

Supplementary Information

Climate–human interactions drive widespread peatland subsidence and carbon vulnerability in China

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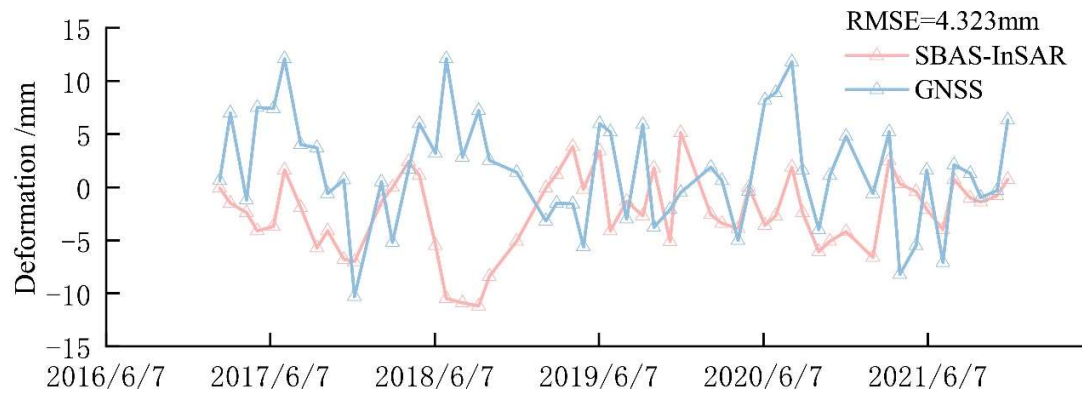
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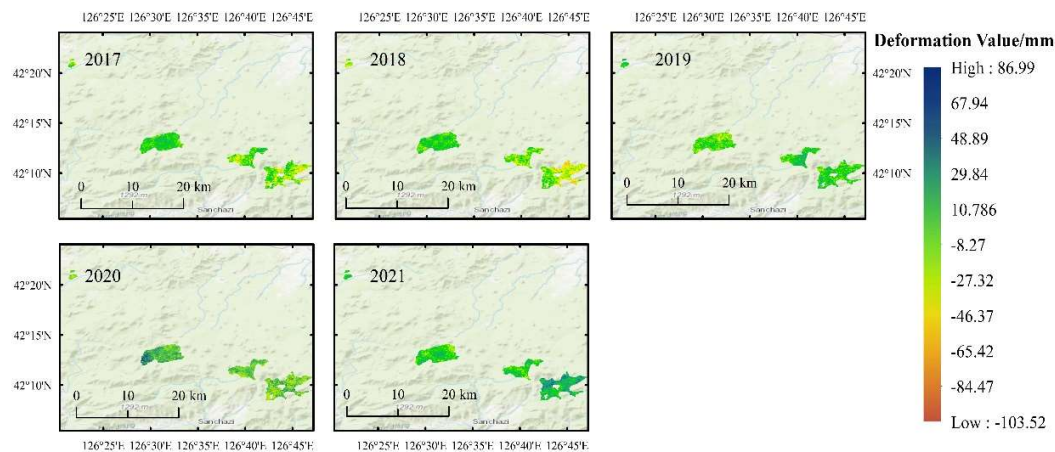
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Supplementary Figure 1 Validation of SBAS-InSAR-derived peatland surface deformation using GNSS benchmark observations

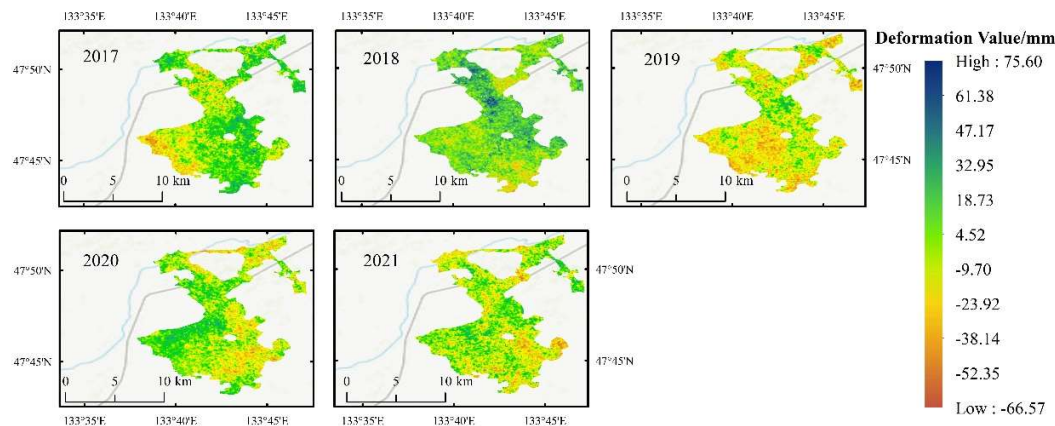


Supplementary Figure 2 Interannual subsidence trends of eight representative peatlands

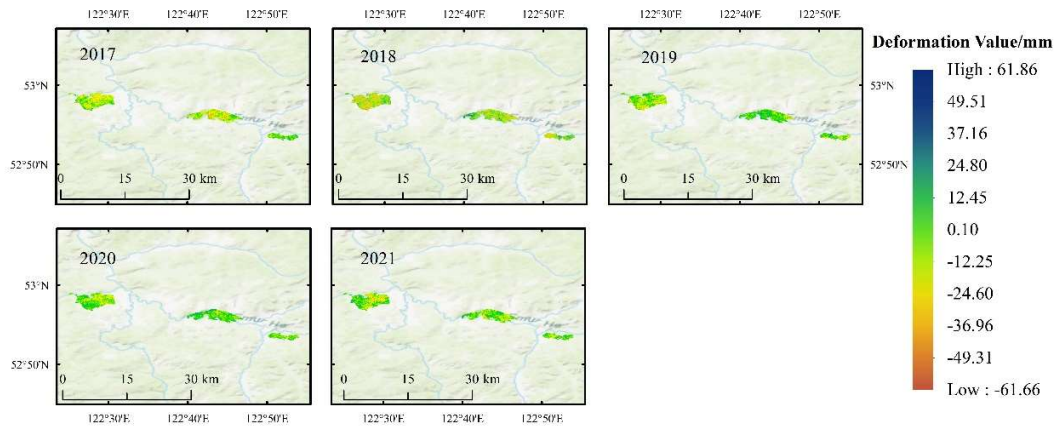
Supplementary Figure 2.1 Interannual sedimentation trends in the Hani peatland



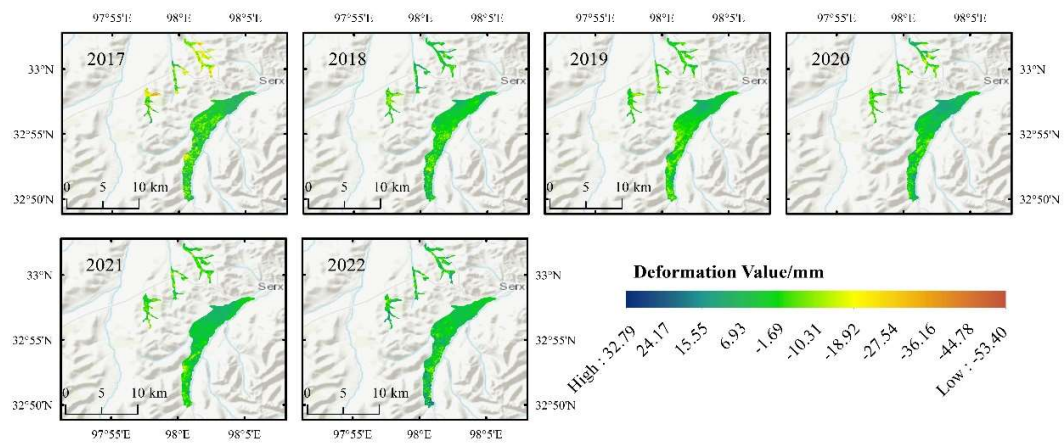
Supplementary Figure 2.2 Interannual sedimentation trends in the Honghe peatland



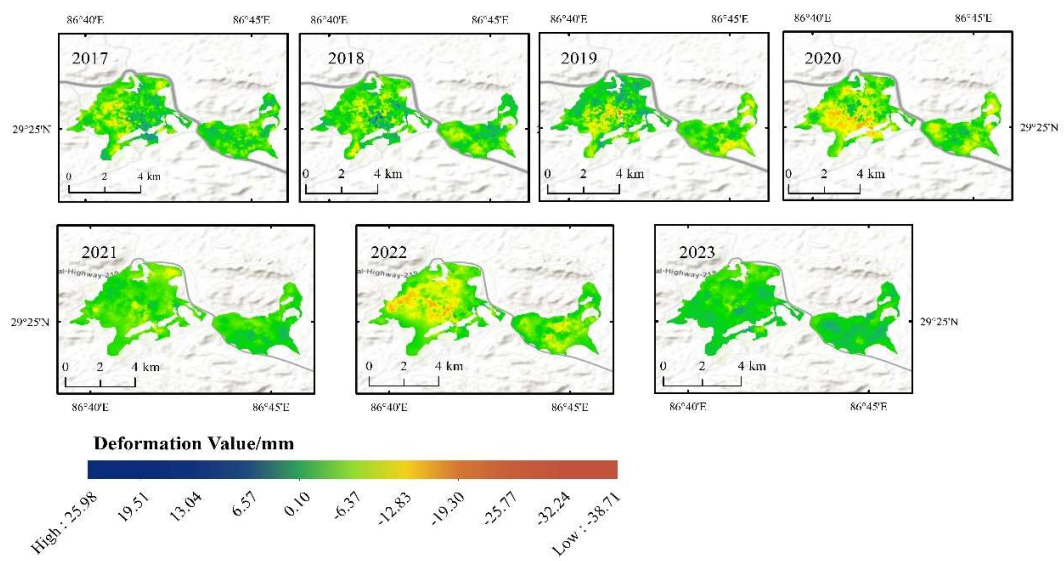
Supplementary Figure 2.3 Interannual sedimentation trends in the Mohe peatland



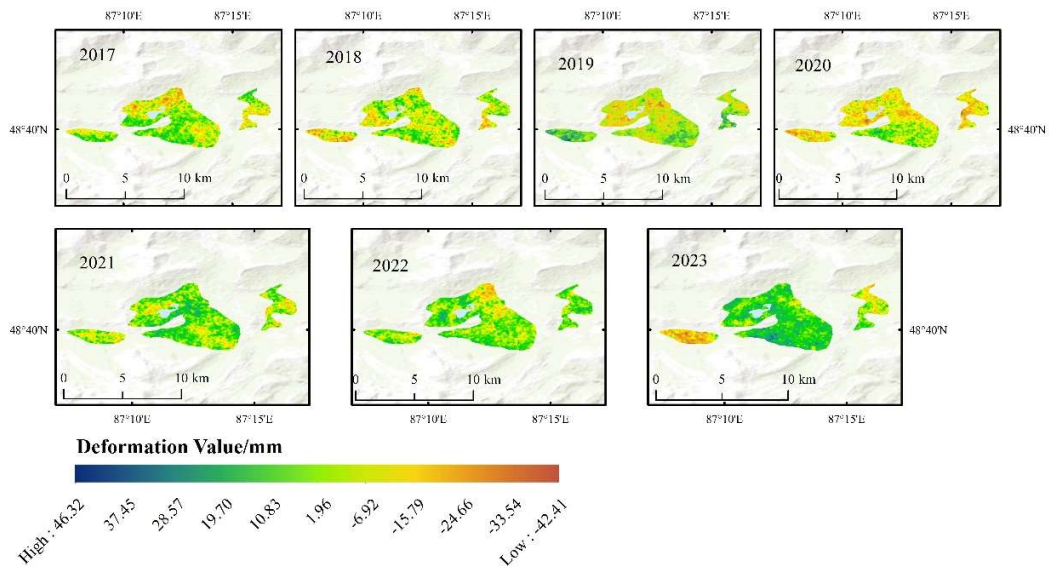
Supplementary Figure 2.4 Interannual sedimentation trends in the Shiqu peatland



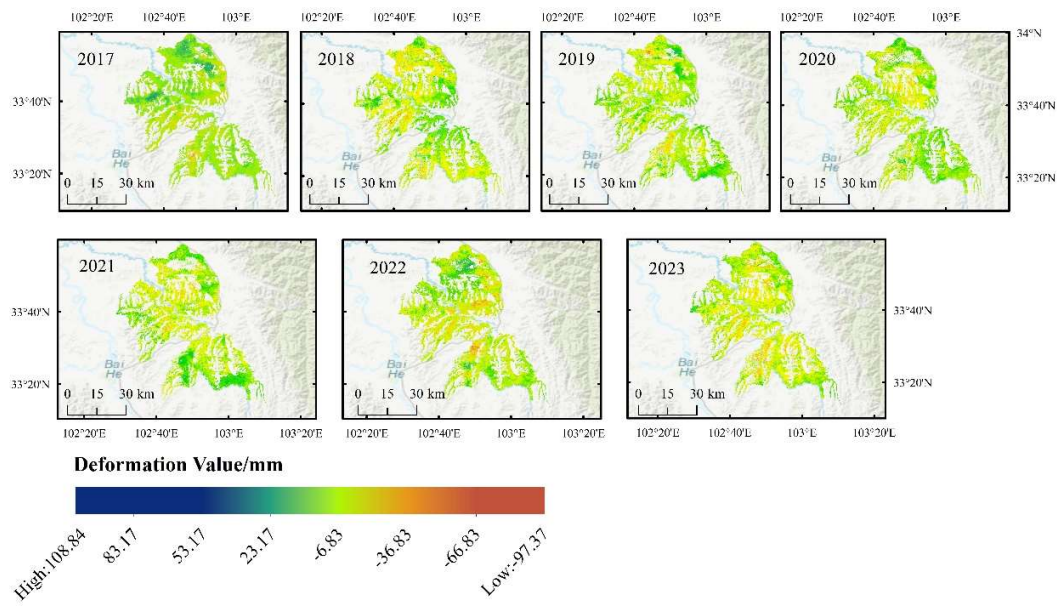
Supplementary Figure 2.5 Interannual sedimentation trends in the Qietuo peatland



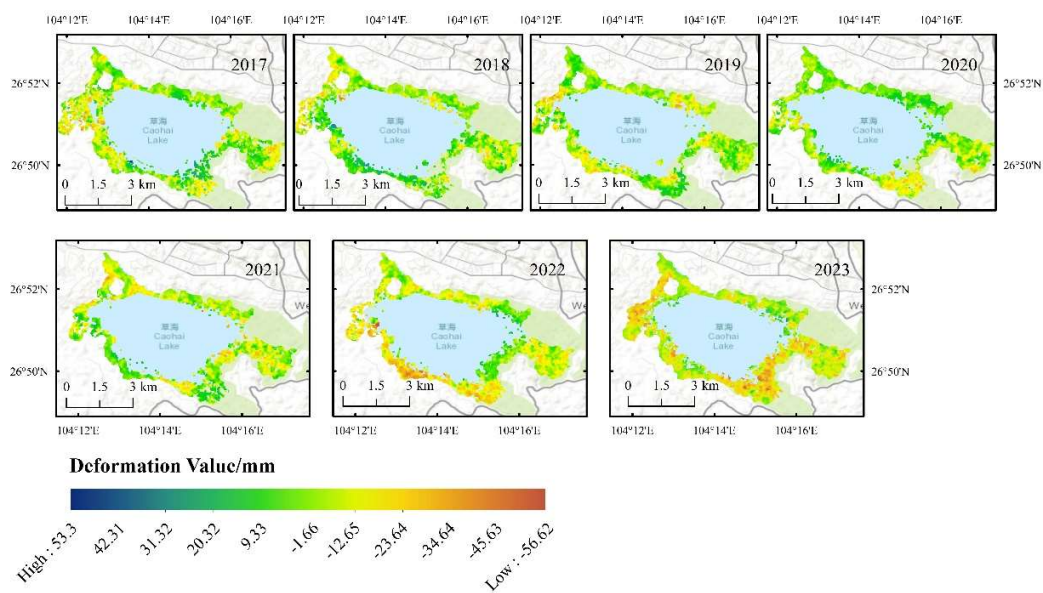
Supplementary Figure 2.6 Interannual sedimentation trends in the Uqirik peatland



Supplementary Figure 2.7 Interannual sedimentation trends in the Zoigê peatland

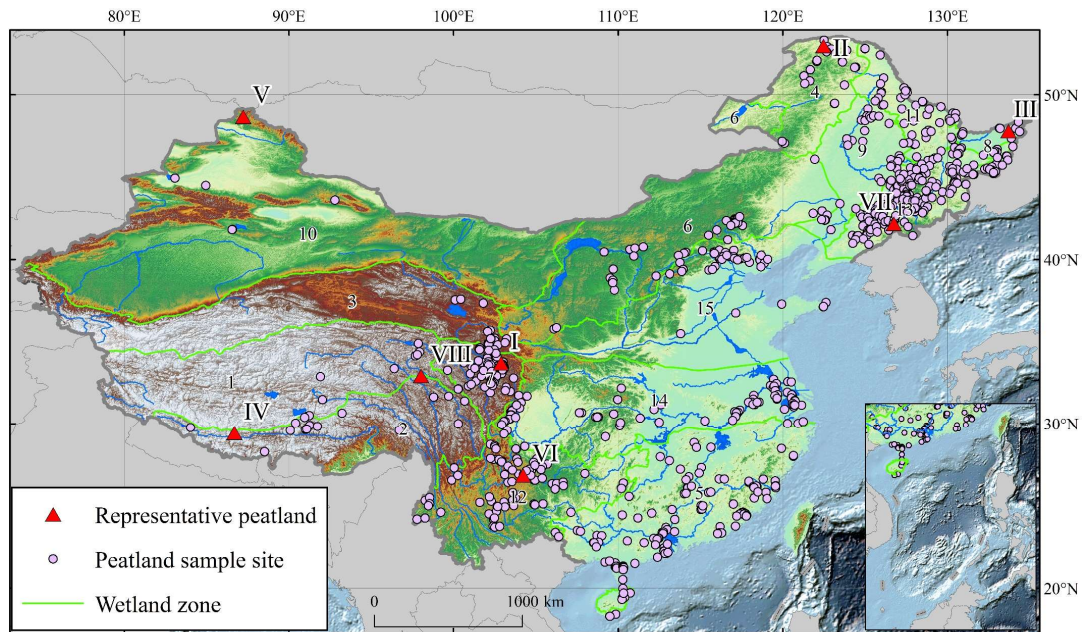


Supplementary Figure 2.8 Interannual sedimentation trends in the Caohai peatland



Supplementary Figure 3 Study area and sampling design.

Map of China showing the distribution of national peatland sampling sites (used for peat profile modeling) and the eight representative peatland monitoring regions (used for InSAR-based surface deformation analysis). Numbers indicate the site IDs of the eight monitoring regions: I Zoigê Peatland, II Mohe Peatland, III Honghe Peatland, IV Qietuo Peatland, V Uqirik Peatland, VI Caohai Peatland, VII Hani Peatland, and VIII Shiqu Peatland.



Supplementary Tables

Supplementary Table 1 Environmental variables used in peatland distribution modeling and subsidence prediction

No.	Variable Name	Description	Unit / Scale	Source	Used in Models	Category	Doi/URL
1	Elevation	Surface elevation	m	SRTM DEM (30 m)	All	Topography	https://doi.org/10.5066/F7PR7TFT (USGS SRTM Global 1 Arc-Second)
2	Slope	Slope angle derived from DEM	degrees	Derived from DEM	All	Topography	Derived from https://doi.org/10.5066/F7PR7TFT
3	Aspect	Slope orientation	degrees	Derived from DEM	All	Topography	Derived from https://doi.org/10.5066/F7PR7TFT
4	TWI	Topographic Wetness Index	unitless	Derived from DEM	All	Topography	Derived from https://doi.org/10.5066/F7PR7TFT
5	NDVI	Normalized Difference Vegetation Index	unitless (0 to 1)	MODIS MOD13Q1 (2010–2020)	All	Vegetation	https://doi.org/10.5067/MODIS/MOD13Q1.061
6	NPP	Net Primary Productivity	g C m ⁻² year ⁻¹	MODIS MOD17A3 (2010–2020)	All	Vegetation	https://doi.org/10.5067/MODIS/MOD17A3HG.F.061
7	NDWI	Normalized Difference Water Index	unitless (-1 to 1)	MODIS MOD09GA (2010–2020)	Distribution, Subsidence	Vegetation	https://doi.org/10.5067/MODIS/MOD09GA.061
8	NMDI	Normalized Multi-band Drought Index	unitless (-1 to 1)	MODIS MOD09GA (2010–2020)	Distribution, Subsidence	Vegetation	https://doi.org/10.5067/MODIS/MOD09GA.061
9	Pre	Annual precipitation	mm/year	CHELSA v2.1 climate data representing current conditions and future projections under SSP1-2.6, SSP3-7.0, and SSP5-8.5 scenarios	All	Climate	https://doi.org/10.1038/sdata.2017.122
10	Tem	Mean annual temperature	°C	CHELSA v2.1 climate data representing current conditions and future projections under SSP1-2.6, SSP3-7.0, and SSP5-8.5 scenarios	All	Climate	https://doi.org/10.1038/sdata.2017.122
11	SPEI	Standardized Precipitation Evapotranspiration Index	unitless (–2 to +2)	Daily SPEI dataset in China from 1980 to 2100; 2010–2020 subset used for current modeling, 2081–2100 used for scenario simulations under SSP1-2.6, SSP3-7.0, and SSP5-8.5	All	Climate	https://doi.org/10.6084/m9.figshare.24988335
12	Scd	Snow cover days	Count	CHELSA v2.1 climate data representing current conditions and future projections under SSP1-2.6, SSP3-7.0, and SSP5-8.5 scenarios	TOC, BD, Depth, Subsidence	Climate	https://doi.org/10.1038/sdata.2017.122
13	Bio05	Max temperature of warmest month	°C	CHELSA v2.1 climate data representing current conditions and future projections under SSP1-2.6, SSP3-7.0, and SSP5-8.5 scenarios	Distribution, Subsidence	Climate	https://doi.org/10.1038/sdata.2017.122
14	Bio15	Precipitation seasonality (CV)	%	CHELSA v2.1 climate data representing current conditions and future projections under SSP1-2.6, SSP3-7.0, and SSP5-8.5 scenarios	Distribution, Subsidence	Climate	https://doi.org/10.1038/sdata.2017.122
15	Bio17	Precipitation of driest quarter	mm	CHELSA v2.1 climate data representing current conditions and future projections under SSP1-2.6, SSP3-7.0, and SSP5-8.5 scenarios	TOC, BD, Depth, Subsidence	Climate	https://doi.org/10.1038/sdata.2017.122
16	MHP	Mid-Holocene precipitation	mm/year	WorldClim 1.4 downscaled paleo climate	Distribution	Climate	https://doi.org/10.1002/joc.1276
17	MHT	Mid-Holocene temperature	°C	WorldClim 1.4 downscaled paleo climate	Distribution	Climate	https://doi.org/10.1002/joc.1276
18	Swe	Snow water equivalent	mm	CHELSA v2.1 climate data representing current conditions and future projections under SSP1-2.6, SSP3-7.0, and SSP5-8.5 scenarios	Subsidence	Climate	https://doi.org/10.1038/sdata.2017.122
19	Soil pH	Soil pH in water (0–30 cm)	pH units	SoilGrids v2.0	TOC, BD, Depth, Subsidence	Soil	https://doi.org/10.5194/soil-7-217-2021
20	Soil Clay	Clay content (0–30 cm)	%	SoilGrids v2.0	All	Soil	https://doi.org/10.5194/soil-7-217-2021
21	Soil Silt	Silt content (0–30 cm)	%	SoilGrids v2.0	All	Soil	https://doi.org/10.5194/soil-7-217-2021
22	Soil Sand	Sand content (0–30 cm)	%	SoilGrids v2.0	All	Soil	https://doi.org/10.5194/soil-7-217-2021
23	Soil BD	Soil bulk density (0–30 cm)	g cm ⁻³	SoilGrids v2.0	TOC estimation	Soil	https://doi.org/10.5194/soil-7-217-2021
24	GLW4	Livestock density	head km ⁻²	FAO GLW v4	Subsidence	Human Influence	http://www.fao.org/live-stock-systems/global-distributions/en/
25	DistoR	Distance to nearest road	meters	OSM / national road data	Subsidence	Human Influence	https://www.openstreetmap.org
26	DistoD	Distance to drainage ditches	meters	OSM / national road data	Subsidence	Human Influence	https://www.openstreetmap.org
27	Ground Water	Depth to groundwater	mm	GRACE/GFO-based groundwater storage change dataset in China from 2005 to 2020	Subsidence	Human Influence	https://doi.org/10.12237/casearth.65387a5a819aec0f26f0931c

28	S1_ARI_Mean	Sentinel-1 average radar intensity (VV/VH)	unitless	Sentinel-1 processed SAR indices	Distribution, Subsidence	SAR	Derived from Sentinel-1 VV/VH via GEE
29	S1_CM	Coherence magnitude from Sentinel-1	unitless	Sentinel-1 InSAR stack	Subsidence	SAR	Derived from Sentinel-1 VV/VH via GEE
30	S1_NDPOL_Mean	Sentinel-1 normalized depolarization ratio	unitless	Sentinel-1 dual-pol data	Distribution	SAR	Derived from Sentinel-1 VV/VH via GEE