**Supplementary Table 1.** List of CMIP5 models used in the study and their characteristics

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Model** | **Institute** | **Experiment** | **Variable and time frequency** | **Ensemble members** | **Latitude x longitude** |
| BCC-CSM1.1 | Beijing Climate Center, China Meteorological Administration | Decadal1980/ Decadal2005 | Monthly : Pr, Tasmax, Tasmin | r[1-4]i1p1 | ~2.8° x 2.8° |
| Daily : Pr |
| RCP4.5 / RCP8.5 | Monthly : Pr, Tasmax, Tasmin | r1i1p1 |
| Daily : Pr |
| CMCC-CM | Centro Euro-Mediterraneo per I Cambiamenti Climatici, Italy | Decadal1980/  Decadal2005 | Monthly : Pr, Tasmax, Tasmin | r1i[1-3]p1 | ~0.75° x 0.75° |
| Daily : Pr |
| RCP4.5 / RCP8.5 | Monthly : Pr, Tasmax, Tasmin | r1i1p1 |
| Daily : Pr |
| CNRM-CM5 | Centre National de Recherches Météorologiques,  Centre Européen de Recherche et Formation Avancée en Calcul Scientifique  France | Decadal1980 /Decadal2005 | Monthly : Pr, Tasmax, Tasmin | r[1-10]i1p1 | ~1.4° x 1.4° |
| Daily : Pr |
| RCP4.5 | Monthly : Pr, Tasmax, Tasmin | r1i1p1 |
| Daily : Pr |
| RCP8.5 | Monthly : Pr, Tasmax, Tasmin | r[1,2,4,6,10]i1p1 |
| Daily : Pr | r1i1p1 |
| FGOALS-g2 | Institute of Atmospheric Physics, Chinese Academy of Sciences  China | Decadal1980/Decadal 2005 | Monthly : Pr, Tasmax, Tasmin | r[1-3]i1p1 | ~2.8° x 2.815° |
| Daily : Pr |
| RCP4.5 / RCP8.5 | Monthly : Pr, Tasmax, Tasmin | r1i1p1 |
| Daily : Pr |
| IPSL-CM5A-LR | Institut Pierre Simon Laplace  France | Decadal1980/Decadal 2005 | Monthly : Pr, Tasmax, Tasmin | r[1-6]i1p1 | ~1.9° x 3.75° |
| Daily : Pr |
| RCP4.5 / RCP8.5 | Monthly : Pr, Tasmax, Tasmin | r[1-4]i1p1 |
| Daily : Pr |
| MIROC5 | Atmosphere and Ocean Research Institute (The University of Tokyo), National Institute for Environmental Studies, and Japan Agency for Marine-Earth Science and Technology  Japan | Decadal1980/Decadal 2005 | Monthly : Pr, Tasmax, Tasmin | r[1-6]i1p1 | ~1.4° x 1.4° |
| Daily : Pr |
| RCP4.5 / RCP8.5 | Monthly : Pr, Tasmax, Tasmin | r[1-3]i1p1 |
| Daily : Pr |
| MPI-ESM-LR | Max Planck Institute  for Meteorology  Germany | Decadal1980/Decadal 2005/RCP4.5/RCP8.5 | Monthly : Pr, Tasmax, Tasmin | r[1-3]i1p1 | ~1.9° x 1.875° |
| Daily : Pr |
| MRI-CGCM3 | Meteorological Research Institute  Japan | Decadal1980/Decadal 2005 | Monthly : Pr, Tasmax, Tasmin | r[1-3]i1p1 | ~1.1° x 1.125° |
| Daily : Pr |
| RCP4.5 / RCP8.5 | Monthly : Pr, Tasmax, Tasmin | r1i1p1 |

**Tasmax:** maximum temperature **Tasmin:** minimum temperature **Pr:** precipitation

**Source:** https://www.ipcc-data.org/sim/gcm\_monthly/AR5/Reference-Archive.html

**Supplementary Table 2.** Relative change in grain yield (kg/ha) in rainfed and irrigated conditions under RCP4.5 and RCP8.5

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **State** | **Rainfed** | | | | | | **Irrigated** | | | | | |
| **2013-2039** | | **2043-2069** | | **2073-2099** | | **2013-2039** | | **2043-2069** | | **2073-2099** | |
| **RCP4.5** | **RCP8.5** | **RCP4.5** | **RCP8.5** | **RCP4.5** | **RCP8.5** | **RCP4.5** | **RCP8.5** | **RCP4.5** | **RCP8.5** | **RCP4.5** | **RCP8.5** |
| North Dakota | 83 | 62 | 42 | 21 | 42 | -312 | 307 | 338 | 492 | 492 | 492 | 369 |
| Minnesota | 0 | 0 | -58 | -174 | -116 | -522 | 66 | 99 | 99 | 33 | 66 | -165 |
| South Dakota | -67 | -89 | -178 | -245 | -223 | -646 | 72 | 72 | 36 | -36 | 0 | -396 |
| Iowa | -66 | -100 | -199 | -366 | -266 | -930 | 39 | 0 | -39 | -118 | -78 | -510 |
| Illinois | -170 | -238 | -305 | -509 | -441 | -1154 | -40 | -40 | -121 | -201 | -161 | -644 |
| Indiana | -173 | -138 | -276 | -449 | -414 | -1036 | -41 | -41 | -81 | -162 | -122 | -567 |
| Ohio | -132 | -99 | -264 | -396 | -363 | -924 | 41 | 41 | 0 | -82 | -41 | -454 |
| Nebraska | -163 | -163 | -300 | -463 | -436 | -1062 | 0 | 0 | -120 | -200 | -120 | -760 |
| Kansas | -228 | -228 | -354 | -506 | -481 | -1062 | -121 | -161 | -281 | -442 | -362 | -1126 |
| Missouri | -187 | -187 | -312 | -467 | -405 | -1059 | -40 | -40 | -120 | -200 | -160 | -679 |

**Supplementary Table 3.** Relative change in water productivity (kg grain yield/ mm evapotranspiration) in rainfed and irrigated conditions under RCP4.5 and RCP8.5

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **State** | **Rainfed** | | | | | | **Irrigated** | | | | | |
| **2013-2039** | | **2043-2069** | | **2073-2099** | | **2013-2039** | | **2043-2069** | | **2073-2099** | |
| **RCP4.5** | **RCP8.5** | **RCP4.5** | **RCP8.5** | **RCP4.5** | **RCP8.5** | **RCP4.5** | **RCP8.5** | **RCP4.5** | **RCP8.5** | **RCP4.5** | **RCP8.5** |
| North Dakota | 0.4 | 0.3 | 0.3 | 0.2 | 0.2 | -0.7 | 0.7 | 0.8 | 1.0 | 1.0 | 1.0 | 0.3 |
| Minnesota | 0.2 | 0.1 | -0.1 | -0.2 | -0.2 | -1.3 | 0.3 | 0.3 | 0.2 | 0.1 | 0.1 | -0.8 |
| South Dakota | -0.1 | -0.1 | -0.4 | -0.6 | -0.6 | -1.8 | 0.1 | 0.1 | -0.2 | -0.4 | -0.3 | -1.6 |
| Iowa | -0.2 | -0.2 | -0.5 | -0.9 | -0.7 | -2.3 | 0.0 | 0.0 | -0.4 | -0.5 | -0.5 | -1.8 |
| Illinois | -0.4 | -0.5 | -0.8 | -1.3 | -1.0 | -2.8 | -0.2 | -0.2 | -0.5 | -0.9 | -0.6 | -2.1 |
| Indiana | -0.3 | -0.3 | -0.7 | -1.1 | -1.0 | -2.6 | -0.2 | -0.1 | -0.4 | -0.7 | -0.5 | -1.9 |
| Ohio | -0.3 | -0.2 | -0.6 | -0.9 | -0.8 | -2.2 | 0.0 | 0.0 | -0.3 | -0.5 | -0.4 | -1.6 |
| Nebraska | -0.3 | -0.3 | -0.8 | -1.2 | -1.0 | -2.7 | -0.2 | -0.2 | -0.5 | -0.8 | -0.6 | -2.3 |
| Kansas | -0.5 | -0.5 | -1.0 | -1.5 | -1.3 | -2.9 | -0.5 | -0.5 | -1.0 | -1.4 | -1.2 | -3.2 |
| Missouri | -0.4 | -0.4 | -0.7 | -1.2 | -1.0 | -2.6 | -0.2 | -0.2 | -0.5 | -0.9 | -0.7 | -2.2 |