Cryospheric Databases in China

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1st Asian CryoNet Workshop
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December 3-5, 2013

Outline

- Data centers and databases of cryospheric data in China
- Representative datasets at WestDC.westgis
- Data sharing and services
- Toward World Data System for Cold and Arid Regions

1. Data Centers and Databases of Cryospheric Data in China

- Cold and Arid Regions Science Data Center (Lanzhou)
- Chinese National Arctic and Antarctic Data Center (Shanghai)
- Third Pole Environment Database (Beijing)
- Information System of Chinese Glacier Resources and Change
- Data Information System of Permafrost Environment Investigation over the Qinghai-Tibet Plateau

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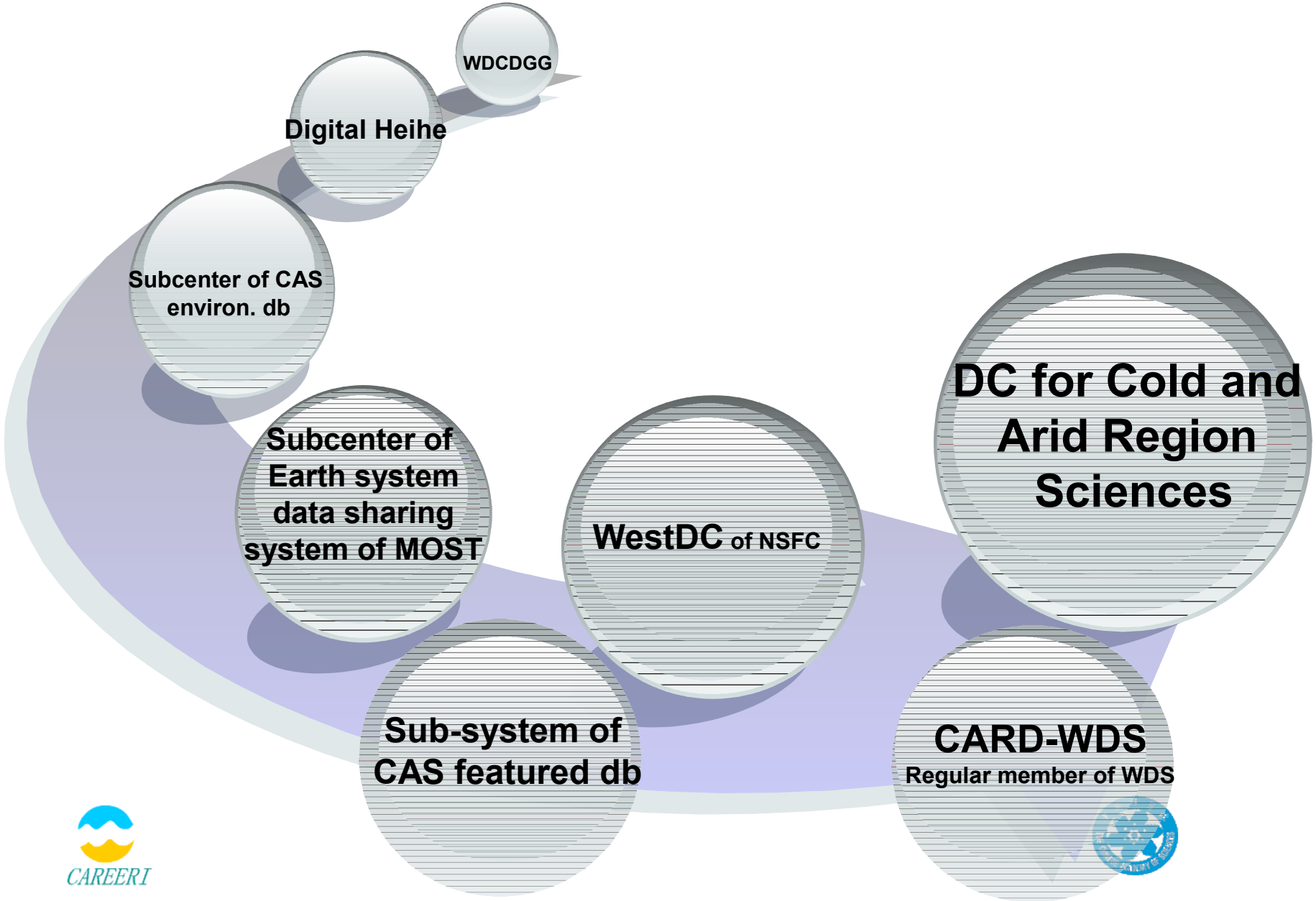
Cold and Arid Regions Science Data Center at Lanzhou



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Chinese portal

http://westdc.westgis.ac.cn

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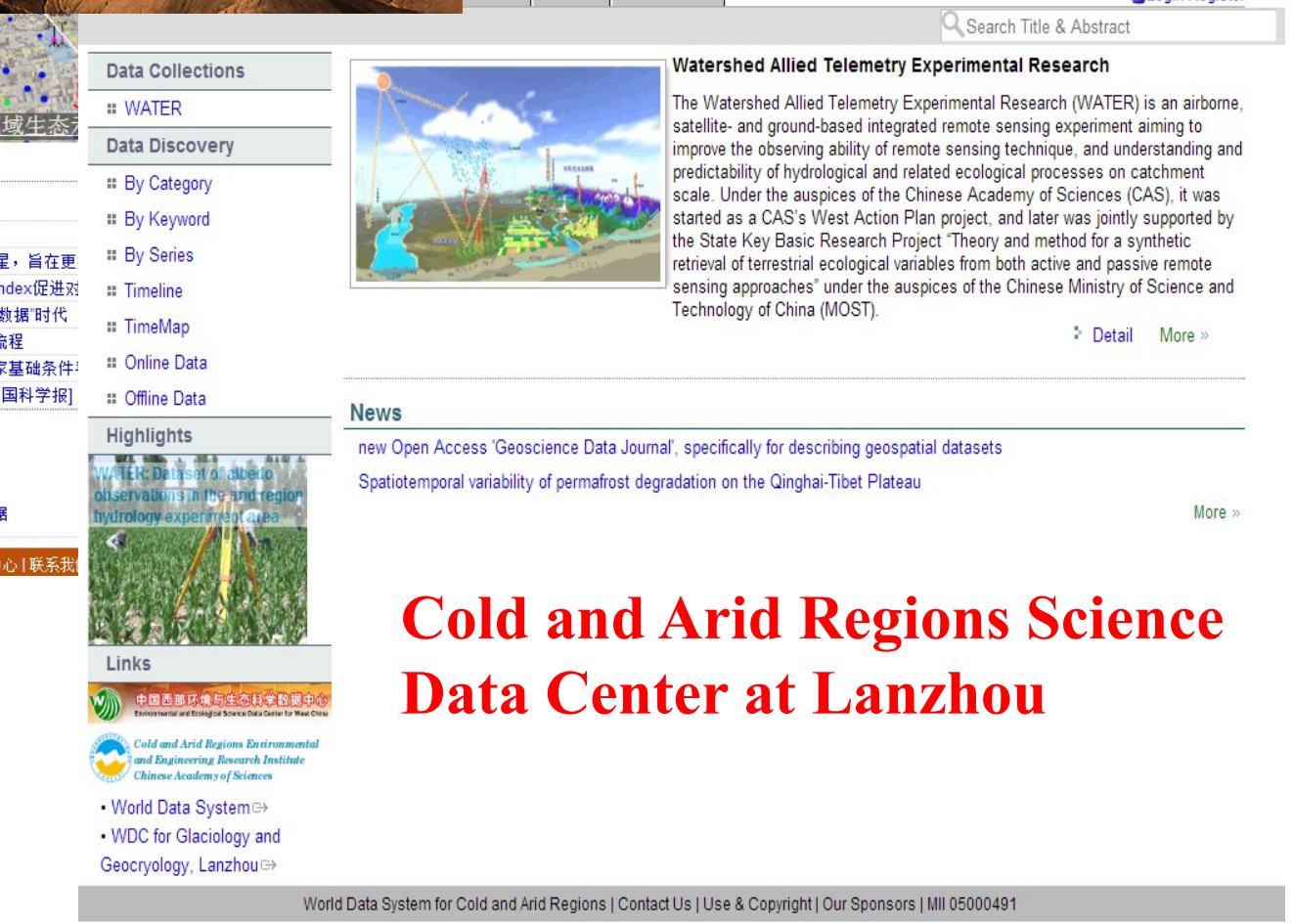
English portal

http://card.westgis.ac.cn



Cold and Arid Regions Science Data Center at Lanzhou

WDS International Programme Office
c/o NICT, 4-2-1 Nukui-Kitamachi,
Koganei, Tokyo 184-8795, Japan
Tel. +81 42 327 6395 Fax. +81 42 327 6490
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ICSU
WORLD DATA SYSTEM

Zhuotong Nan
320 Donggang West Road
Lanzhou
Gansu 730000
China

Monday, 03 June 2013

Subject: CARD as Regular Member of ICSU World Data System

Dear Zhuotong Nan,

Cold and Arid Regions Science Data Center at Lanzhou applied for membership in the new International Council for Science (ICSU) World Data System (WDS). On behalf of ICSU and the WDS Scientific Committee (WDS-SC), it is my distinct honour and pleasure to formally accept your organization as a Regular Member of ICSU-WDS, pending the finalization of a signed agreement with ICSU (as noted in the application). A template agreement is provided on the ICSU-WDS website (http://icsu-wds.org/membership/join-icsu-wds/template-agreement).

As described on the WDS website, Regular Members are nodes within a 'system of data systems' that deal directly with data curation and data analysis services. Your application was reviewed favourably by two referees. The summary of their comments at the end of this letter is intended to help your organization become a more effective

Regular membership in the new World Data System

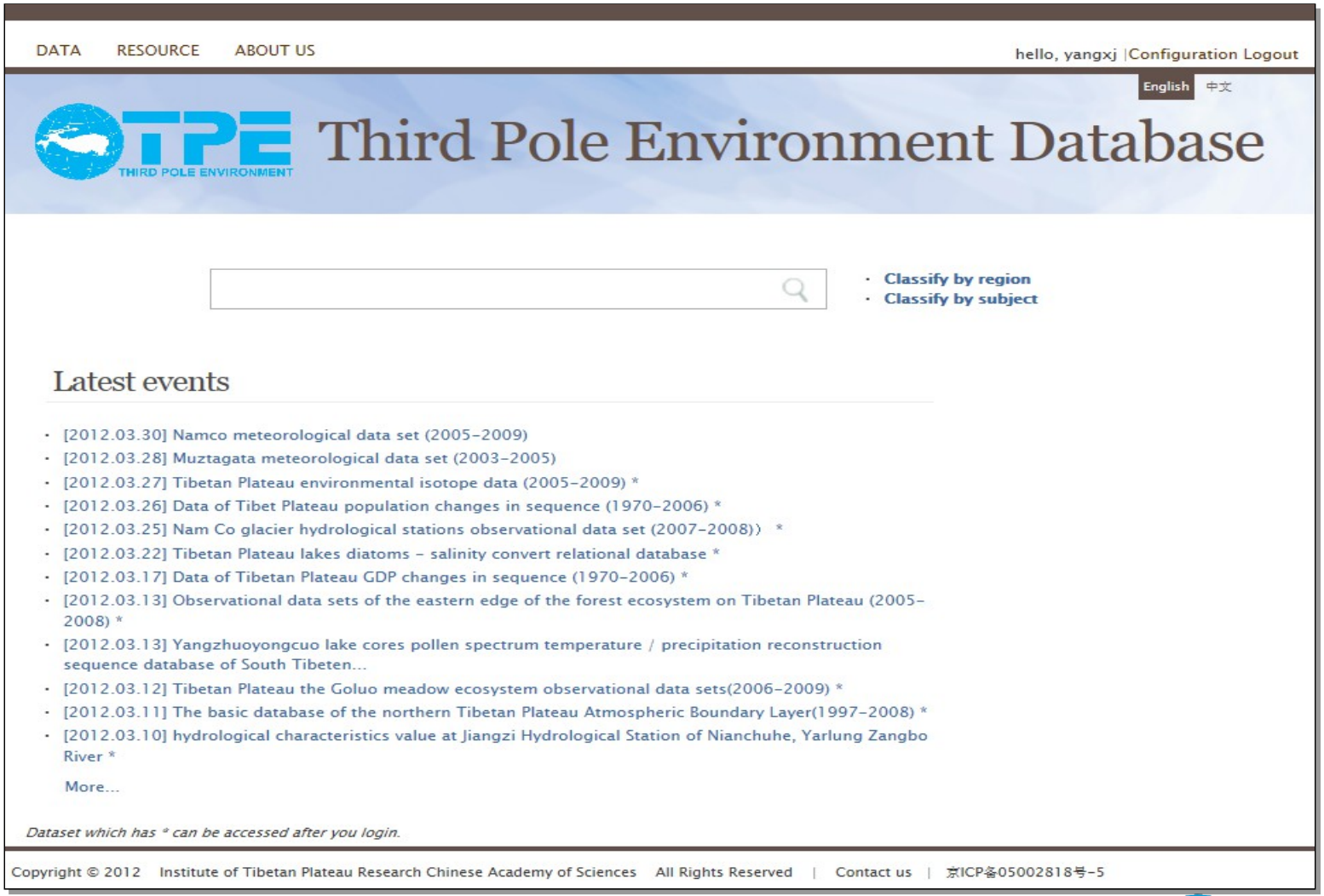
CA

To show your affiliation as an ICSU-WDS Member, we would like to encourage you to display the WDS logo on your

Chinese National Arctic and Antarctic Data Center

http://www.chinare.org.cn/cn/index/ (in Chinese)
http://www.chinare.org.cn/en/index/ (in english)

Third Pole Environment Database



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http://www.tpedatabase.cn/ (in Chinese)

Information System of Chinese Glacier Resources and Change

http://westdc.westgis.ac.cn/glacier (in Chinese), PI: Prof. Shiying Liu

Data Information System of Permafrost Environment Investigation over the Qinghai-Tibet Plateau

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http://pf.crs.ac.cn/ (in Chinese), PI: Prof. Lin Zhao

2. Representative Datasets

- Chinese Glacier Inventory
- Snow dataset: in situ observations and snow depth/snow water equivalent datasets derived from remote sensing
- Frozen soil data: permafrost distribution map of China, soil surface freeze/thaw data derived from remote sensing, and borehole data
- Cryospheric data of other regions
- Experimental datasets from the Watershed Allied Telemetry Experimental Research (WATER), HiWATER, HEIFE, and other experiments.

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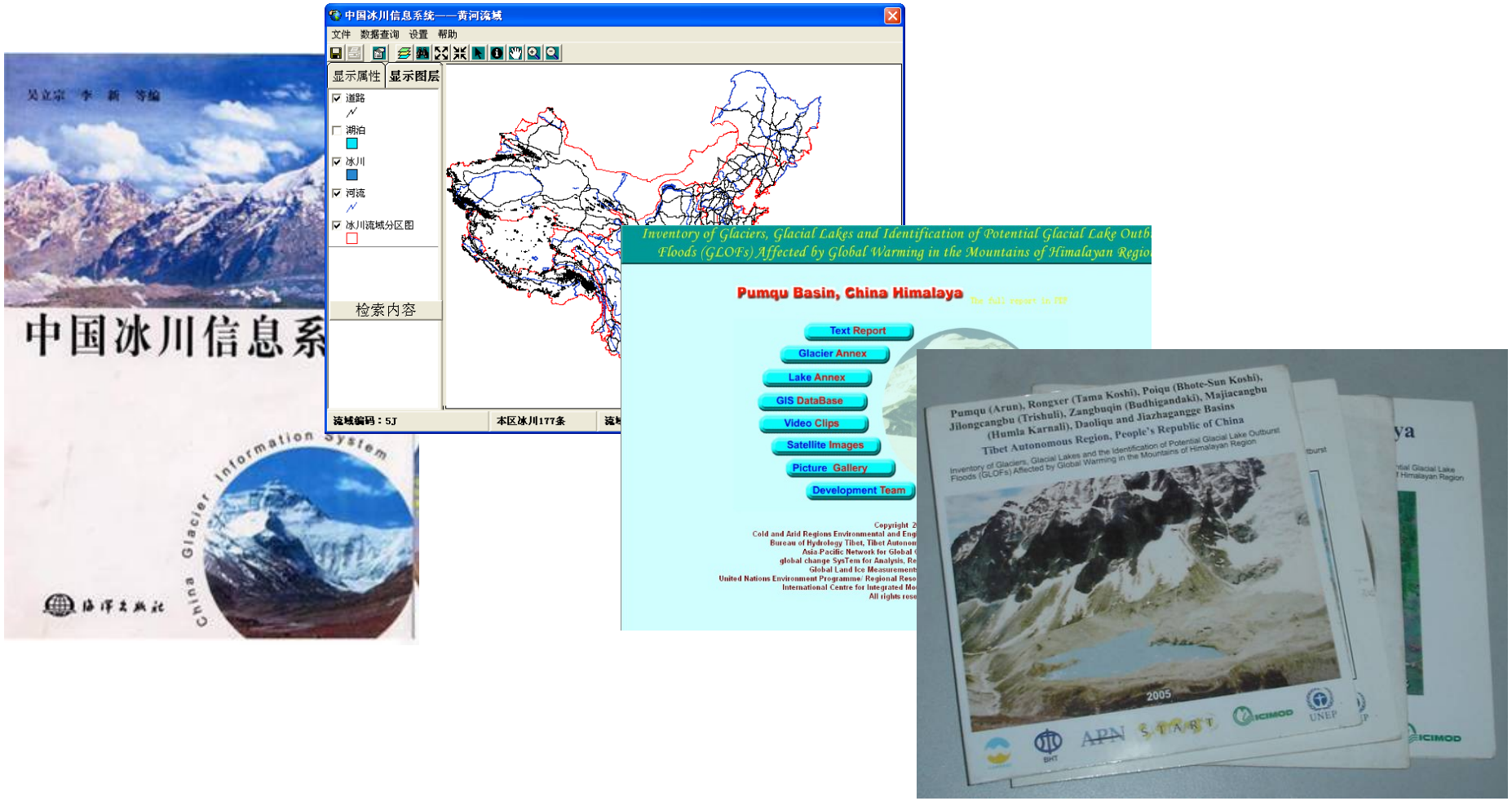
2.1 Chinese glacier inventory



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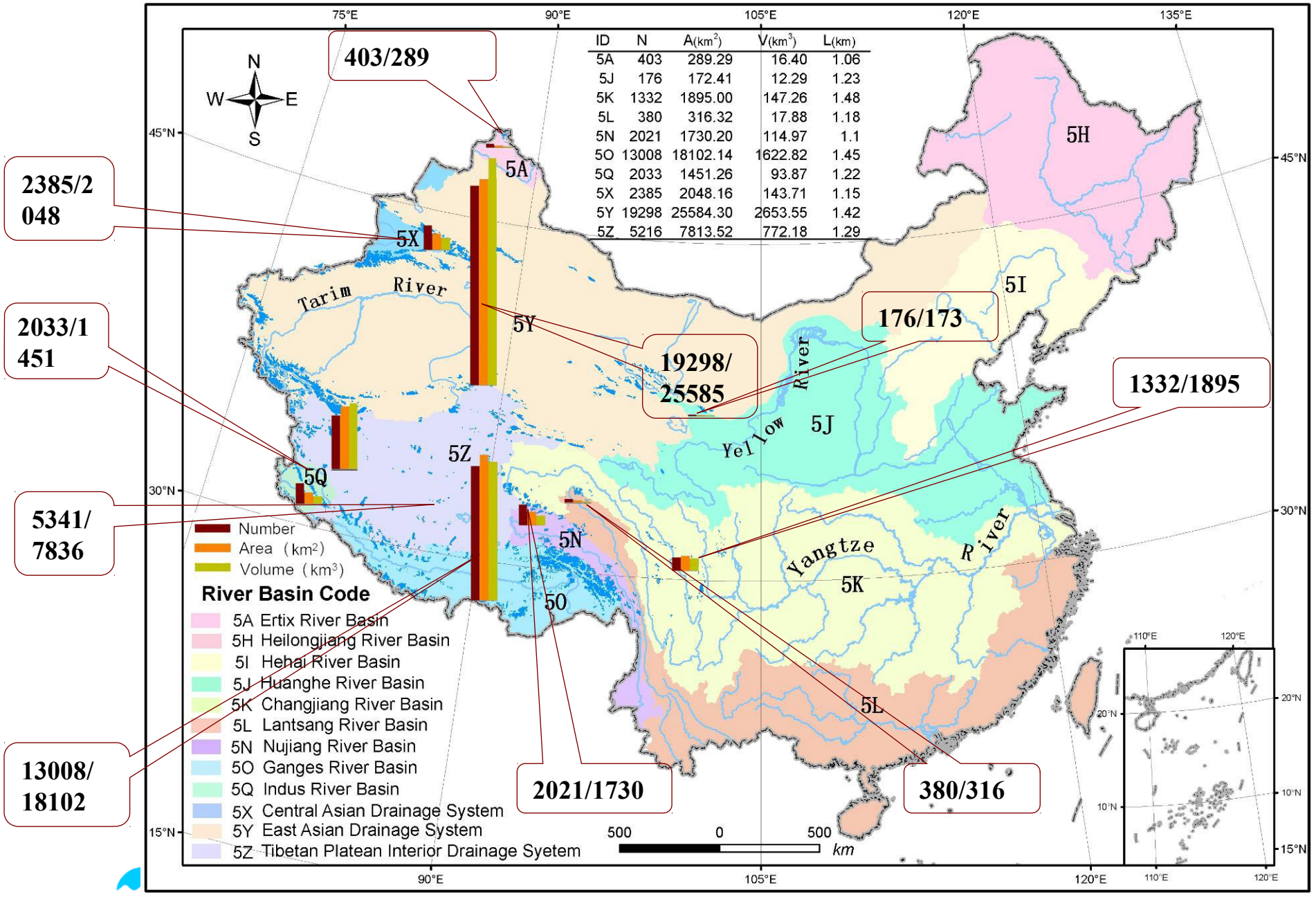
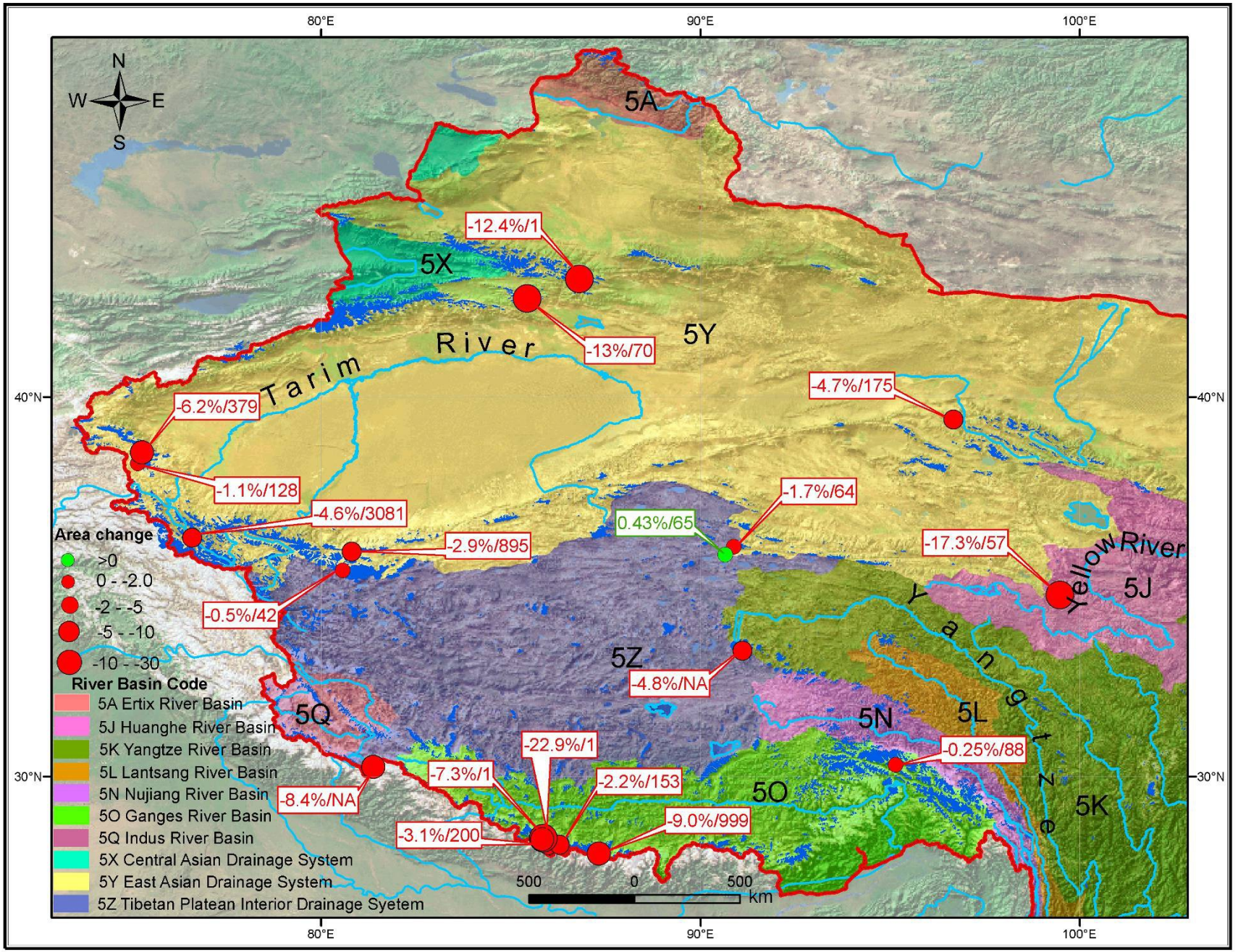


Glacier distribution map and statistics of number, area, and ice volume of glaciers in China



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Li et al., 2008

2.2 Snow data

- In situ observations
  - The daily snow depth observations of west China from 1960s to present.
- The snow depth derived from passive microwave remote sensing (SMMR and SSM/I)
  - Modified algorithm
  - Long time series, 1978~2012

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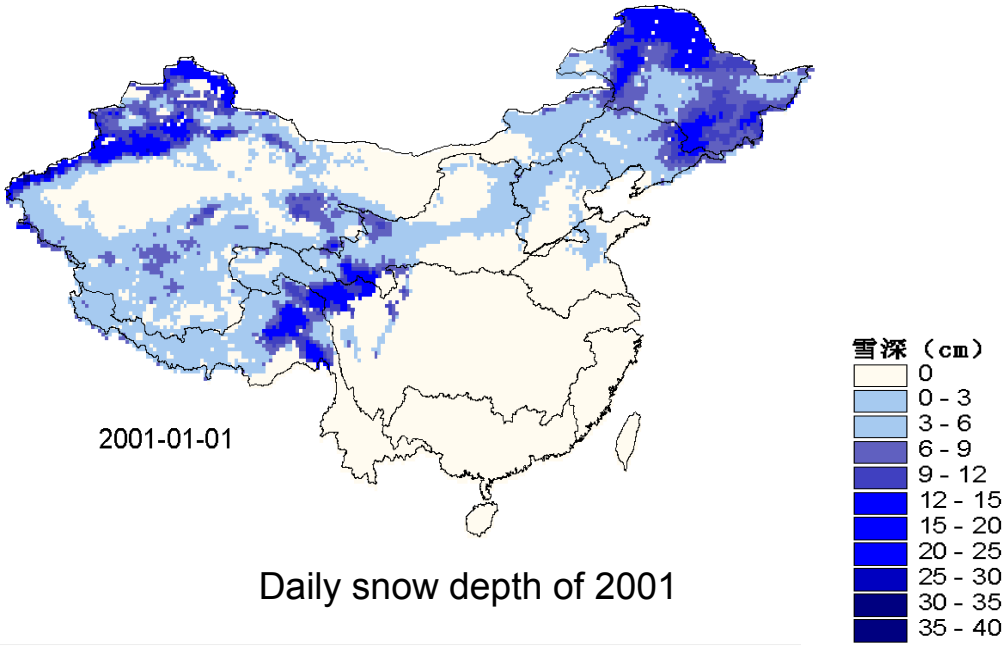
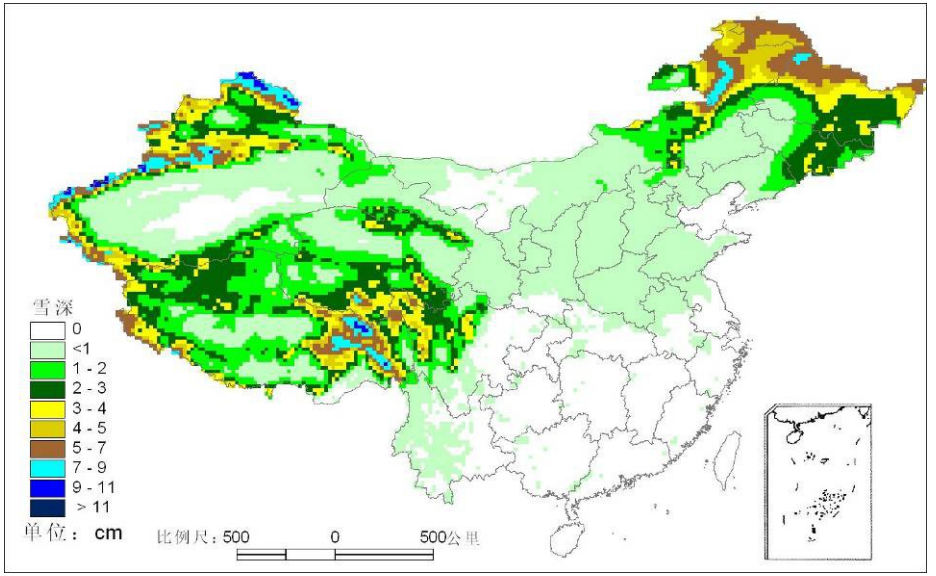
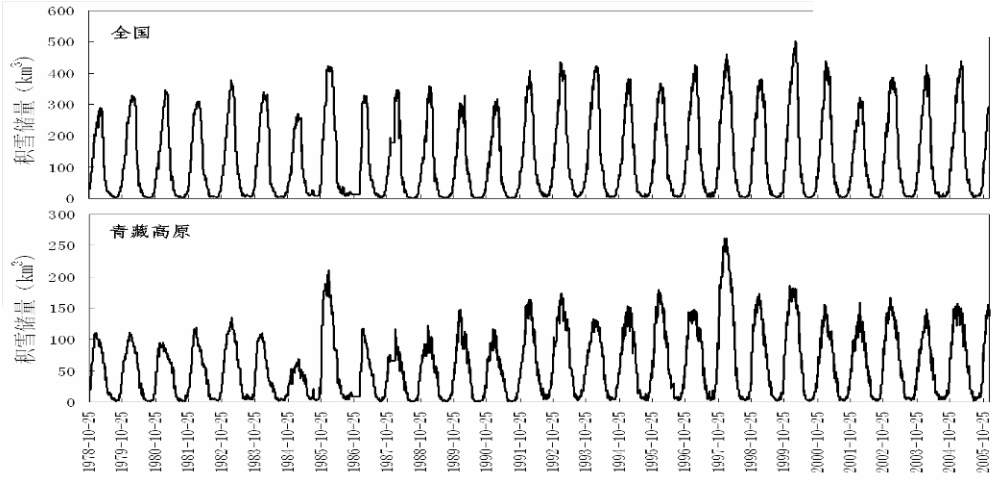
Snow depth data set (1978 – 2005) derived from PM remote sensing



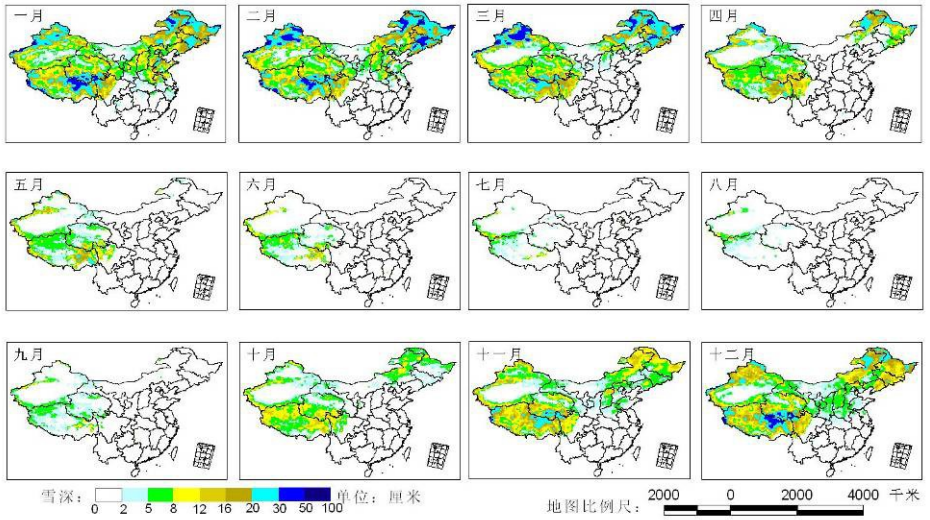
Daily snow depth of 2001



Mean snow depth (1978-2005)

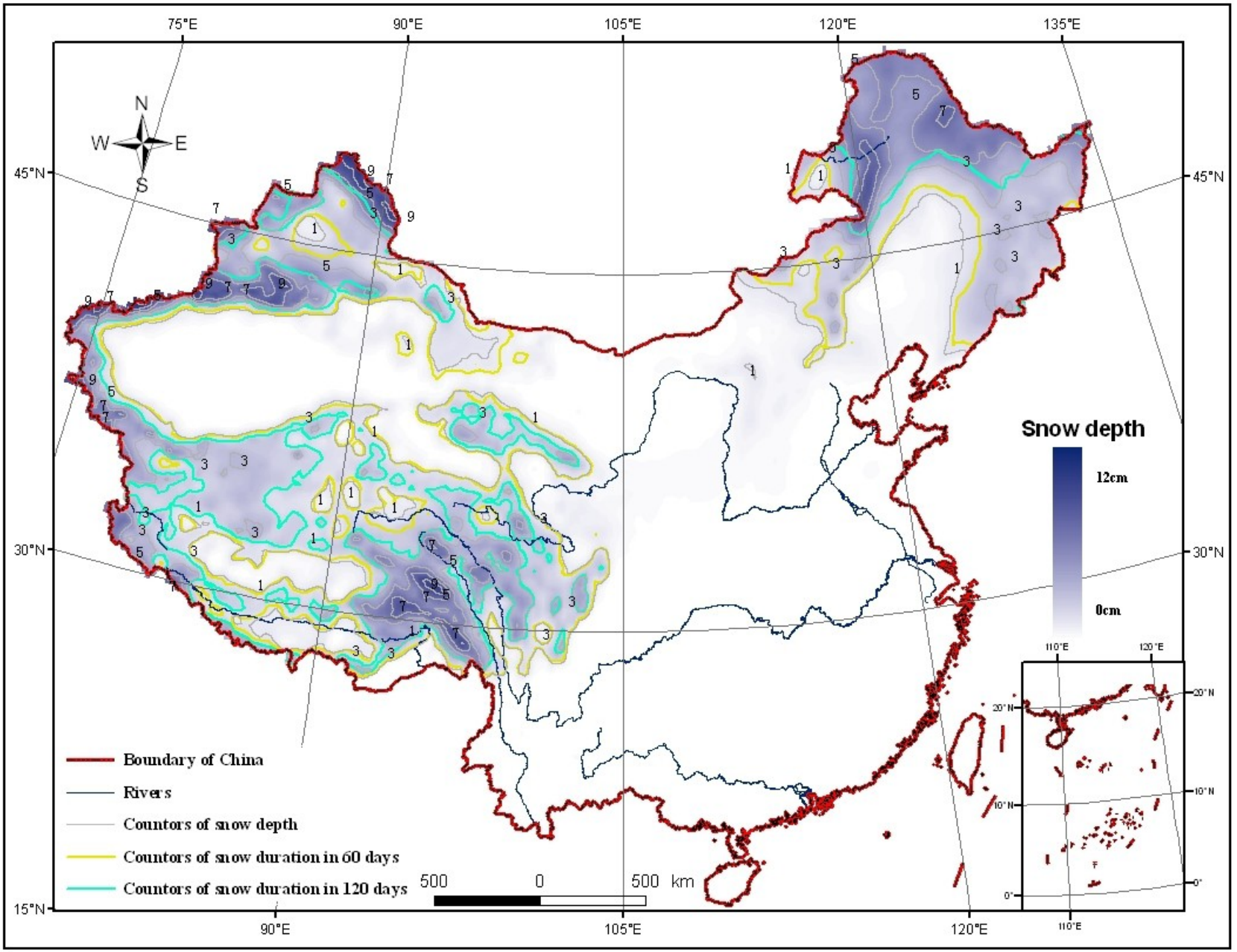


Snow depth variation from 1978 to 2005



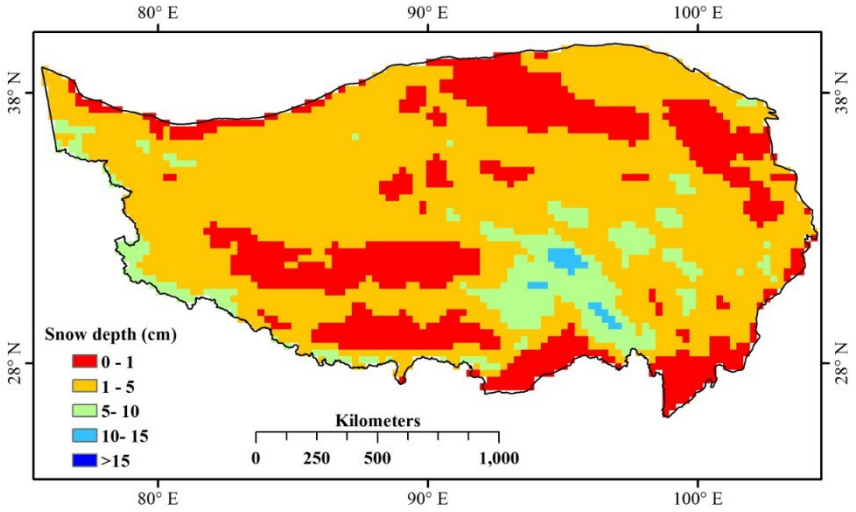
Monthly maximum snow depth

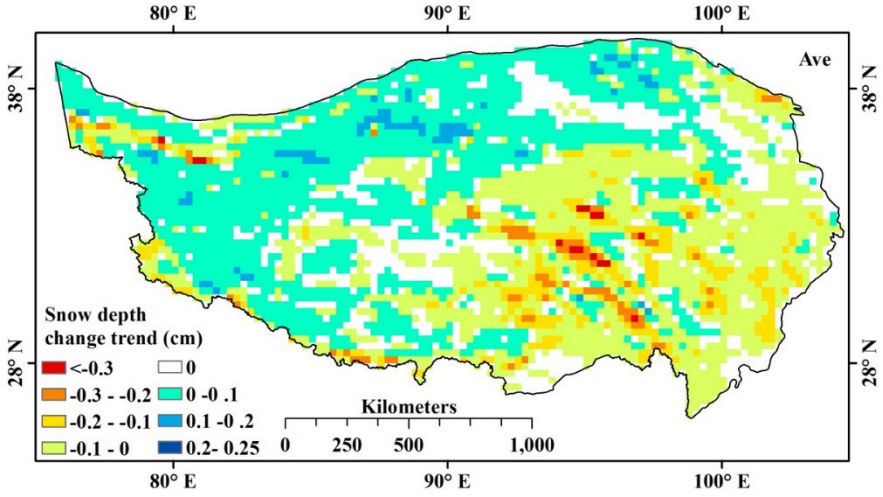
Che et al., 2008

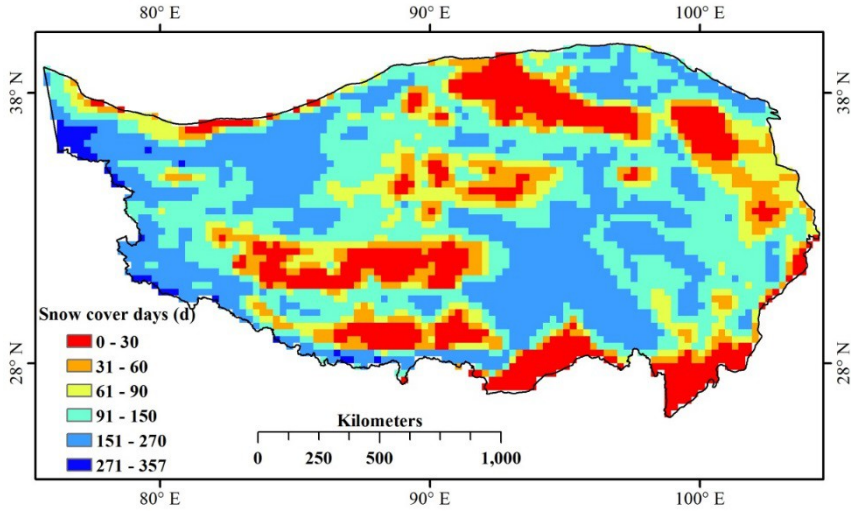


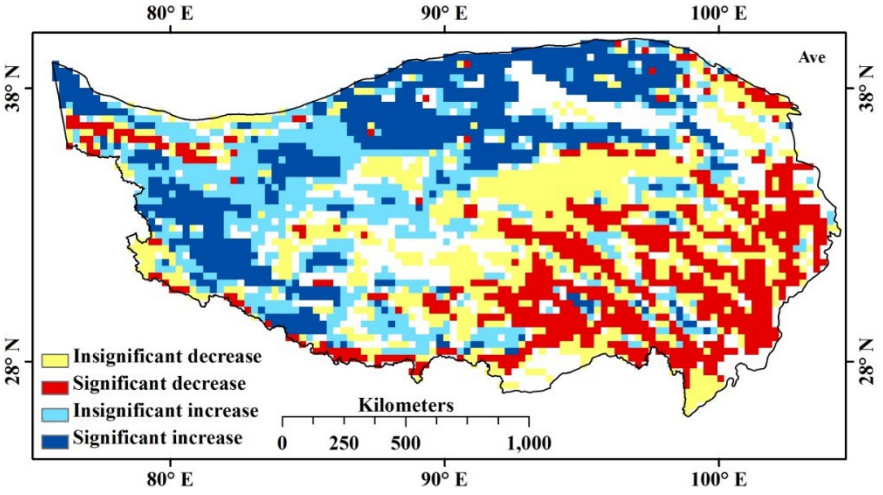
Distribution of averaged snow depth and steady snow cover extents in China

Li et al., 2008





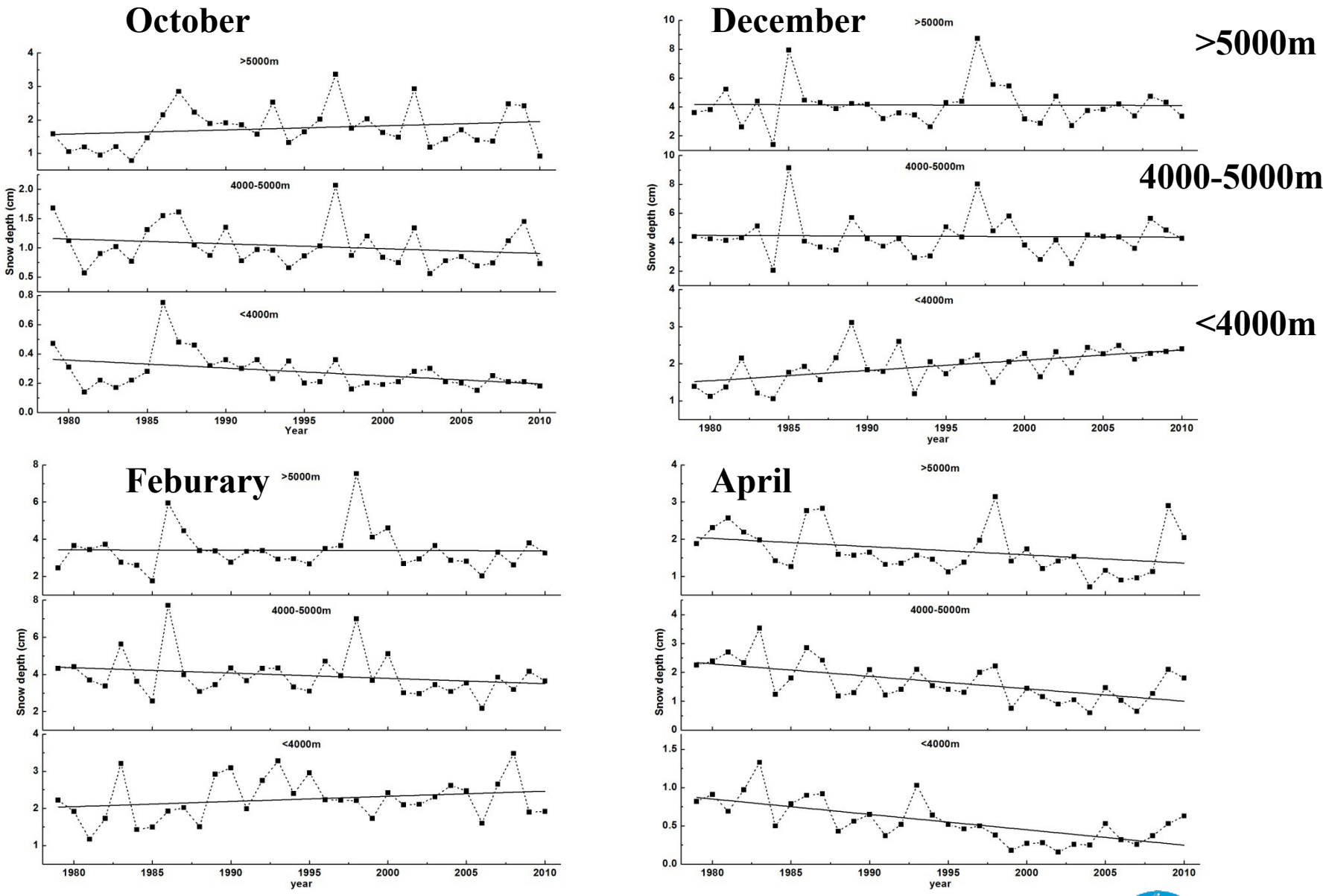




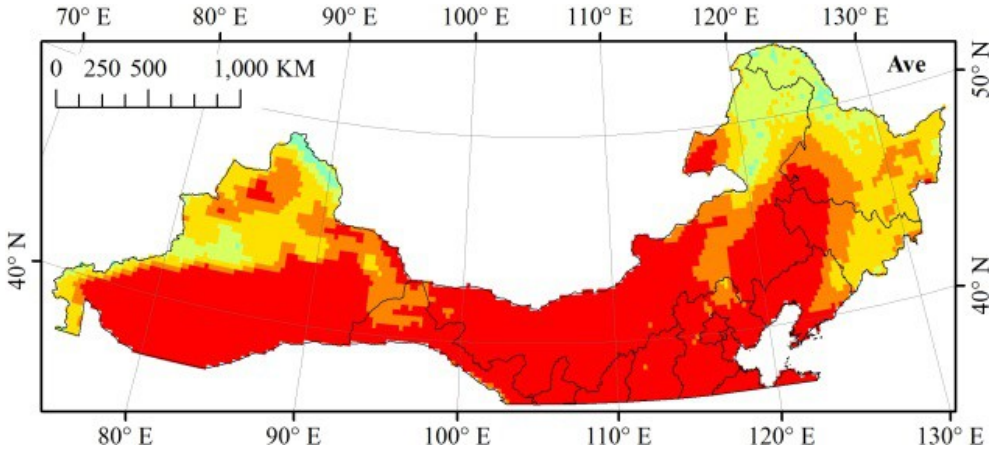
Mean snow depth and snow cover days of 32 years

Interannual change trend and its statistical significance of snow depth

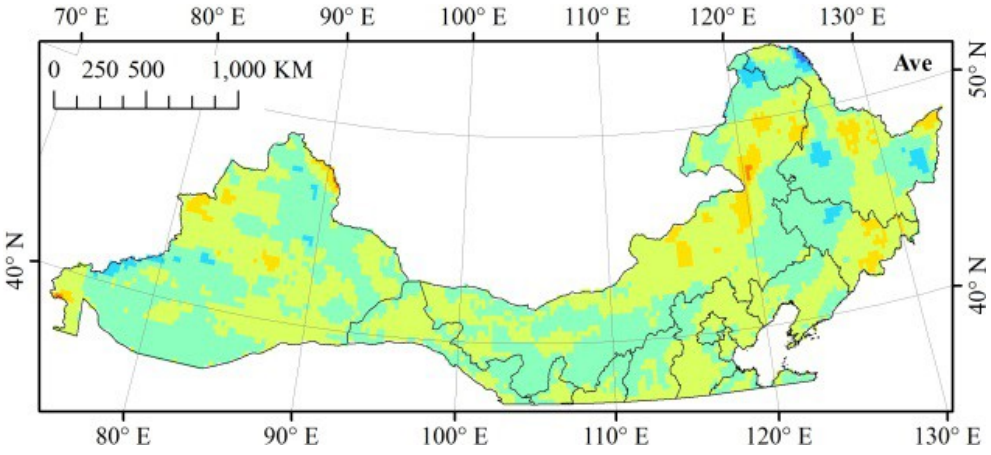
Che et al., 2013



Snow depth variation in different snow season



Mean snow depth in north China over 24 years



Variation trend of snow depth in north China over 24 years

- In north China, snow cover mainly distributed in the mountainous areas, maximum snow in in January and February.
- Annual SCD significantly decreased in the deep snow areas and insignificantly increase in the Northeast plain and Junggar basin.

Dai et al., 2012; Che et al., 2013

2.3 Frozen soil data

- **Borehole ground temperature observations**
  - **More than one hundred borehole data along the Qinghai-Tibet highway and railway are archived.**
- **Frozen soil map**
  - **Historic frozen soil maps were digitized**
  - **GIS based frozen soil mapping**
- **Surface soil freeze/thaw derived from Remote sensing**
- **GIS and digital roadbed of the Qinghai-Tibet railway**

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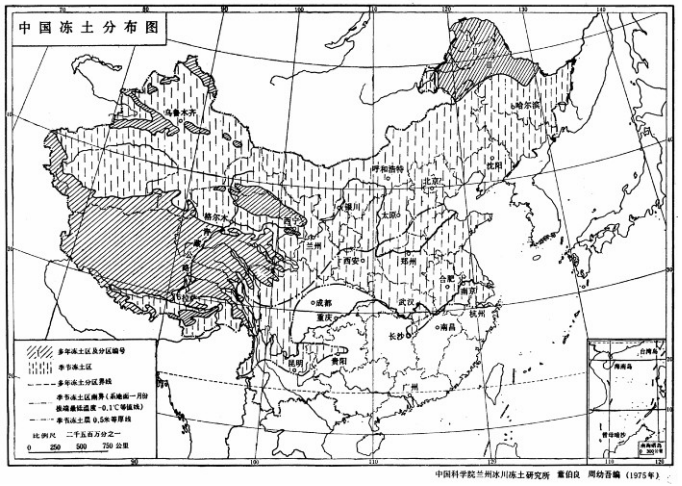
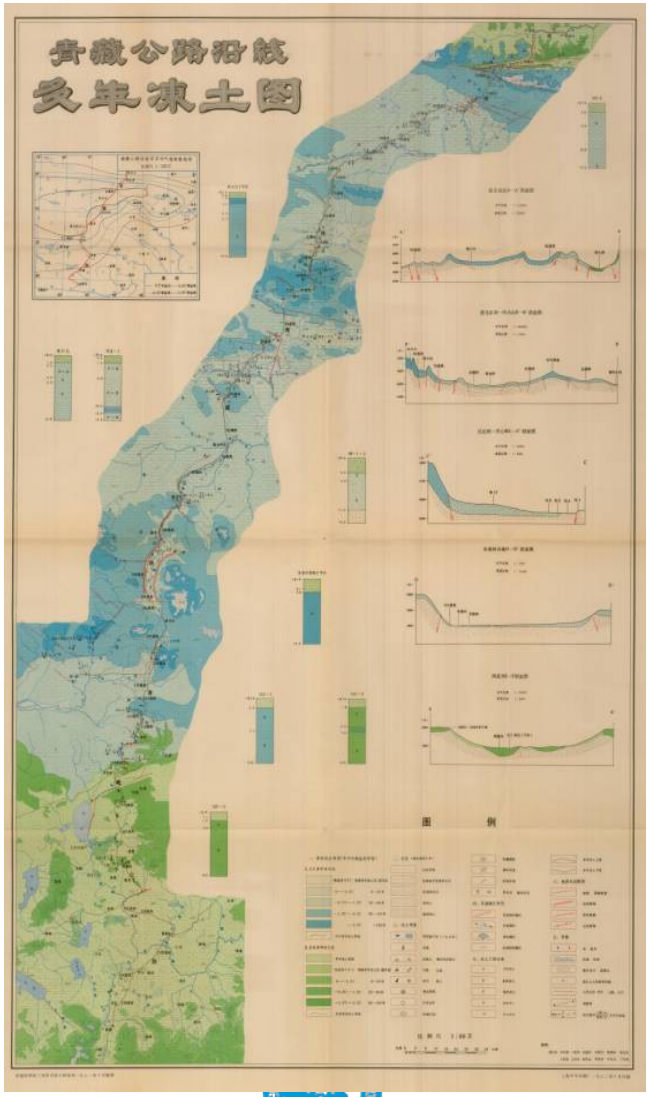
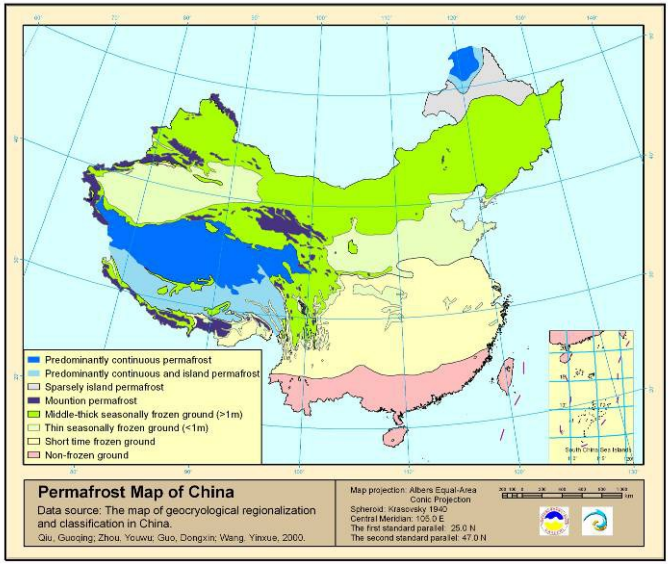
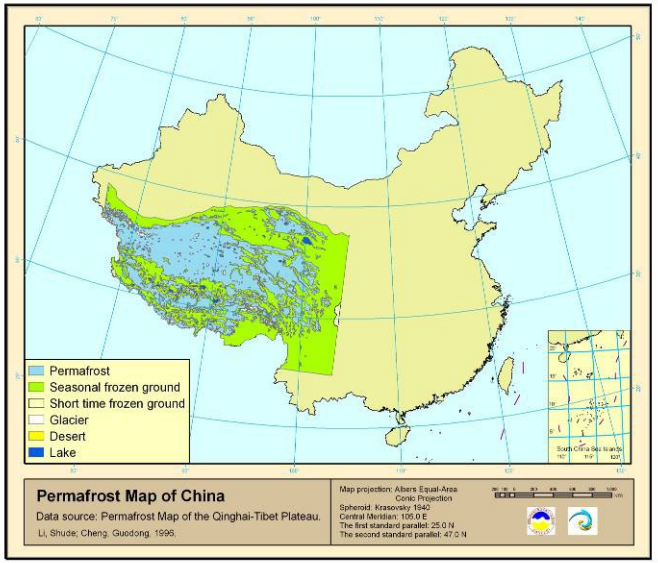
Historic frozen soil maps









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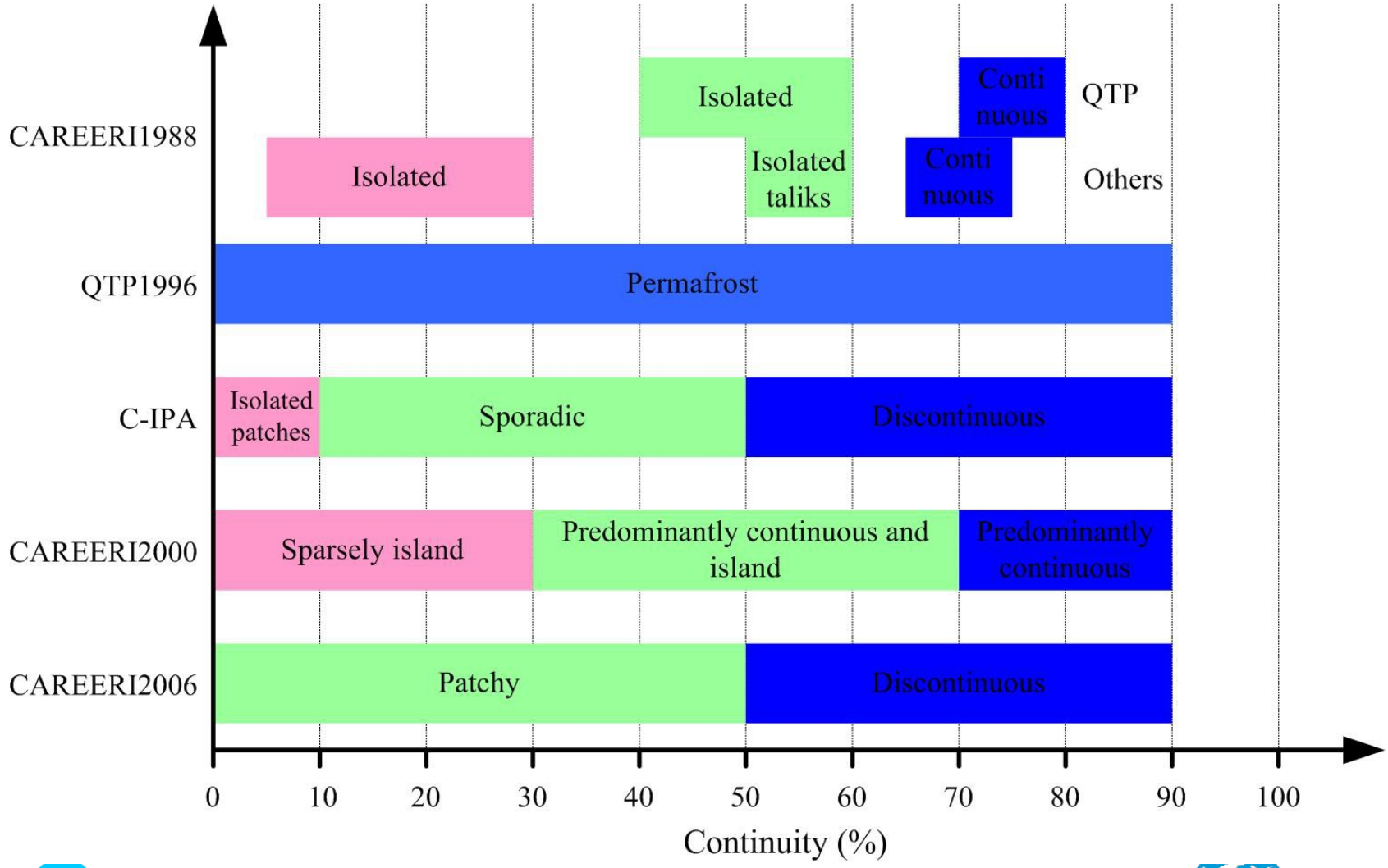
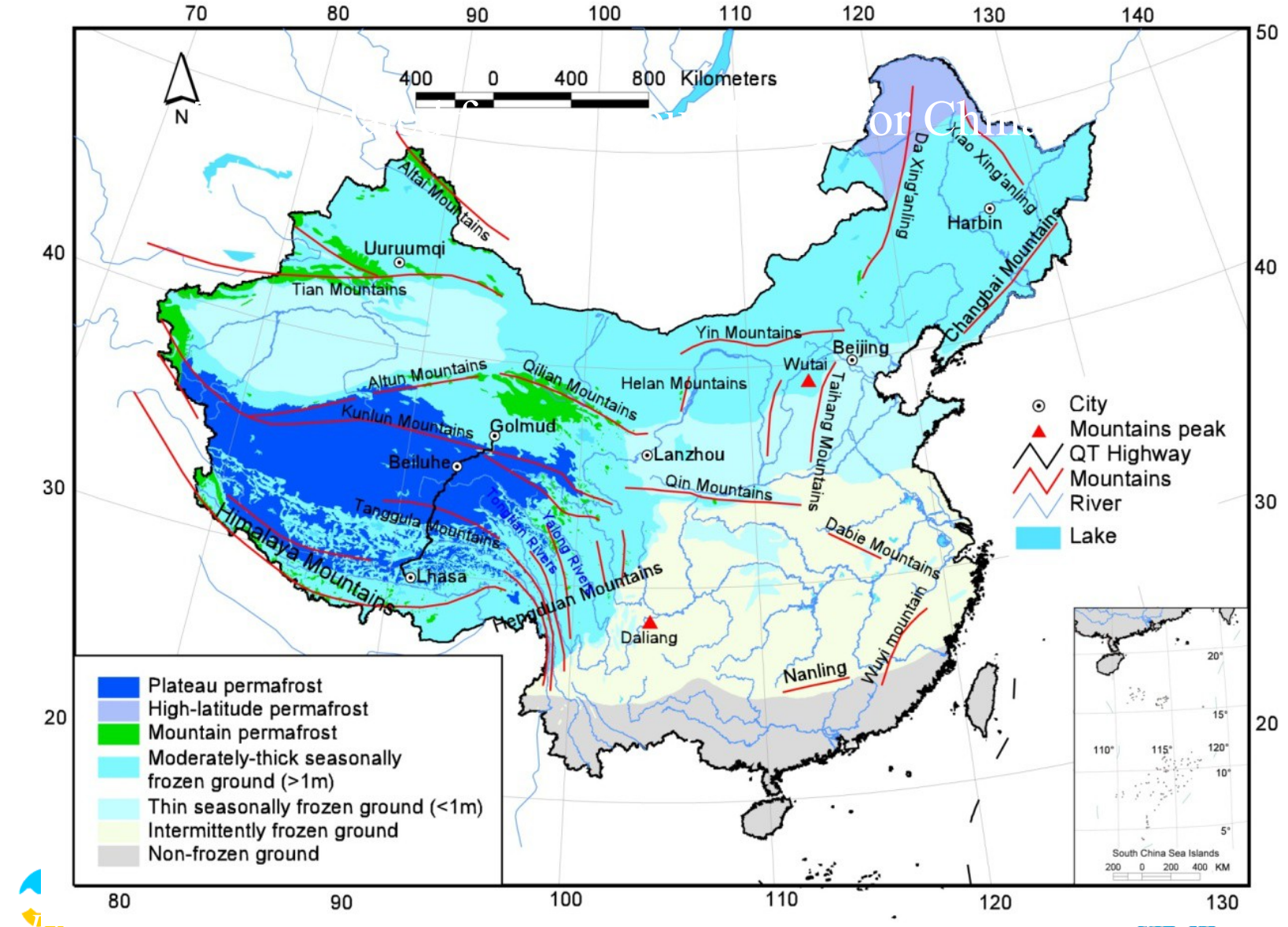
Overview of existing permafrost maps



A new frozen soil map of China



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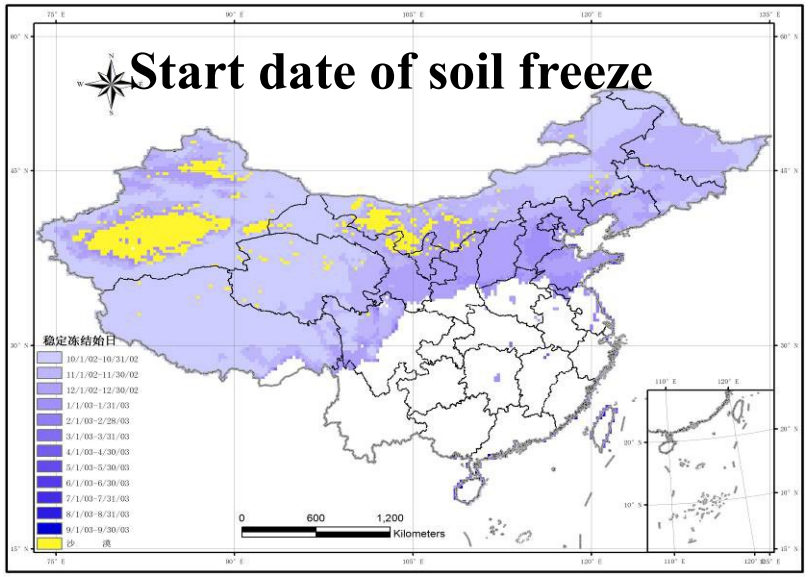
Ran et al., 2013, PPP

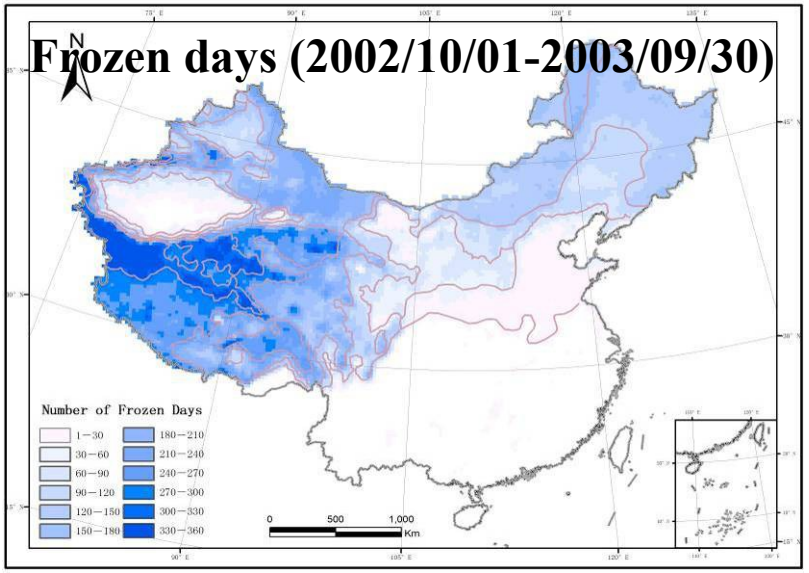
Overview of Existing Permafrost Maps

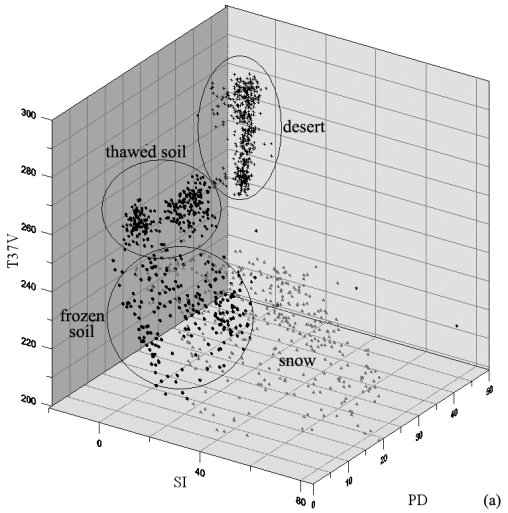
Table 4 The area of frozen ground in China based on the updated frozen -ground map.

	Frozen ground area ($\times 10^6$ km^2)	
Class	Including glaciers and lakes	Excluding glaciers and lakes
Total Permafrost	1.65	1.59
(a) High-altitude permafrost	1.41	1.35
(a1) Mountain permafrost	0.31	0.30
(a2) Plateau permafrost	1.10	1.05
(b) High-latitude permafrost	0.24	0.24
Seasonally frozen ground	5.41	5.36
Instantaneous frozen ground	1.73	1.71

Soil freeze/thaw data set (1994 – 2004) derived from PM remote sensing







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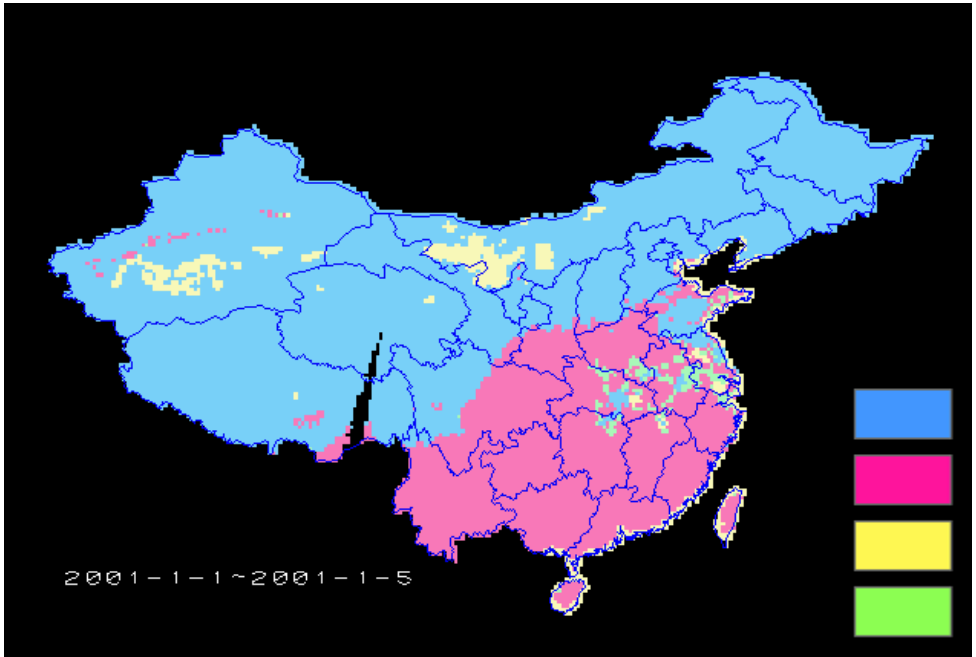
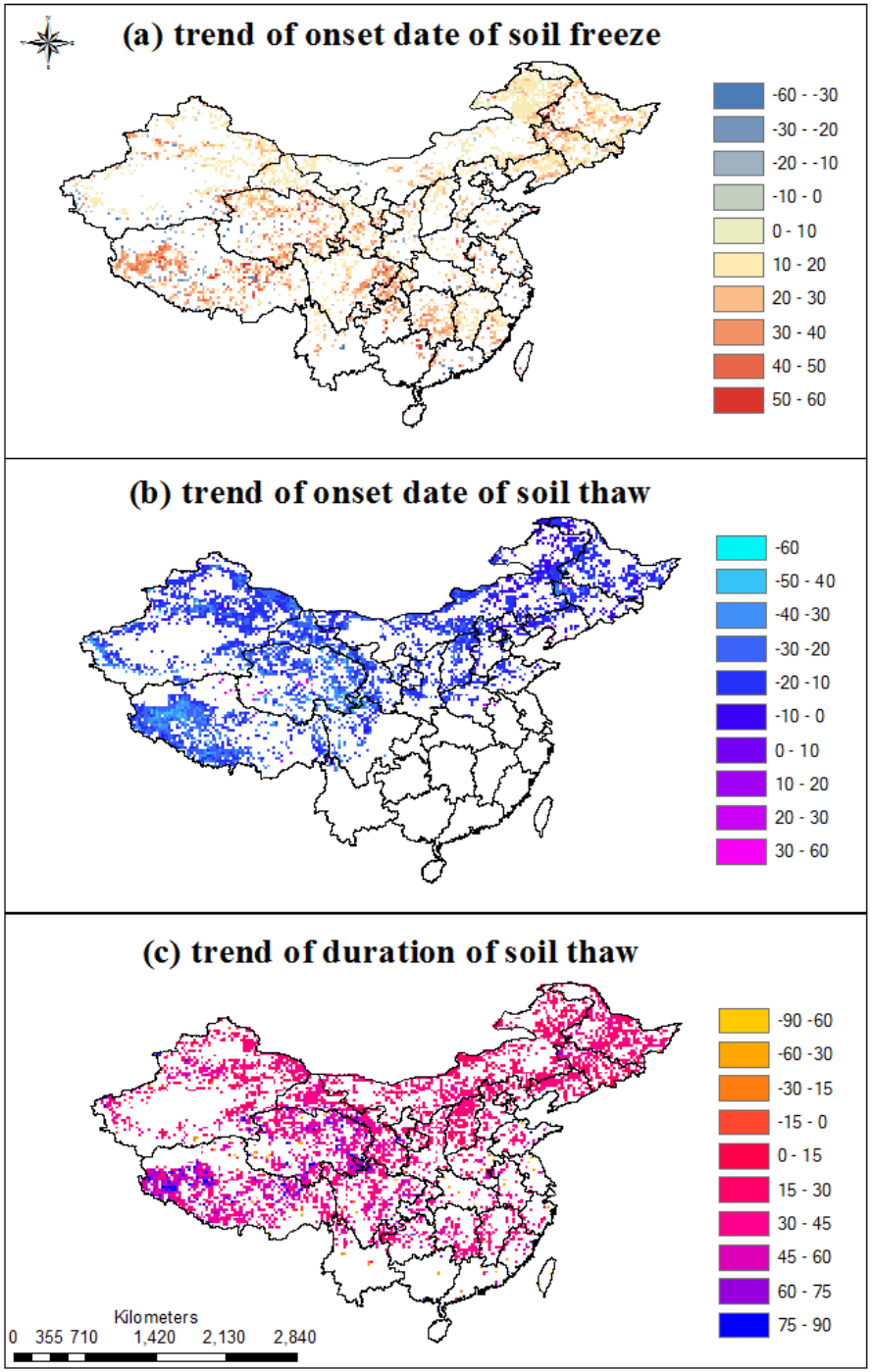




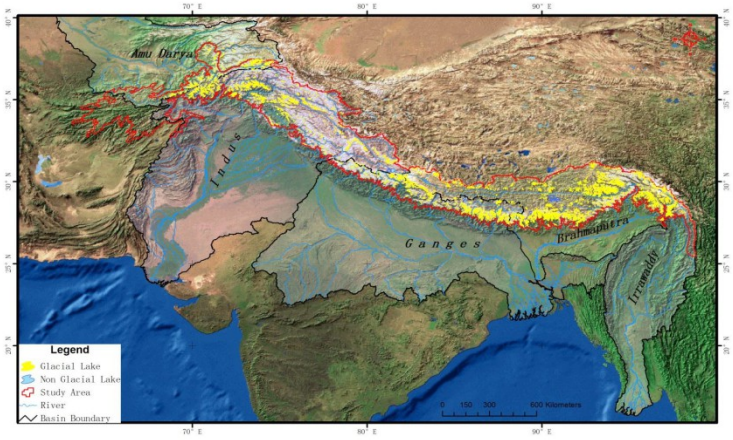
Trend Analysis

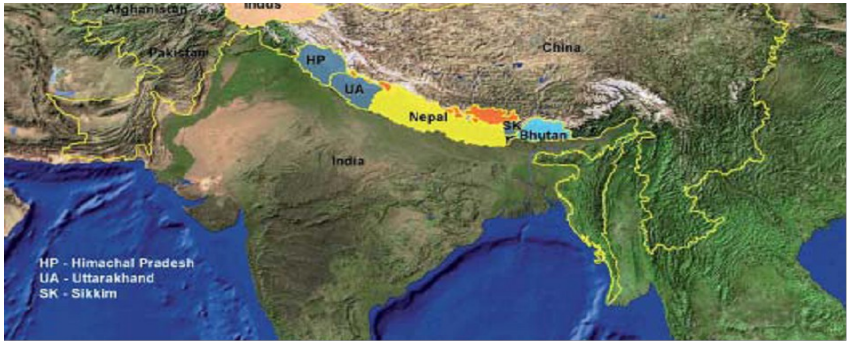
F-test, 90% Confidence

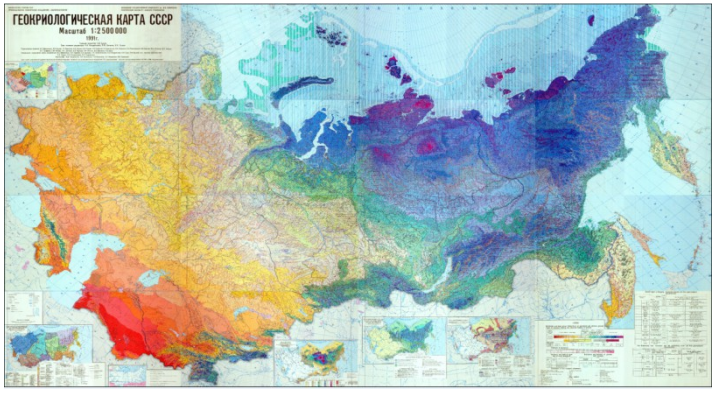
- onset date of soil freeze is postponed 19.6±14.6 days
- onset date of soil thaw is advanced -19.0±9.4 days
- duration of soil thaw is shortened for 34.3±16.5 days

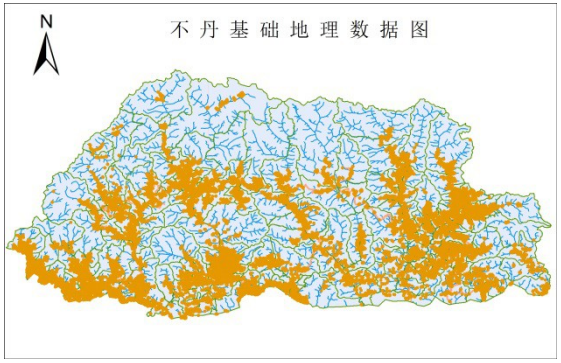
Li et al., 2012, JAE; Jin et al., 2013

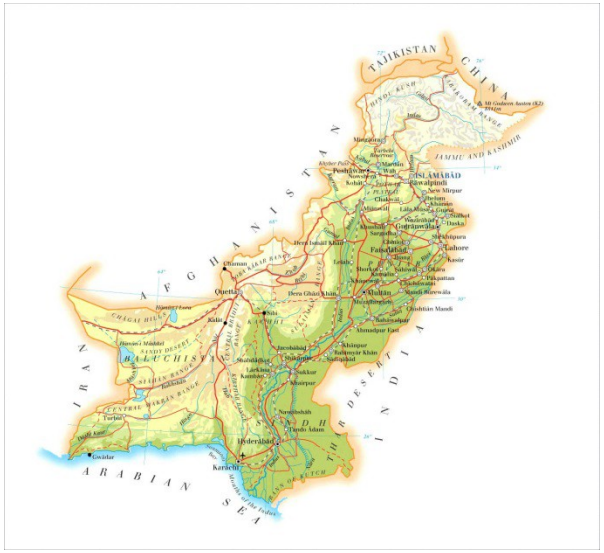
2.4 High Asia cryosphere data

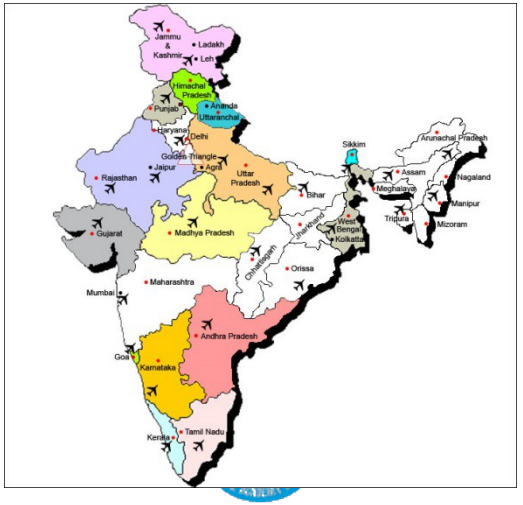




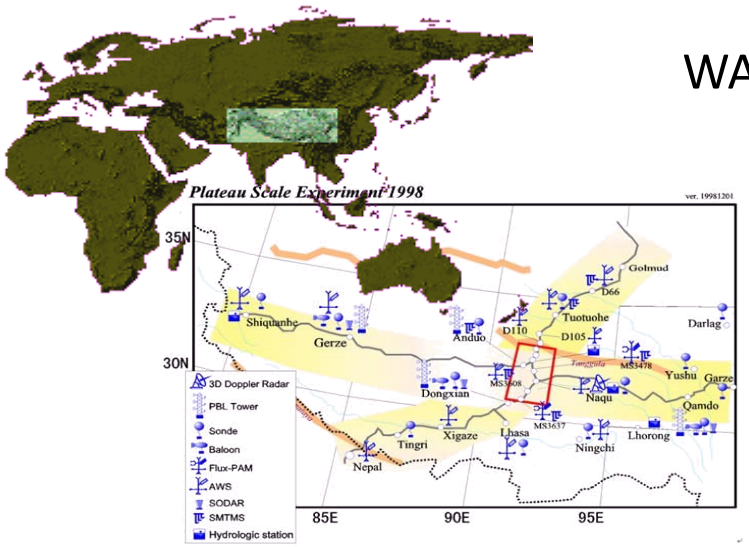






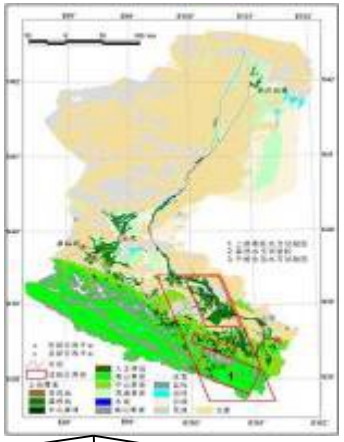


2.5 Representative datasets—field experiment datasets

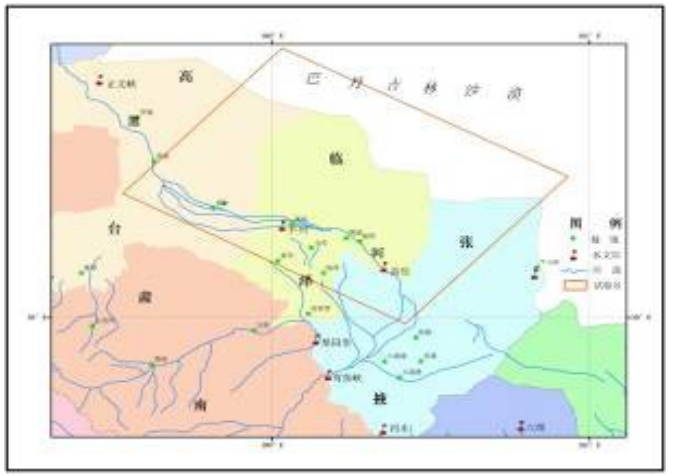


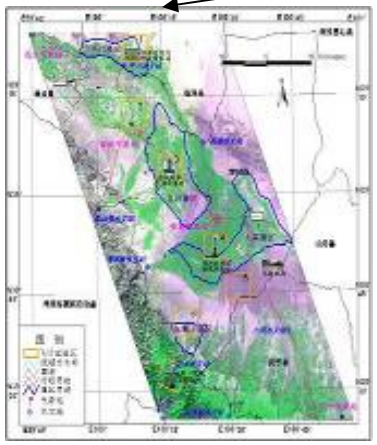
GAME Tibet

WATER experiment datasets



HEIFE





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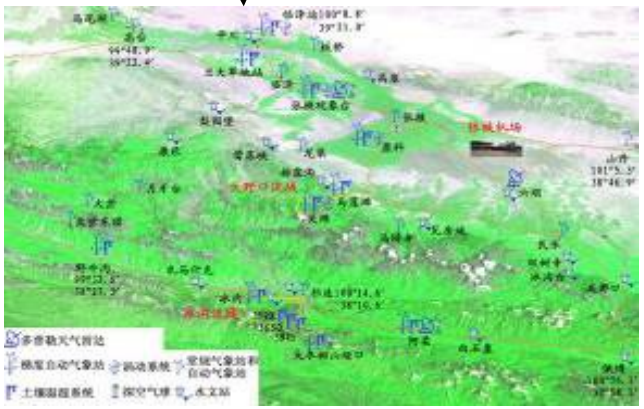
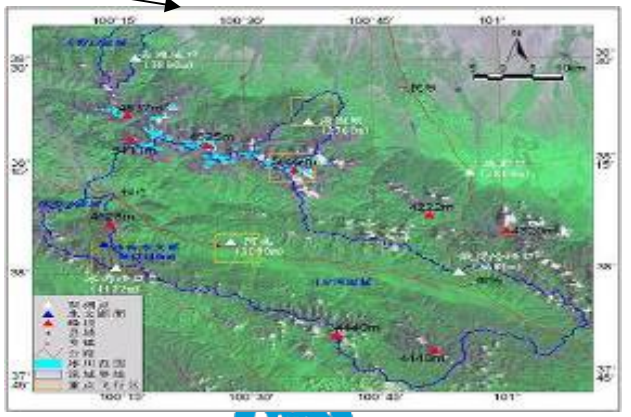


Hydro-meteor stations

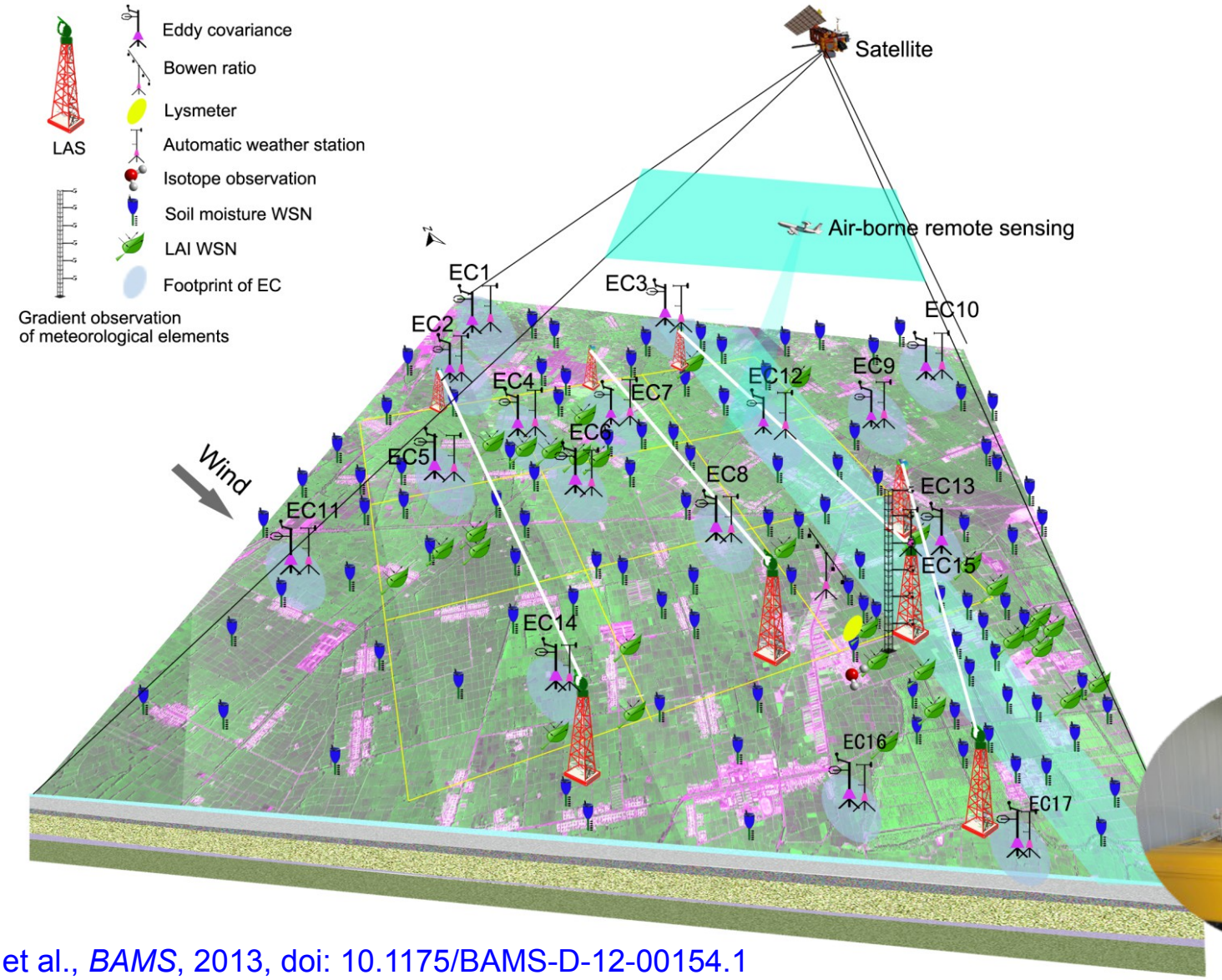


Hydro testings in cold area

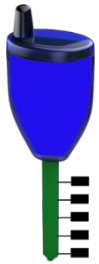
Data System for WATER (Watershed Allied Telemetry Experimental Research)

- Built from August 2008
- To acquire, interpret and publish data from the WATER experiment.

An observation matrix to capture the land surface heterogeneity

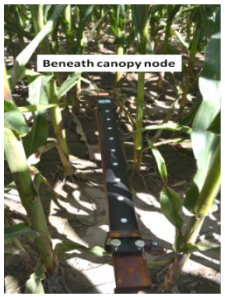


WATERNet



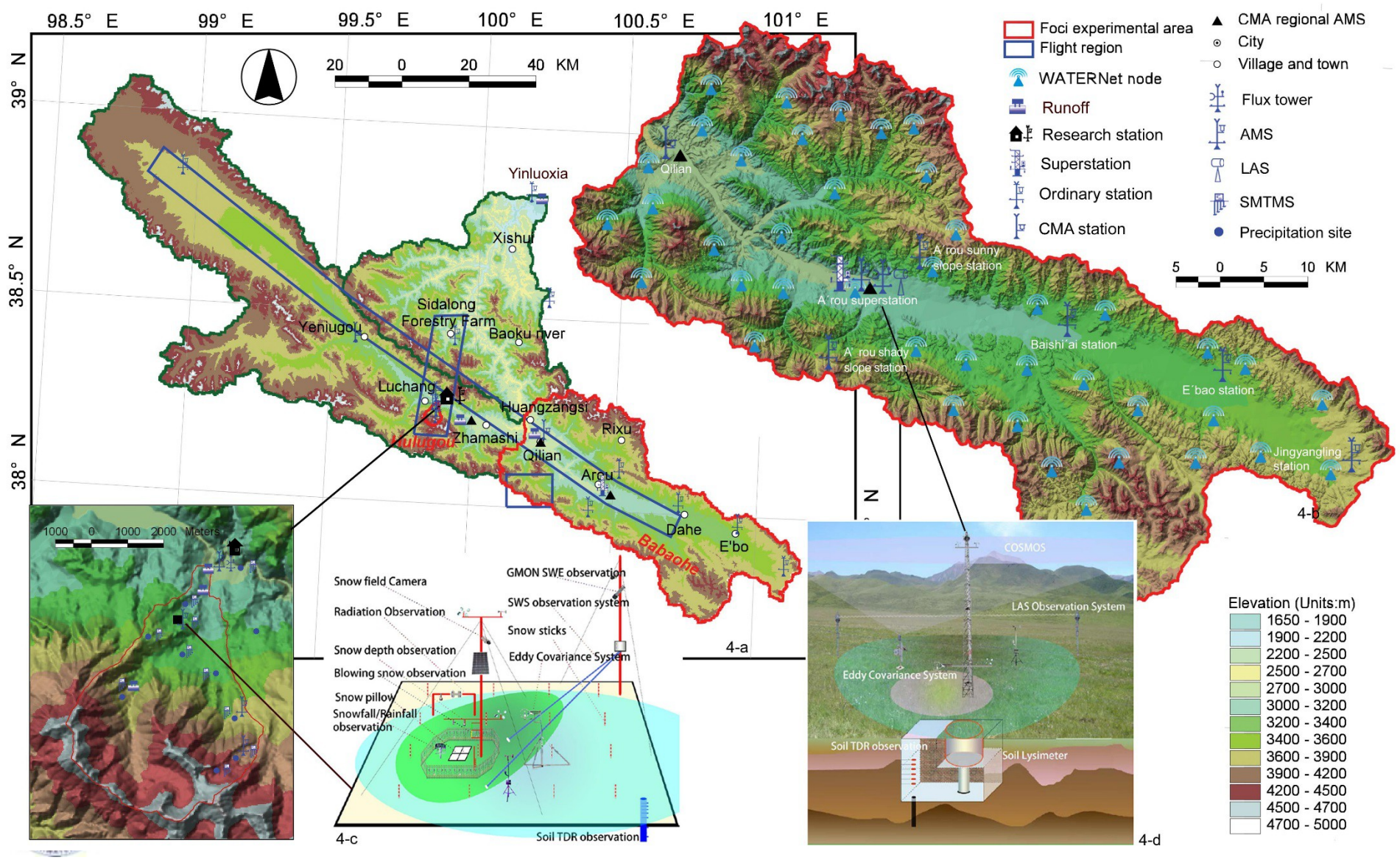
SoilNet

LAINet

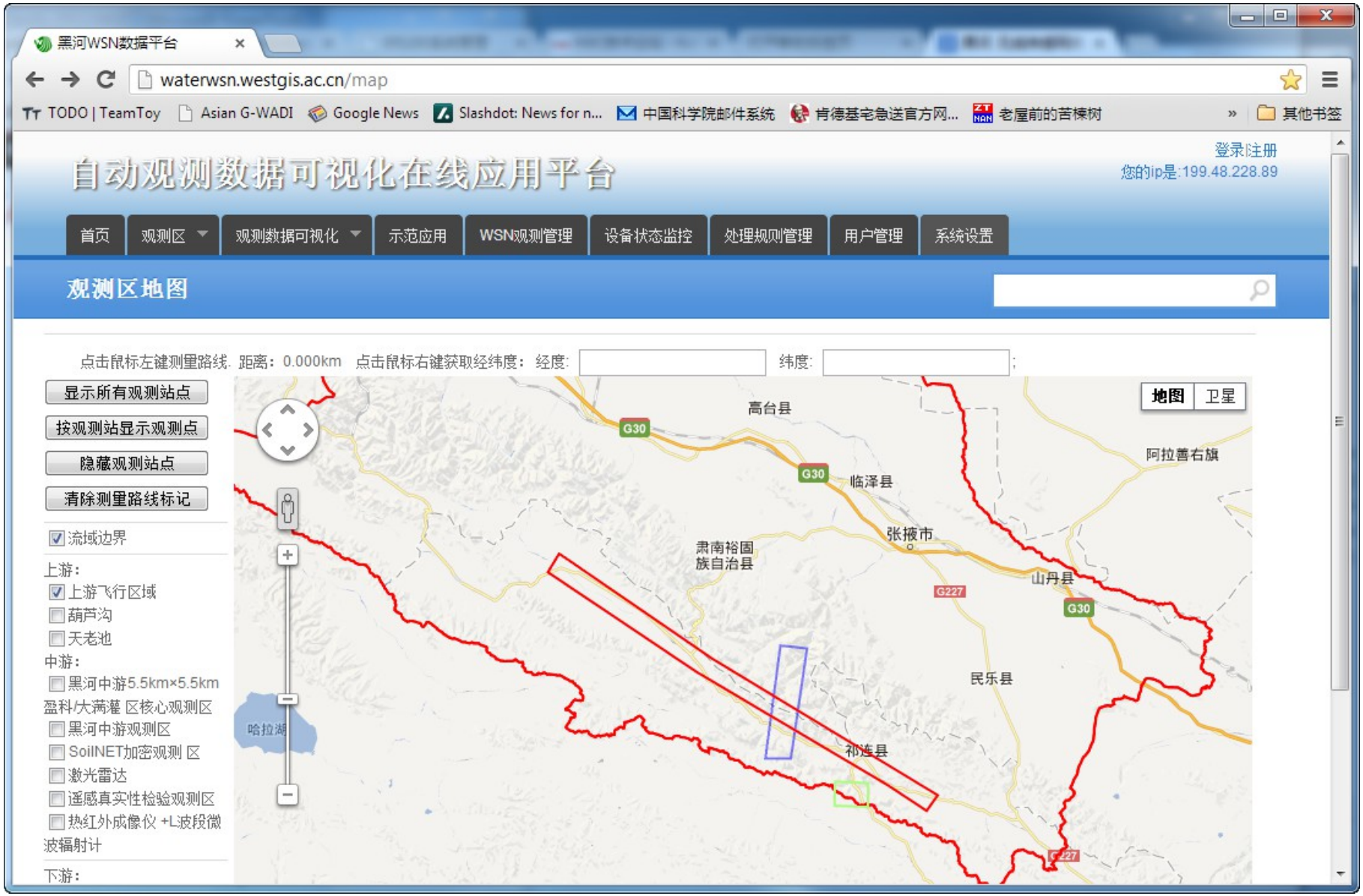


Li et al., *BAMS*, 2013, doi: 10.1175/BAMS-D-12-00154.1

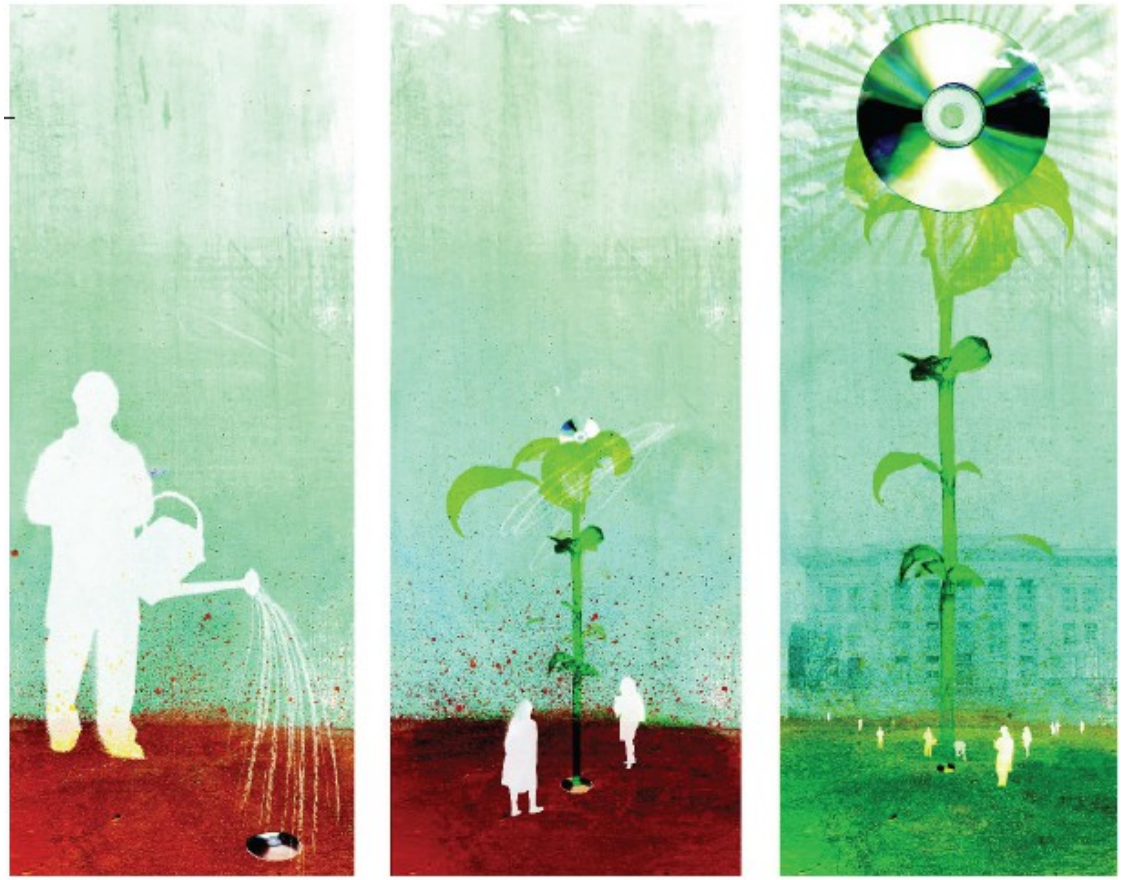
Upstream area instrumentation



Linking Wireless Sensor Network deployed in Heihe basin to the data system, automating data collection, quality control, visualization as well as device management



3. Data Service



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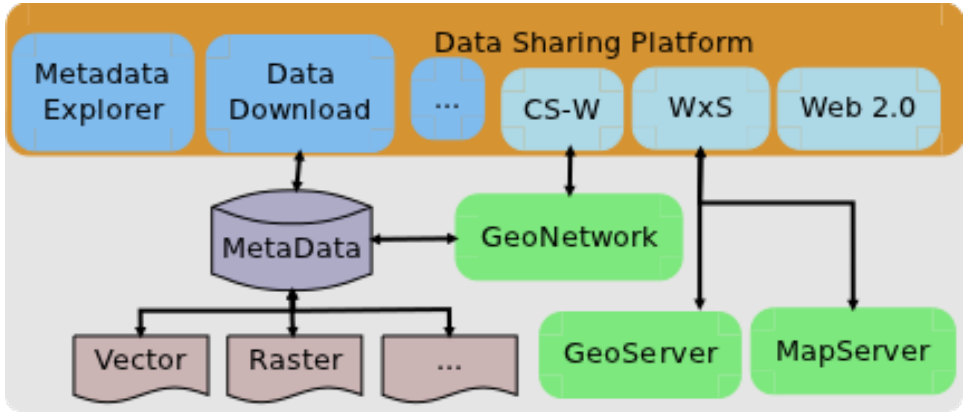
Technical infrastructure: Data Sharing Platform

- **Based on ISO 19115 metadata**
- **First use of DOI for data copyright in China**
- **Designated person for data service**
- **Data Sharing Policy: Full & Open**



Technical architecture

本数据引用方式

Tan, M., et al., 2003,2650-Year Beijing Stalagmite Layer Thickness and Temperature Reconstruction,IGBP PAGES/World Data Center for Paleoclimatology,Data Contribution Series # 2003-050.NOAA/NGDC Paleoclimatology Program, Boulder CO, USA.

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黑河综合遥感联合试验：盈科绿洲与花寨子荒漠加密观测区叶面积指数LAI观测数据集

WATER: Dataset of LAI measurements in the Yingke oasis and Huazhaizi desert steppe foci experimental areas

本数据集为盈科绿洲与花寨子荒漠加密观测区的叶面积指数数据集。

测量日期与内容：

2008-05-20、2008-05-24、2008-05-25、2008-05-28、2008-05-31、2008-06-06、2008-06-11、2008-06-12、2008-06-14、2008-06-16、2008-06-21、2008-06-27、2008-07-02、2008-07-09期间在盈科绿洲与花寨子荒漠加密观测区用LAI3000、量角器、直尺等测量了植被（玉米、小麦）结构参数。

测量方法为：利用直尺测量玉米和小麦每株各叶片的最大长度、最大宽度。将每片叶子分为三段测量叶倾角，并分别测量每段的长和宽。用尺子测量测量株高和每片叶子的叶基高。用皮尺测量同一垄上N株（如20株）作物的距离，由此得到株间距，同时测量冠层高，记录多个数据求平均值作为最终冠层高度。用皮尺测量垄距和垄间距。每块样地拔两株有代表性的植株回室内，测量杆长、杆宽、杆周长，并用LAI3000测量叶片最长、最宽以及面积。 数据以Excel保存。

本数据引用方式

范闻捷, 辛晓洲, 阎广建, 王锦地, 陶欣, 姚延娟, 闫彬彦, 沈心一, 周春艳, 李丽, 刘思含, 苏高利, 闻建光, 夏传福, 张阳, 周梦维, 陈玲, 任华忠, 肖月庭. 黑河综合遥感联合试验：盈科绿洲与花寨子荒漠加密观测区叶面积指数LAI观测数据集. 北京大学; 中国科学院遥感应用研究所; 北京师范大学. 2008. doi:10.3972/water973.0137.db [Fan Wenjie, Xin Xiaozhou, Yan Guangjian, Wang Jindi, Tao Xin, Yao Yanjuan, Yan Binyan, Shen Xinyi, Zhou Chunyan, Li Li, Liu Sihan, Su Gaoli, Wen Jianguang, Xia Chuanfu, Zhang Yang, Zhou Mengwei, Chen Ling, Ren Huazhong, Xiao Yueting. WATER: Dataset of LAI measurements in the Yingke oasis and Huazhaizi desert steppe foci experimental areas. Peking University; Institute of Remote Sensing Applications, Chinese Academy of Sciences; Beijing Normal University. 2008. doi:10.3972/water973.0137.db]

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项目支持信息

本试验的开展及数据的管理与发布获得了以下项目的支持：

1. 国家重点基础研究发展规划（973）项目：陆表生态环境要素主被动遥感协同反演理论与方法（项目编号:2007CB714400）

2. 中国科学院西部行动计划（二期）项目：黑河流域遥感—地面观测同步试验与综合模拟平台建设（项目编号:KZCX2-XB2-09）

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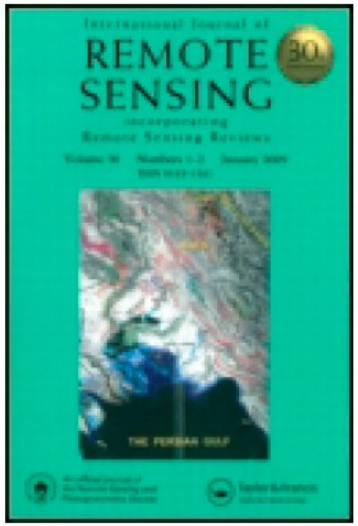

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Estimation of effects of a freezing environment on vegetation using model simulation and a truck-mounted microwave radiometer

Z. J. Zhang [a b], L. X. Zhang [b c], G. Q. Sun [d] & S. J. Zhao [b c]

ULABY, F.T., MOORE, R.K. and FUNG, A.K., 1986, *Microwave Remote Sensing: Active and Passive*, vol. 3 (Dedham, MA: Artech House).

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Services Statistics

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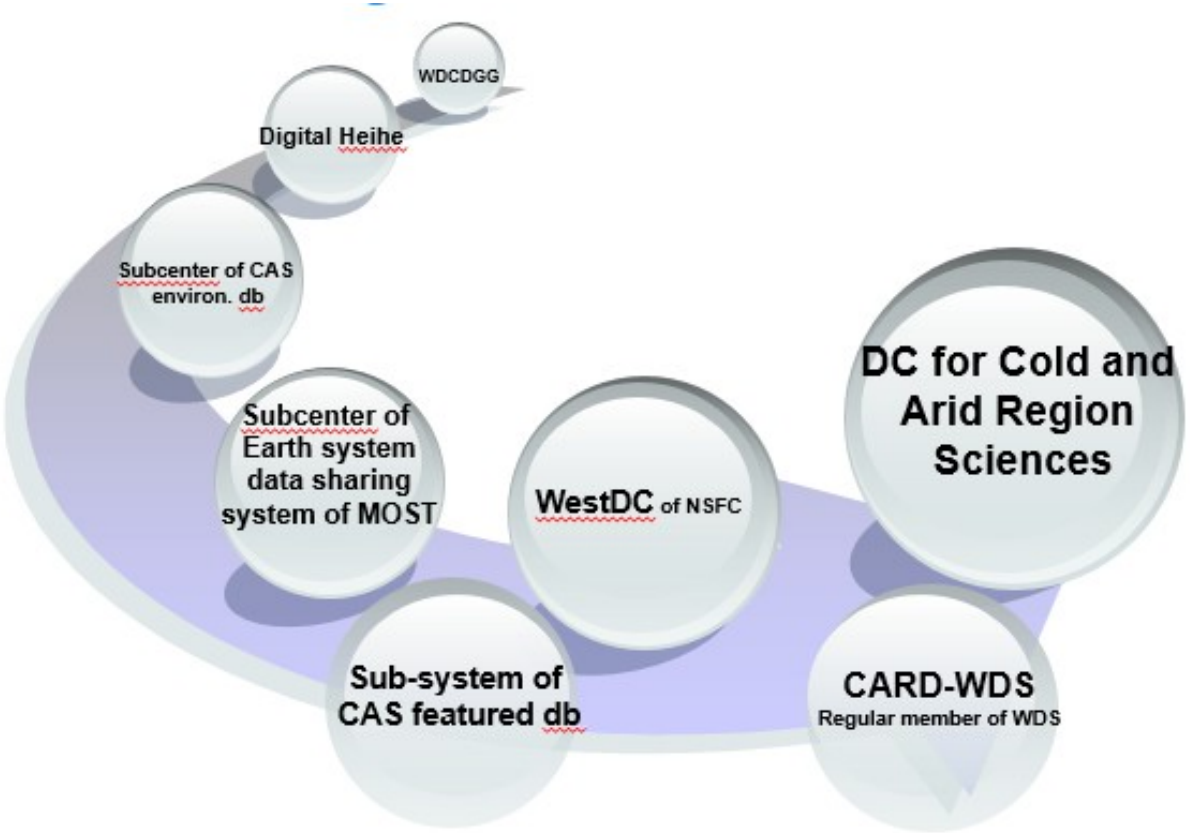
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