Supplementary Materials:

Changes of glaciers and glacial lakes implying corridor-barrier effects and climate change in the Hengduan Shan, southeastern Tibetan Plateau

Xin WANG,1, 2 Kaiguo CHAI,1 Shiyin LIU,2 Junfeng WEI,1 Zongli JIANG,1

Qionghuan LIU1

*1Department of Geography, Hunan University of Science and Technology, Xiangtan, China*

*2* *State Key Laboratory of Cryosphere Science, Northwest Institute of Eco-Environment and Resources, Chinese Academy of Sciences, Lanzhou, China*

*Correspondence: Xin Wang <*[*xinwang\_hn@163.com*](mailto:xinwang_hn@163.com)*>*

**1. Supplementary Figure**



Supplementary **Fig. S1** Spatial distribution of mean annual precipitation from ITPCAS in the Hengduan Shan for 1979–2012

The China Meteorological Forcing Dataset (CMFD, http://westdc.westgis.ac.cn/data/) was produced by merging a variety of data sources (China Meteorological Administration station data, TRMM satellite precipitation analysis data, GLDAS data, GEWEX-SRB downward shortwave radiation data). This dataset currently covers the period 1979-2012. Its spatial resolution is 0.1 deg. and its temporal resolution is 3-hr. The forcing dataset used in this study area was developed by Data Assimilation and Modeling Center for Tibetan Multi-spheres, Institute of Tibetan Plateau Research, Chinese Academy of Sciences (ITPCAS).

As Figure 1 shows, spatial distribution of average annual precipitation can be characterized by a decline from southwest (average 1150mm) and southeast (average 850mm/a) to the center of Ningjing–Yunling Shan (average 500mm), which indicates that the Ningjing–Yunling Shan is the important transitional zone for exchange of moisture and energy between southwest monsoon and southeast monsoon.

**2. Supplementary Tables**

Supplementary **Table S1** Variation of linear trends of mean annual precipitation and temperature from 1970 to 2014 in Hengduan Shan

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Station name | Altitude  (m) | North latitude | East Longitude | Precipitation(mm)  Average Rate(mm/a) | | Temperature(°C)  Average Rate (°C/a) | |
| Changdu | 3306 | 31°09′ | 97°10′ | 477 | 1.07 | 7.76 | 0.02\*\* |
| Dingqing | 3873 | 31°25′ | 95°36′ | 638 | 1.30 | 3.63 | 0.02\*\* |
| Shiqu | 4250 | 32°59′ | 98°06′ | 576 | 0.93 | -1.02 | 0.04\*\* |
| Ruoergai | 3440 | 33°35′ | 102°58′ | 640 | -0.35 | 1.39 | 0.05\*\* |
| Deige | 3200 | 31°48′ | 98°35′ | 623 | 1.00 | 6.84 | 0.02\*\* |
| Ganzi | 3380 | 31°37′ | 100°00′ | 658 | 0.29 | 5.89 | 0.03\*\* |
| Songpan | 2851 | 32°39′ | 103°34′ | 713 | -0.91 | 6.12 | 0.03\*\* |
| Maerkang | 2664 | 31°54′ | 102°14′ | 782 | 0.89 | 8.74 | 0.02\*\* |
| Daofu | 2957 | 30°59′ | 101°07′ | 613 | 0.79 | 8.09 | 0.02\*\* |
| Xiaojin | 2369 | 31°00′ | 102°21′ | 622 | 0.57 | 12.18 | 0.01\* |
| Batang | 2589 | 30°00′ | 99°06′ | 473 | 1.04 | 12.92 | 0.02\*\* |
| Xinlong | 3050 | 30°56′ | 100°19′ | 624 | 2.01\* | 7.68 | 0.02\*\* |
| Litang | 3949 | 30°00′ | 10016′ | 731 | 3.37\* | 3.59 | 0.04\*\* |
| Kangding | 2616 | 30°03′ | 101°58′ | 837 | 2.70\* | 7.26 | 0.02\*\* |
| Jiulong | 3760 | 29°00′ | 101°30′ | 915 | 1.56 | 9.08 | 0.02\*\* |
| Yuexi | 1660 | 28°39′ | 102°31′ | 1102 | -1.59 | 13.20 | 0.01\* |
| Muli | 2427 | 27°56′ | 101°16′ | 813 | -1.09 | 12.97 | 0.09\*\* |
| Daocheng | 3700 | 29°03′ | 100°18′ | 635 | 1.51 | 4.69 | 0.04\*\* |
| Yanyuan | 2545 | 27°26′ | 101°31′ | 806 | -1.24 | 12.40 | 0.01\* |
| Xichang | 1591 | 27°54′ | 102°16′ | 1003 | 1.78 | 17.12 | 0.02\*\* |
| Deiqin | 3319 | 28°29′ | 98°55′ | 635 | 0.98 | 5.68 | 0.05\*\* |
| Gongshan | 3300 | 27°45′ | 98°40′ | 1745 | -3.99 | 14.74 | 0.01\* |
| Xianggeli | 3277 | 27°50′ | 99°42′ | 637 | -0.42 | 6.18 | 0.04\*\* |
| Weixi | 2326 | 27°10′ | 99°17′ | 952 | -1.51 | 11.69 | 0.02\*\* |
| Lijiang | 2392 | 26°52′ | 100°13′ | 956 | 0.32 | 12.92 | 0.03\*\* |
| Huaping | 1245 | 26°38′ | 101°16′ | 1060 | -1.52 | 19.70 | 0.00 |
| Dali | 1991 | 25°42′ | 100°11′ | 1040 | -2.40 | 15.07 | 0.02\*\* |

The linear trend is considered to be statistically significant if it is significant at the 0.05 level. (\*\*) the trend is significant at the 0.01 level, (\*) the trend is significant at the 0.05 level, (None \*) the trend is not statistically significant at the 0.05 level.

Supplementary **Table S2** Information of Landsat images used in this study

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Time period | Date of acquisition | Satellite and sensor | Scene/product ID | Path/row | Cloud cover (%) | Resolution  (m) |
| ～2014 | 01/06/2014 | Landsat OLI | LC81300372014152LGN00 | 130/37 | 0 | 30 |
|  | 01/06/2014 | Landsat OLI | LC81300382014152LGN00 | 130/38 | 12 | 30 |
|  | 12/02/2015 | Landsat OLI | LC81300392015043LGN00 | 130/39 | 15 | 30 |
|  | 07/12/2013 | Landsat OLI | LC81300402013341LGN00 | 130/40 | 2 | 30 |
|  | 14/04/2014 | Landsat OLI | LC81300412014104LGN00 | 130/41 | 0 | 30 |
|  | 27/08/2014 | Landsat OLI | LC81310362014239LGN00 | 131/36 | 5 | 30 |
|  | 01/10/2015 | Landsat OLI | LC81310372015274LGN00 | 131/37 | 0 | 30 |
|  | 15/11/2014 | Landsat OLI | LC81310382014319LGN00 | 131/38 | 3 | 30 |
|  | 02/01/2015 | Landsat OLI | LC81310392015002LGN00 | 131/39 | 3 | 30 |
|  | 31/01/2014 | Landsat OLI | LC81310402014031LGN00 | 131/40 | 2 | 30 |
|  | 11/10/2013 | Landsat OLI | LC81310412013284LGN00 | 131/41 | 0 | 30 |
|  | 19/09/2014 | Landsat OLI | LC81320372014262LGN00 | 132/37 | 3 | 30 |
|  | 21/10/2014 | Landsat OLI | LC81320382014294LGN00 | 132/38 | 1 | 30 |
|  | 21/10/2014 | Landsat OLI | LC81320392014294LGN00 | 132/39 | 0 | 30 |
|  | 06/01/2014 | Landsat OLI | LC81320402014006LGN00 | 132/40 | 2 | 30 |
|  | 15/04/2015 | Landsat OLI | LC81320412015105LGN00 | 132/41 | 3 | 30 |
|  | 24/12/2014 | Landsat OLI | LC81320422014358LGN00 | 132/42 | 0 | 30 |
|  | 13/11/2014 | Landsat OLI | LC81330372014317LGN00 | 133/37 | 4 | 30 |
|  | 29/09/2015 | Landsat OLI | LC81330382015272LGN00 | 133/38 | 0 | 30 |
|  | 29/09/2015 | Landsat OLI | LC81330392015272LGN00 | 133/39 | 0 | 30 |
|  | 09/10/2013 | Landsat OLI | LC81330402013282LGN00 | 133/40 | 7 | 30 |
|  | 19/04/2014 | Landsat OLI | LC81330412014109LGN00 | 133/41 | 7 | 30 |
|  | 13/08/2013 | Landsat OLI | LC81340372013225LGN00 | 134/37 | 0 | 30 |
|  | 20/11/2014 | Landsat OLI | LC81340382014324LGN00 | 134/38 | 2 | 30 |
|  | 10/06/2013 | Landsat OLI | LC81340392013161LGN00 | 134/39 | 5 | 30 |
|  | 06/10/2015 | Landsat OLI | LC81340402015279LGN00 | 134/40 | 6 | 30 |
|  | 19/05/2014 | Landsat OLI | LC81350382014139LGN00 | 135/38 | 5 | 30 |
|  | 29/12/2014 | Landsat OLI | LC81350392014363LGN00 | 135/39 | 8 | 30 |
| ～2000 | 01/11/2000 | Landsat TM | LT51300372000306BJC00 | 130/37 | 0 | 30 |
|  | 13/06/2001 | Landsat TM | LT51300382001164BJC00 | 130/38 | 0 | 30 |
|  | 13/06/2001 | Landsat TM | LT51300392001164BJC00 | 130/39 | 0 | 30 |
|  | 02/01/2000 | Landsat TM | LT51300402000002BJC00 | 130/40 | 19 | 30 |
|  | 09/05/2000 | Landsat TM | LT51300412000130BKT01 | 130/41 | 3 | 30 |
|  | 21/09/2000 | Landsat TM | LT51310362000265BJC00 | 131/36 | 0 | 30 |
|  | 21/09/2000 | Landsat TM | LT51310372000265BJC00 | 131/37 | 0 | 30 |
|  | 12/08/2000 | Landsat ETM+ | LE71310382000225SGS00 | 131/38 | 4 | 30 |
|  | 21/09/2000 | Landsat TM | LT51310392000265BJC00 | 131/39 | 8 | 30 |
|  | 09/01/2000 | Landsat TM | LT51310402000009BJC00 | 131/40 | 17 | 30 |
|  | 02/12/2000 | Landsat ETM+ | LE71310412000337SGS00 | 131/41 | 1 | 30 |
|  | 09/10/2001 | Landsat ETM+ | LE71320372001282SGS00 | 132/37 | 0 | 30 |
|  | 14/08/2001 | Landsat TM | LT51320382001226BJC00 | 132/38 | 1 | 30 |
|  | 14/08/2001 | Landsat TM | LT51320392001226BJC00 | 132/39 | 4 | 30 |
|  | 02/11/2001 | Landsat TM | LT51320402001306BJC00 | 132/40 | 1 | 30 |
|  | 29/11/1999 | Landsat TM | LT51320411999333BKT00 | 132/41 | 0 | 30 |
|  | 15/11/2000 | Landsat TM | LT51320422000320BJC00 | 132/42 | 3 | 30 |
|  | 05/10/2000 | Landsat TM | LT51330372000279BJC00 | 133/37 | 0 | 30 |
|  | 05/10/2000 | Landsat TM | LT51330382000279BJC00 | 133/38 | 0 | 30 |
|  | 14/05/2000 | Landsat TM | LT51330392000135BJC00 | 133/39 | 1 | 30 |
|  | 25/11/2001 | Landsat TM | LT51330402001329BJC00 | 133/40 | 19 | 30 |
|  | 16/02/2000 | Landsat ETM+ | LE71330412000047SGS00 | 133/41 | 1 | 30 |
|  | 04/10/2000 | Landsat ETM+ | LE71340372000278SGS00 | 134/37 | 1 | 30 |
|  | 13/05/2000 | Landsat ETM+ | LE71340382000134SGS00 | 134/38 | 1 | 30 |
|  | 13/05/2000 | Landsat ETM+ | LE71340392000134SGS01 | 134/39 | 0 | 30 |
|  | 05/05/2000 | Landsat TM | LT51340402000126BJC00 | 134/40 | 0 | 30 |
|  | 07/03/1999 | Landsat TM | LT51350381999066BKT00 | 135/38 | 9 | 30 |
|  | 12/05/2000 | Landsat TM | LT51350392000133BJC00 | 135/39 | 1 | 30 |
| ～1990 | 11/11/1992 | Landsat TM | LT51300371992316BJC01 | 130/37 | 20 | 30 |
|  | 11/11/1992 | Landsat TM | LT51300381992316BJC01 | 130/38 | 28 | 30 |
|  | 11/11/1992 | Landsat TM | LT51300391992316BJC01 | 130/39 | 33 | 30 |
|  | 19/01/1989 | Landsat TM | LT51300401989019BKT00 | 130/40 | 12 | 30 |
|  | 07/02/1990 | Landsat TM | LT51300411990038BKT00 | 130/41 | 5 | 30 |
|  | 25/06/1991 | Landsat TM | LT51310361991176BJC00 | 131/36 | 0 | 30 |
|  | 02/01/1989 | Landsat TM | LT41310371989002XXX02 | 131/37 | 0 | 30 |
|  | 02/01/1989 | Landsat TM | LT41310381989002XXX02 | 131/38 | 0 | 30 |
|  | 02/01/1989 | Landsat TM | LT41310391989002XXX02 | 131/39 | 0 | 30 |
|  | 18/03/1990 | Landsat TM | LT51310401990077BKT00 | 131/40 | 3 | 30 |
|  | 05/05/1990 | Landsat TM | LT51310411990125BKT00 | 131/41 | 6 | 30 |
|  | 25/01/1989 | Landsat TM | LT41320371989025AAA02 | 132/37 | 20 | 30 |
|  | 25/01/1989 | Landsat TM | LT41320381989025AAA02 | 132/38 | 10 | 30 |
|  | 25/01/1989 | Landsat TM | LT41320391989025AAA02 | 132/39 | 0 | 30 |
|  | 07/11/1991 | Landsat TM | LT51320401991311BKT00 | 132/40 | 2 | 30 |
|  | 04/11/1990 | Landsat TM | LT51320411990308BKT01 | 132/41 | 0 | 30 |
|  | 01/09/1990 | Landsat TM | LT51320421990244BKT00 | 132/42 | 7 | 30 |
|  | 31/12/1988 | Landsat TM | LT41330371988366XXX02 | 133/37 | 20 | 30 |
|  | 13/10/1991 | Landsat TM | LT51330381991286BKT00 | 133/38 | 6 | 30 |
|  | 13/10/1991 | Landsat TM | LT51330391991286BKT00 | 133/39 | 0 | 30 |
|  | 31/12/1988 | Landsat TM | LT41330401988366XXX02 | 133/40 | 0 | 30 |
|  | 13/12/1990 | Landsat TM | LT51330411990347BKT01 | 133/41 | 14 | 30 |
|  | 30/08/1990 | Landsat TM | LT51340371990242BKT02 | 134/37 | 6 | 30 |
|  | 23/01/1989 | Landsat TM | LT41340381989023AAA01 | 134/38 | 10 | 30 |
|  | 24/04/1990 | Landsat TM | LT51340391990114BKT02 | 134/39 | 13 | 30 |
|  | 24/04/1990 | Landsat TM | LT51340401990114BKT02 | 134/40 | 18 | 30 |
|  | 17/05/1990 | Landsat TM | LT51350381990137BKT00 | 135/38 | 2 | 30 |
|  | 17/05/1990 | Landsat TM | LT51350391990137BKT00 | 135/39 | 2 | 30 |