



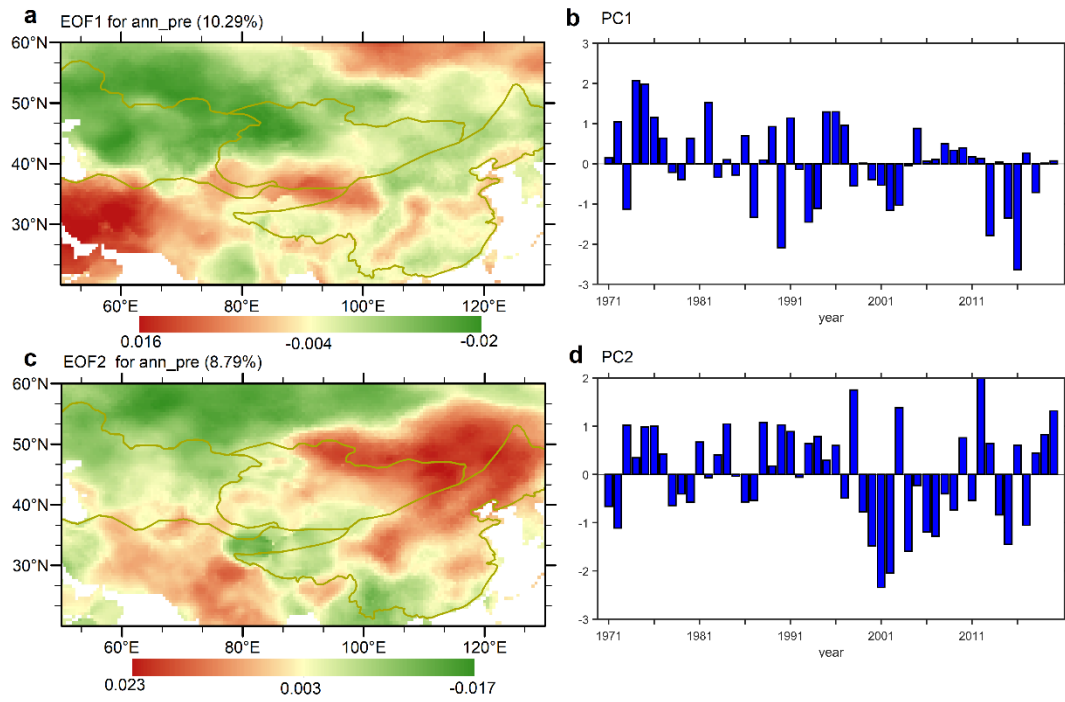
*Supplement of*

## **Simultaneous seasonal dry/wet signals in eastern and central Asia since the Last Glacial Maximum**

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**Figure S1.** The EOF modes and corresponding time series of annual mean precipitation in EA and CA over 1971–2020.

**Table S1.** Paleoclimate records selected in this study.

| Code | Section name       | Record type | Lat   | Lon   | Evaluation (m a.s.l) | Precipitation regime | Dating materials                                 | Dating Method   | Time period (cal ka BP) | Proxy  | Proxy indication     | References                                    |
|------|--------------------|-------------|-------|-------|----------------------|----------------------|--|-----------------|-------------------------|--|----------------------|---|
| 1    | Caspian Sea        | Lake        | 41.93 | 50.67 | -28                  | winter               | Ostracods  | <sup>14</sup> C | 12.4-2.4                | Pollen   | Moisture             | Leroy et al. (2014)                           |
| 2    | YE section         | Loess       | 37.60 | 55.43 | 383                  | winter               | Quartz   | OSL             | 11.8-0                  | $\delta^{13}\text{C}_{\text{org}}$   | Moisture             | Wang et al. (2020)                            |
| 3    | Ton Cave           | Speleothem  | 38.40 | 67.34 | 3226                 | winter               | Carbonate  | U-Th            | 135-0                   | $\delta^{13}\text{C}$  | Moisture             | Cheng et al. (2016)                           |
| 4    | Valikhanov section | Loess       | 43.17 | 69.31 | 1000                 | winter               | Bulk organic matter, charcoal                    | <sup>14</sup> C | 46-0                    | $\delta^{13}\text{C}$  | Moisture             | Ran and Feng (2014)                           |
| 5    | Osh section        | Loess       | 40.61 | 73.01 | 1038                 | winter               | Humins   | <sup>14</sup> C | 30-0                    | Grain-size, MS   | Effective moisture   | Li et al. (2021)                              |
| 6    | Lake Karakul       | Lake        | 39.02 | 73.53 | 3915                 | winter               | plant remains, bulk sediments, living charophyte | <sup>14</sup> C | ~29-0                   | TIC, TOC, C/N, Grain-size, $\delta^{13}\text{C}_{\text{carb}}$ , $\delta^{18}\text{O}$ | Moisture             | Heinecke et al. (2017); Mischke et al. (2017) |
| 7    | BSK section        | Loess       | 42.70 | 74.78 | 1432                 | winter               | Bulk organic matter                              | <sup>14</sup> C | 26-0                    | Grain-size, MS, color proxies  | Moisture             | Li et al. (2020a)                             |
| 8    | Lake Issyk-Kul     | Lake        | 42.50 | 77.10 | 1607                 | summer               | Bulk sediments                                   | <sup>14</sup> C | 12.75-3.6               | $\delta^{18}\text{O}$ , $\delta^{13}\text{C}$ , Pollen, CaCO <sub>3</sub> , MS         | Moisture             | Ricketts et al. (2001); Leroy et al. (2021)   |
| 9    | HC14 section       | Loess       | 43.88 | 80.60 | 554                  | summer               | Bulk organic matter                              | <sup>14</sup> C | 10-0                    | MS   | Moisture             | Jia et al. (2021)                             |
| 10   | ZS section         | Loess       | 42.93 | 80.96 | 1650                 | summer               | Quartz   | OSL             | 12.6-0                  | Grain-size, MS   | Moisture             | Kang et al. (2020)                            |
| 11   | Lake Sayram        | Lake        | 41.50 | 81.03 | 2072                 | summer               | Bulk sediments                                   | <sup>14</sup> C | 13.8-0                  | Pollen   | Moisture             | Jiang et al. (2013, 2022)                     |
| 12   | Kesang Cave        | Speleothem  | 42.87 | 81.75 | ~2000                | summer               | Carbonate  | U-Th            | 22.8-0                  | $\delta^{18}\text{O}$  | Precipitation        | Cheng et al. (2012, 2016)                     |
| 13   | Yili section       | Loess       | 43.86 | 81.97 | 928                  | summer               | Charcoal   | <sup>14</sup> C | 15-0                    | A/C ratio  | Moisture             | Li et al. (2011)                              |
| 14   | Lake Aibi          | Lake        | 45.01 | 82.86 | 200                  | summer               | Bulk sediments                                   | <sup>14</sup> C | 13.8-0                  | Pollen   | Moisture             | Wang et al. (2013)                            |
| 15   | XEB section        | Loess       | 43.42 | 82.99 | 888                  | summer               | Quartz   | OSL             | 12-0                    | Grain-size, MS   | Moisture             | Kang et al. (2020)                            |
| 16   | TLD16 section      | Loess       | 43.36 | 83.02 | 1567                 | summer               | Quartz   | OSL             | 20-0                    | MS   | Moisture             | Jia et al. (2021)                             |
| 17   | ZKT section        | Loess       | 43.53 | 83.30 | 846                  | summer               | Bulk organic matter                              | <sup>14</sup> C | 16-0                    | MS   | Moisture             | Chen et al. (2016); Jia et al. (2021)         |
| 18   | KS16 section       | Loess       | 43.43 | 83.62 | 1314                 | summer               | Quartz   | OSL             | 12-0                    | MS   | Moisture             | Jia et al. (2021)                             |
| 19   | Baluk Cave         | Speleothem  | 42.43 | 84.73 | 2400                 | summer               | Carbonate  | U-Th            | 9.3-0                   | Trace elements   | Moisture             | Liu et al. (2020)                             |
| 20   | LJW 10 section     | Loess       | 43.97 | 85.33 | 1462                 | summer               | Quartz and K-feldspar                            | OSL             | 16-0                    | MS   | Moisture             | Chen et al. (2016)                            |
| 21   | Lake Bosten        | Lake        | 41.94 | 86.76 | 1048                 | summer               | Bulk organic matter, plant, tree leaves          | <sup>14</sup> C | 8.2-0                   | Pollen   | Moisture             | Huang et al. (2009)                           |
| 22   | Narenxia peat      | Peat        | 48.80 | 86.90 | 1760                 | summer               | Bulk peat, lake mud                              | <sup>14</sup> C | 11.8-0                  | Pollen, $\delta^{13}\text{C}$  | Annual precipitation | Feng et al. (2017); Zhang and Feng (2018)     |
| 23   | Lake Kanas         | Lake        | 48.70 | 87.01 | 1365                 | summer               | Terrestrial plant macrofossils                   | <sup>14</sup> C | 13.4-0                  | Pollen   | Annual precipitation | Huang et al. (2018)                           |
| 24   | Big Black peat     | Peat        | 48.68 | 87.18 | 2168                 | summer               | Cellulose  | <sup>14</sup> C | 9.5-0                   | Pollen, $\delta^{18}\text{O}$ , $\delta^{13}\text{C}$                                  | Moisture             | Xu et al. (2019)                              |
| 25   | Lake               | Lake        | 47.20 | 87.29 | 479                  | summer               | Bulk organic matter                              | <sup>14</sup> C | 9.5-0                   | Pollen, $\delta^{13}\text{C}$ , grain-   | Moisture             | Liu et al. (2008)                             |

|    |                       |             |       |       |      |        |  |                      |        |   |                                       |   |
|----|-----------------------|-------------|-------|-------|------|--------|--|----------------------|--------|---|---------------------------------------|---|
| 26 | Wulungu<br>ZL section | Loess       | 43.50 | 87.33 | 1756 | summer | K-feldspar                                       | OSL                  | 10.8-0 | size<br>MS  | Moisture                              | Chen et al. (2016); Gao et al. (2019)                   |
| 27 | Tuolehaite<br>peat    | Peat        | 48.44 | 87.54 | 1700 | summer | Plant residuals                                  | <sup>14</sup> C      | 10.6-0 | Pollen  | Moisture                              | Zhang et al. (2020)                                     |
| 28 | Chaiwopu<br>peat      | Peat        | 43.35 | 88.30 | 800  | summer | Plant, Bulk sediments                            | <sup>14</sup> C      | 11.5-0 | Pollen  | Moisture                              | Yang et al. (2021)                                      |
| 29 | Hoton Nurr            | Lake        | 48.67 | 88.30 | 2083 | summer | Bulk sediments                                   | <sup>14</sup> C      | 11.5-0 | Pollen  | Annual precipitation                  | Rudaya et al. (2009)                                    |
| 30 | Lake Akkol            | Lake        | 50.38 | 89.42 | 2204 | summer | Bulk sediments                                   | <sup>14</sup> C      | 10-0   | Pollen  | Vegetation change                     | Blyakharchuk et al. (2007)                              |
| 31 | Achit Nuur            | Lake        | 49.42 | 90.52 | 1444 | summer | Bulk sediments, root, mollusk                    | <sup>14</sup> C      | 22.6-0 | δ <sup>18</sup> O                                   | Annual precipitation                  | Sun et al. (2013)                                       |
| 32 | Lake Lup-Nur          | Lake        | 40.00 | 91.00 | 780  | summer | Quartz   | OSL                  | 9-0    | Soluble salt content, grain-size, ostracod, pollen, | Moisture                              | Liu et al. (2016)                                       |
| 33 | Lake Balikun          | Lake        | 43.67 | 92.80 | 1575 | summer | Bulk organic matter, plant macrofossils, pollen; | <sup>14</sup> C      | 29.1-0 | Pollen  | Moisture                              | Tao et al. (2010); An et al. (2012); Zhao et al. (2015) |
| 34 | Bayan Nurr            | Lake        | 49.98 | 93.95 | 932  | summer | Bulk sediments                                   | <sup>14</sup> C      | 15-0   | Pollen  | Annual precipitation                  | Tian et al. (2014)                                      |
| 35 | Qinghai Lake          | Lake        | 37.00 | 100.0 | 3200 | summer | Bulk organic matter                              | <sup>14</sup> C      | 18-0   | δ <sup>18</sup> O                                   | summer monsoon precipitation          | Shen et al. (2005); Liu et al. (2007)                   |
| 36 | Qilian section        | Loess       | 38.16 | 100.2 | 2810 | summer | Bulk organic matter                              | <sup>14</sup> C      | 22-0   | δ <sup>18</sup> O, δ <sup>13</sup> C                | Effective moisture                    | Li et al. (2020b)                                       |
| 37 | Lake Ulaan            | Lake        | 44.53 | 103.6 | 1024 | summer | Bull samples, quartz                             | <sup>14</sup> C, OSL | 17-0   | TOC   | Moisture                              | Lee et al. (2013)                                       |
| 38 | Dongge Cave           | Speleot hem | 25.28 | 108.0 | 680  | summer | Carbonate  | U-Th                 | 16-0   | δ <sup>18</sup> O                                   | summer monsoon precipitation          | Dykoski et al. (2005)                                   |
| 39 | Jiuxian Cave          | Speleot hem | 33.56 | 109.1 | 1495 | summer | Carbonate  | U-Th                 | 19-0   | δ <sup>18</sup> O                                   | summer monsoon precipitation          | Cai et al. (2010)                                       |
| 40 | Lianhua Cave          | Speleot hem | 29.48 | 109.5 | 455  | summer | Carbonate  | U-Th                 | 12.5-0 | δ <sup>18</sup> O                                   | summer monsoon precipitation strength | Zhang et al. (2013)                                     |
| 41 | Sanbao Cave           | Speleot hem | 31.66 | 110.4 | 1900 | summer | Carbonate  | U-Th                 | 13-0   | δ <sup>18</sup> O                                   | Summer rainfall                       | Dong et al. (2009)                                      |
| 42 | Hulu Cave             | Speleot hem | 32.50 | 119.1 | 90   | summer | Carbonate  | U-Th                 | Nov-75 | δ <sup>18</sup> O                                   | summer monsoon precipitation          | Wang et al. (2001)                                      |

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