

Reporting Summary

Nature Portfolio wishes to improve the reproducibility of the work that we publish. This form provides structure for consistency and transparency in reporting. For further information on Nature Portfolio policies, see our [Editorial Policies](#) and the [Editorial Policy Checklist](#).

Statistics

For all statistical analyses, confirm that the following items are present in the figure legend, table legend, main text, or Methods section.

- | | |
|-------------------------------------|--|
| n/a | Confirmed |
| <input type="checkbox"/> | <input checked="" type="checkbox"/> The exact sample size (n) for each experimental group/condition, given as a discrete number and unit of measurement |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> A statement on whether measurements were taken from distinct samples or whether the same sample was measured repeatedly |
| <input type="checkbox"/> | <input checked="" type="checkbox"/> The statistical test(s) used AND whether they are one- or two-sided
<i>Only common tests should be described solely by name; describe more complex techniques in the Methods section.</i> |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> A description of all covariates tested |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> A description of any assumptions or corrections, such as tests of normality and adjustment for multiple comparisons |
| <input type="checkbox"/> | <input checked="" type="checkbox"/> A full description of the statistical parameters including central tendency (e.g. means) or other basic estimates (e.g. regression coefficient) AND variation (e.g. standard deviation) or associated estimates of uncertainty (e.g. confidence intervals) |
| <input type="checkbox"/> | <input checked="" type="checkbox"/> For null hypothesis testing, the test statistic (e.g. F , t , r) with confidence intervals, effect sizes, degrees of freedom and P value noted
<i>Give P values as exact values whenever suitable.</i> |
| <input type="checkbox"/> | <input checked="" type="checkbox"/> For Bayesian analysis, information on the choice of priors and Markov chain Monte Carlo settings |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> For hierarchical and complex designs, identification of the appropriate level for tests and full reporting of outcomes |
| <input type="checkbox"/> | <input checked="" type="checkbox"/> Estimates of effect sizes (e.g. Cohen's d , Pearson's r), indicating how they were calculated |

Our web collection on [statistics for biologists](#) contains articles on many of the points above.

Software and code

Policy information about [availability of computer code](#)

- | | |
|-----------------|---|
| Data collection | No software was used to collect data. |
| Data analysis | Data analysis were performed using R 3.5.2 and Python 3.7.0. The code for the analysis is available at https://github.com/zhangyaonju/prec_sensitivity/ . Details were reported in the Method section. |

For manuscripts utilizing custom algorithms or software that are central to the research but not yet described in published literature, software must be made available to editors and reviewers. We strongly encourage code deposition in a community repository (e.g. GitHub). See the Nature Portfolio [guidelines for submitting code & software](#) for further information.

Data

Policy information about [availability of data](#)

All manuscripts must include a [data availability statement](#). This statement should provide the following information, where applicable:

- Accession codes, unique identifiers, or web links for publicly available datasets
- A description of any restrictions on data availability
- For clinical datasets or third party data, please ensure that the statement adheres to our [policy](#)

All data used in the analysis are publicly accessible. The GIMMS NDVI 3g v1 dataset is available at <http://poles.tpdc.ac.cn/en/data/9775f2b4-7370-4e5e-a537-3482c9a83d88/>, the CRU climate dataset is available at <https://crudata.uea.ac.uk/cru/data/hrg/>, the GPCC precipitation data is available at <https://www.dwd.de/EN/ourservices/gpcc/gpcc.html>, the MsTMIP model outputs are available at <https://doi.org/10.3334/ORNLDAAC/1225>, the CRU-NCEP V6 dataset is available through <https://doi.org/10.3334/ORNLDAAC/1220>, The aridity index data is available at <https://doi.org/10.6084/m9.figshare.7504448.v3>

Human research participants

Policy information about [studies involving human research participants and Sex and Gender in Research](#).

Reporting on sex and gender	NA
Population characteristics	NA
Recruitment	NA
Ethics oversight	NA

Note that full information on the approval of the study protocol must also be provided in the manuscript.

Field-specific reporting

Please select the one below that is the best fit for your research. If you are not sure, read the appropriate sections before making your selection.

- Life sciences Behavioural & social sciences Ecological, evolutionary & environmental sciences

For a reference copy of the document with all sections, see [nature.com/documents/nr-reporting-summary-flat.pdf](https://www.nature.com/documents/nr-reporting-summary-flat.pdf)

Ecological, evolutionary & environmental sciences study design

All studies must disclose on these points even when the disclosure is negative.

Study description	This study presents a satellite estimated long term increase of vegetation sensitivity to precipitation in global drylands. This robust trend is corroborated by model simulations and hydrological theory, both suggest that elevated atmospheric CO2 contributes to this increasing trend of vegetation sensitivity to precipitation in global drylands.
Research sample	We used satellite derived GIMMS NDVI and leaf area index, gross primary production, transpiration, evapotranspiration simulations from 10 models that participated the MsTMIP project. We also used various climate datasets to test the robustness of the precipitation sensitivity calculation. These data are available through the links described in the Data section. The observations/ simulations are spatially contiguous and can represent the entire study region.
Sampling strategy	We used satellite data and model simulations for vegetated land in low-to-mid latitude. To get the average response of the precipitation sensitivity along aridity index, we used bootstrap method and calculated the median of the sensitivity.
Data collection	All datasets were downloaded from Interenet using the URLs in the data availability statement in the main text. The NDVI data is from a series of NOAA satellites. CRU climate and GPCC precipitation datasets are interpolated from weather station observations. The MsTMIP model outputs are from computer simulations. The aridity index is derived from gridded climate data obtained from weather stations and spatial modeling.
Timing and spatial scale	The GIMMS NDVI 3g dataset has a 15-day temporal and 0.083 degree spatial resolution and is available during 1981-2015. The model simulations from MsTMIP have a monthly temporal resolution and 0.5 degree spatial resolution, covering 1980-2011. The spatial extent of our study is the land area between 50 degree North and 50 degree South. The time period we chose is restricted to the availability of satellite data. The satellite observations and model simulations are continuously through time during the study period.
Data exclusions	We excluded three models which present obvious errors in the precipitation sensitivity calculation.
Reproducibility	Our analyses were based on public satellite datasets, terrestrial biome model outputs, climate products and well-defined methods, the results could be reliably reproduced.

Randomization Randomization does not apply in this study as we performed wall-to-wall mapping globally with satellite images and gridded climate dataset.

Blinding Our study only used existing global gridded datasets which do not involve sample collection or selection, therefore blinding is not relevant to our study.

Did the study involve field work? Yes No

Reporting for specific materials, systems and methods

We require information from authors about some types of materials, experimental systems and methods used in many studies. Here, indicate whether each material, system or method listed is relevant to your study. If you are not sure if a list item applies to your research, read the appropriate section before selecting a response.

Materials & experimental systems

- | n/a | Involvement in the study |
|-------------------------------------|--|
| <input checked="" type="checkbox"/> | <input type="checkbox"/> Antibodies |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> Eukaryotic cell lines |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> Palaeontology and archaeology |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> Animals and other organisms |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> Clinical data |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> Dual use research of concern |

Methods

- | n/a | Involvement in the study |
|-------------------------------------|---|
| <input checked="" type="checkbox"/> | <input type="checkbox"/> ChIP-seq |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> Flow cytometry |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> MRI-based neuroimaging |