751m, Layer Fourth: 0.118865065m, Layer Fifth : 0.2121934m, Sixth floor:0.3660658m, Seventh floor:0.619758487m, Eighth floor:1.03802705m, Nineth Floor: 1.72763526m, Tenth floor : 2.8646071m);

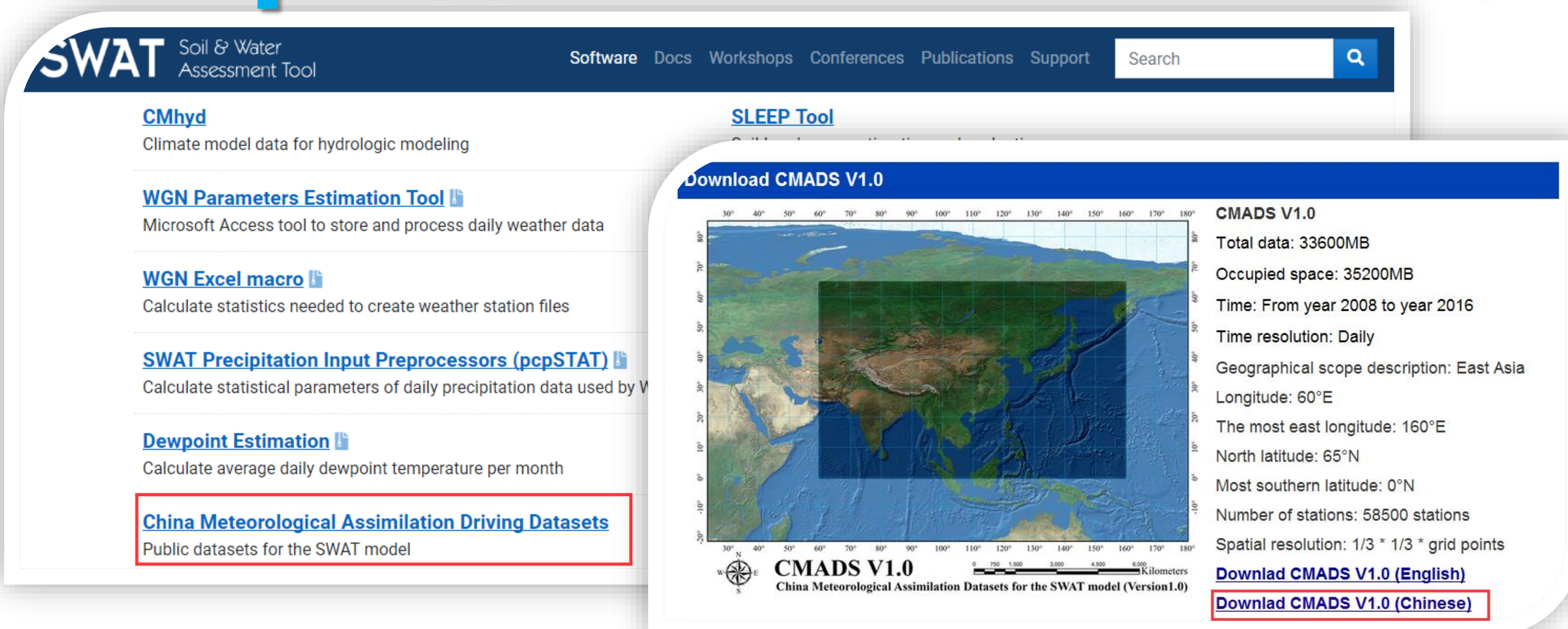
3) Develop CMADS-Snow Fall (CMADS-SF);

4) Develop real-time forecast data of CMADS (CMADS-WRF);

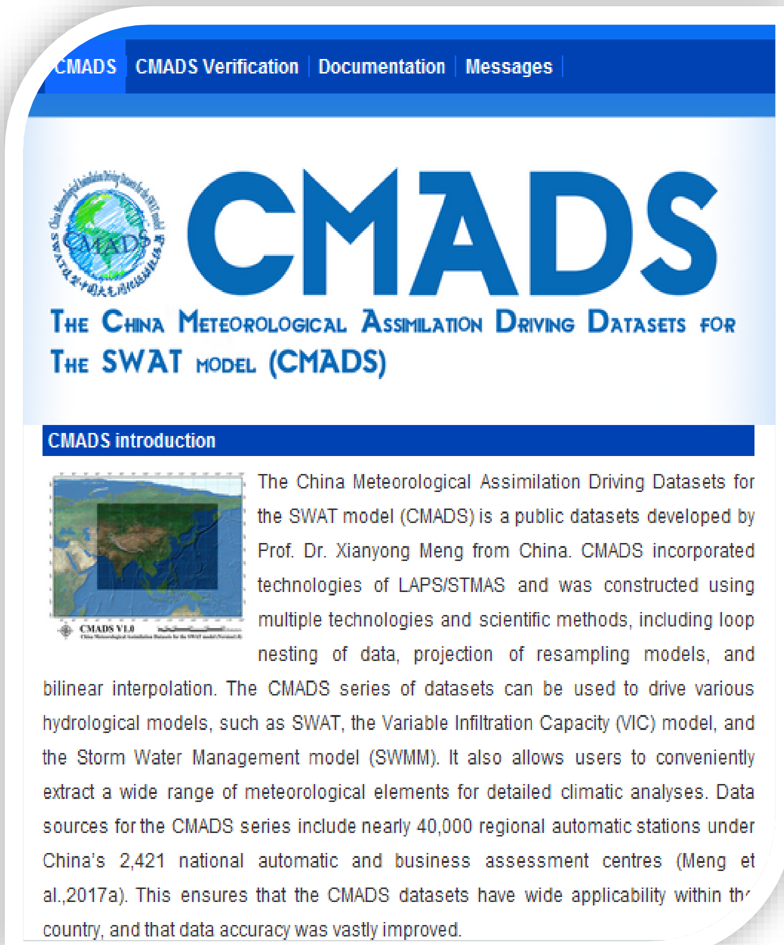
5) Continue to release higher resolution CMADS products.

Welcome to download for free of the CMADS

http://www.cmads.org
https://swat.tamu.edu/



Welcome to join in CMADS Official QQ Group-Scaning!



CMADS
The China Meteorological Assimilation Driving Datasets for the SWAT model (CMADS)

Thanks

Please do not hesitate contact me if there are any questions on CMADS.

Email: xymeng@cau.edu.cn & xymeng@hku.hk