Bundesamt
für Wasserwirtschaft

Managing water scarcity in European and Chinese cropping systems

Exploring the value of long-term data sets to develop and evaluate agricultural management practices

Webinar, June 23rd 2021

Speakers:

Prof. Andreas Klik – University of Natural Resources and Life Sciences Vienna (BOKU)

Dr. Peter Strauss – Federal Agency for Water Management, Austria

Gunther Liebhard, MSc - University of Natural Resources and Life Sciences Vienna (BOKU)

This project is co-funded by the European Union

Project: 773903

This project is co-funded by the Chinese Ministry of Science & Technology under CFM (China-EU Co-Funding Mechanism)

What are long-term studies (LTS)?

Long-term studies (LTS) are critical for **providing key insights** in environmental change and natural resource management

LTS sufficiently long to **quantify the key processes** that structure the system under investigation

LTS **collect systematically and regularly field data** from a particular site or set of sites for more than 10 years

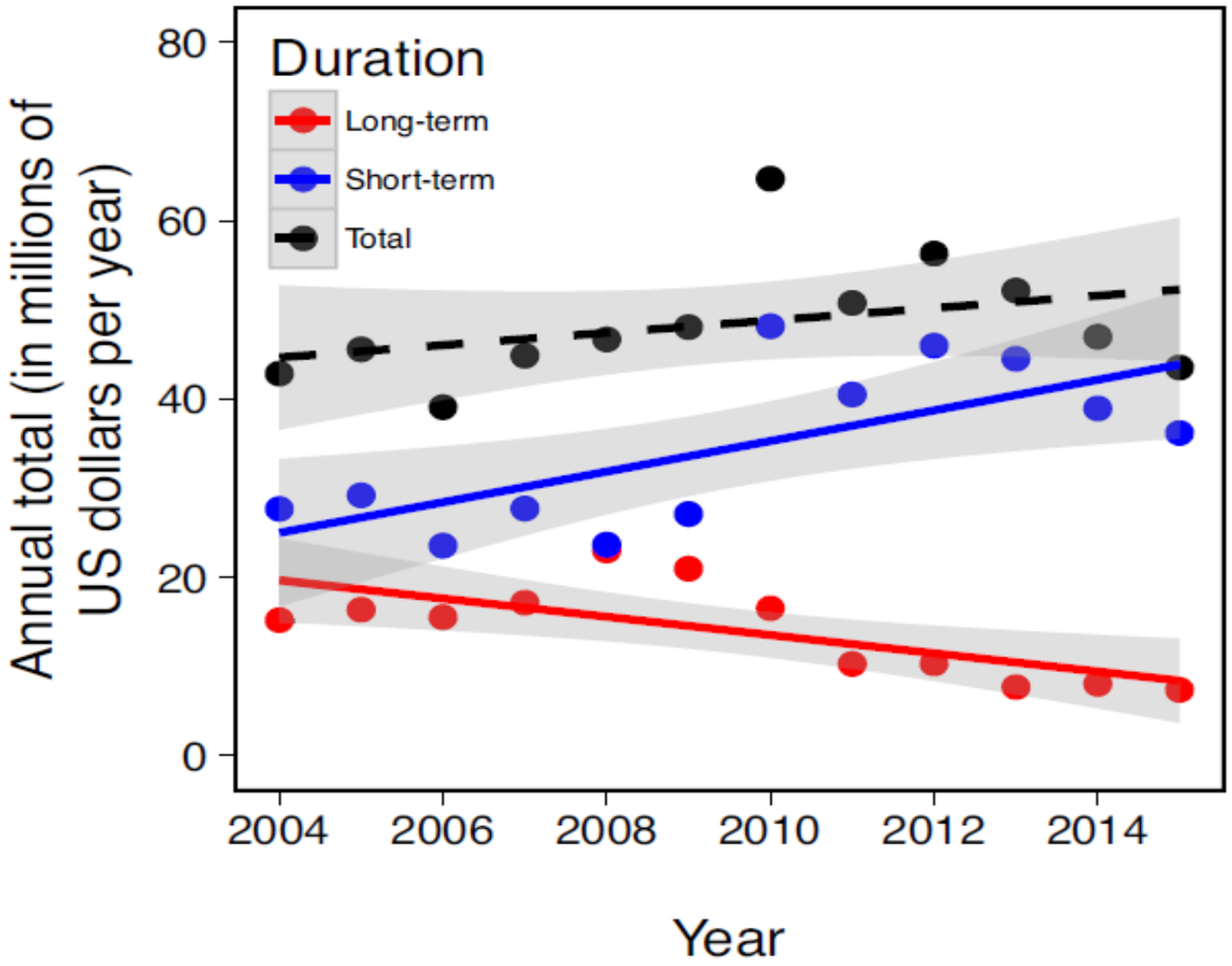
This project is co-funded by the European Union
Project: 773903

This project is co-funded by the Chinese Ministry of Science & Technology under CFM (China-EU Co-Funding Mechanism)

Funding of long-term studies (LTS)

Managing water scarcity in European and Chinese cropping systems

Trends in NSF funding for short- (4 years or shorter) and long-term (> 4 years) ecological and environmental studies



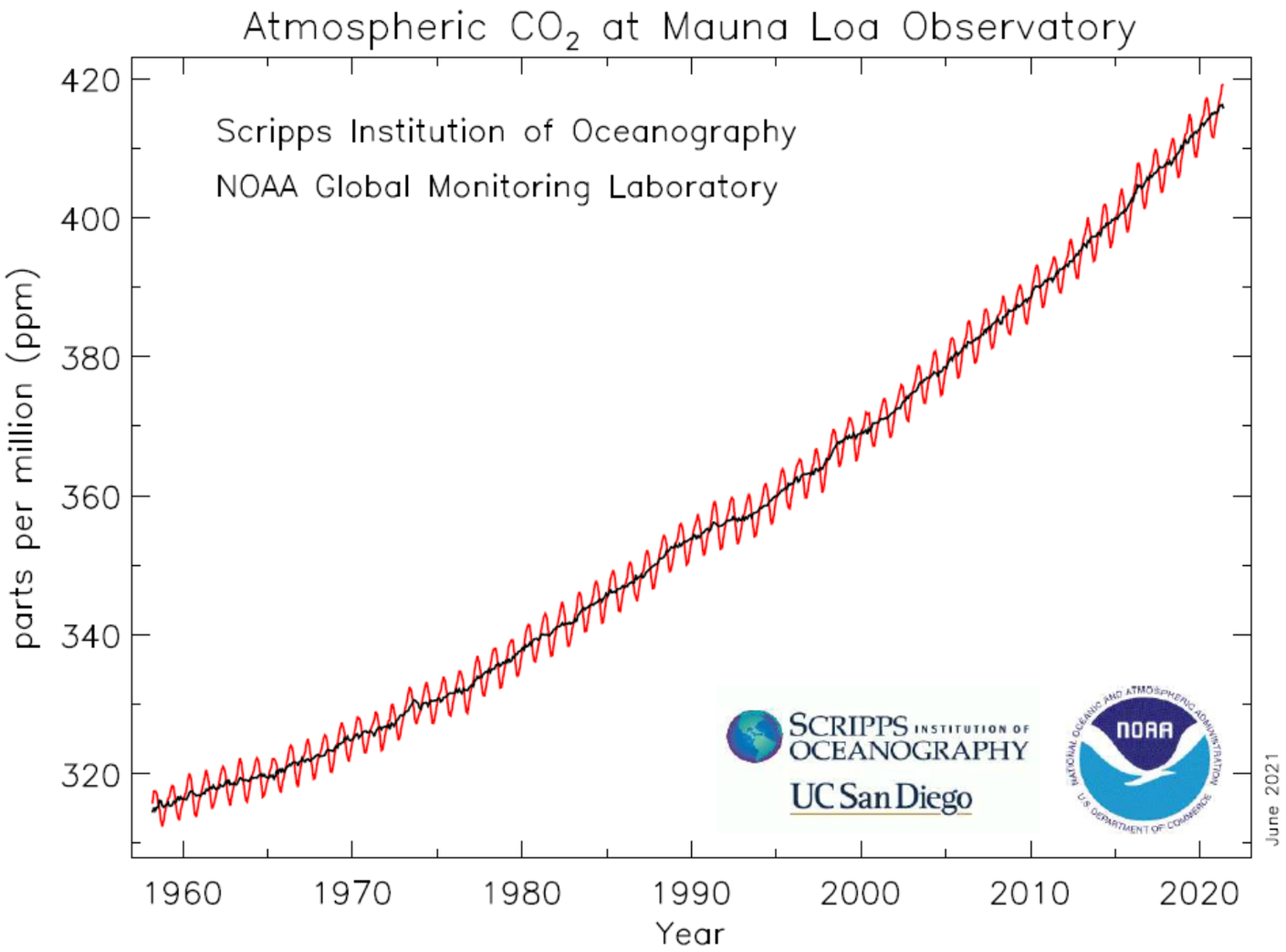
Hughes et al. (2017). BioScience 67

This project is co-funded by the European Union
Project: 773903

This project is co-funded by the Chinese Ministry of Science & Technology under CFM (China-EU Co-Funding Mechanism)

Mauna Loa (Hawaii, USA) record of atmospheric CO_2 concentrations

Managing water scarcity in European and Chinese cropping systems



Keeling (1976)

https://gml.noaa.gov/ccgg/trends/

One of the most famous LT data set started by C. Daving Keeling in March 1958
Study was threatened with termination six times

This project is co-funded by the European Union
Project: 773903

This project is co-funded by the Chinese Ministry of Science & Technology under CFM (China-EU Co-Funding Mechanism)

Key values of LTS (Lindenmayer et al., 2012)

(1) **quantifying responses** to drivers of ecosystem change;

(2) **understanding complex processes** that occur over prolonged periods

(3) **providing core data** that may be used to **develop, parameterize and validate simulation models**

(4) **providing data** at scales relevant to management, and hence critically **supporting evidence-based policy and decision making**

(5) **acting as platforms** for collaborative studies, thus promoting multidisciplinary research

This project is co-funded by the European Union
Project: 773903

This project is co-funded by the Chinese Ministry of Science & Technology under CFM (China-EU Co-Funding Mechanism)

Quantifying responses to drivers of ecosystem change

SHui

Managing water scarcity in European and Chinese cropping systems

Rainfall erosivity (R) expresses erosive power of rainfalls to detach and transport soil particles

R is combination of rainfall kinetic energy and rainfall intensity during a rain event

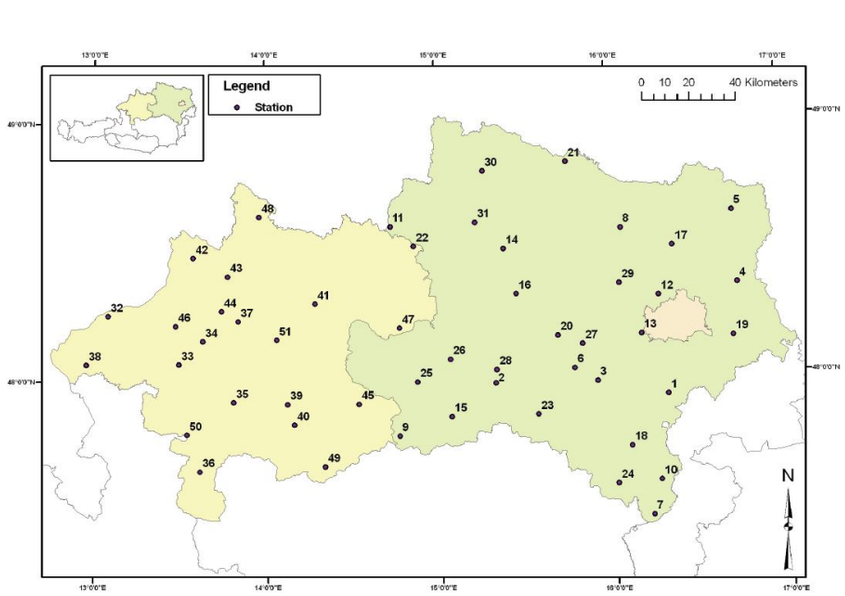


Figure 1. Spatial distribution of rain gauges in northeastern Austria.

Klik and Konecny (2012). Trans. ASABE

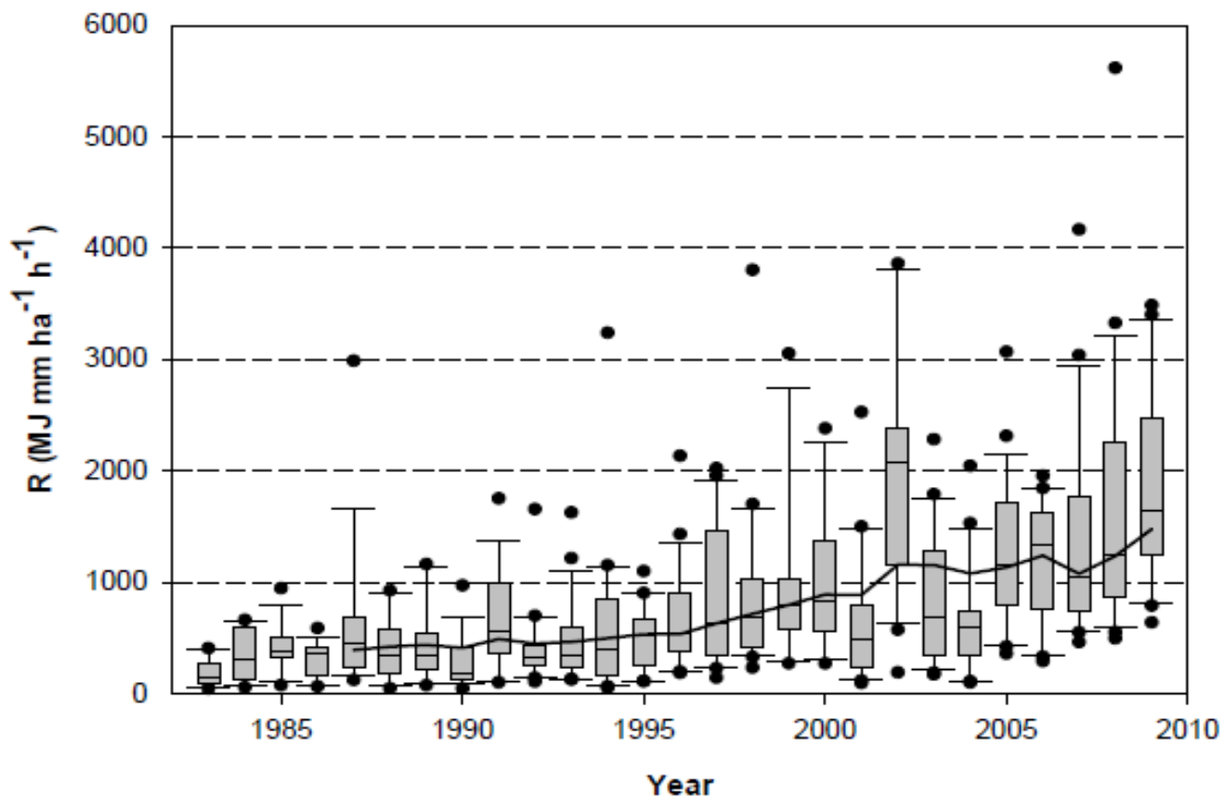


Figure 4. Mean rainfall erosivity (*R*) (May-October) of stations with statistically increasing trends, including 25/75 percentiles (boxes), 5/95 percentiles (vertical lines), outliers (dots), and five-year running average.

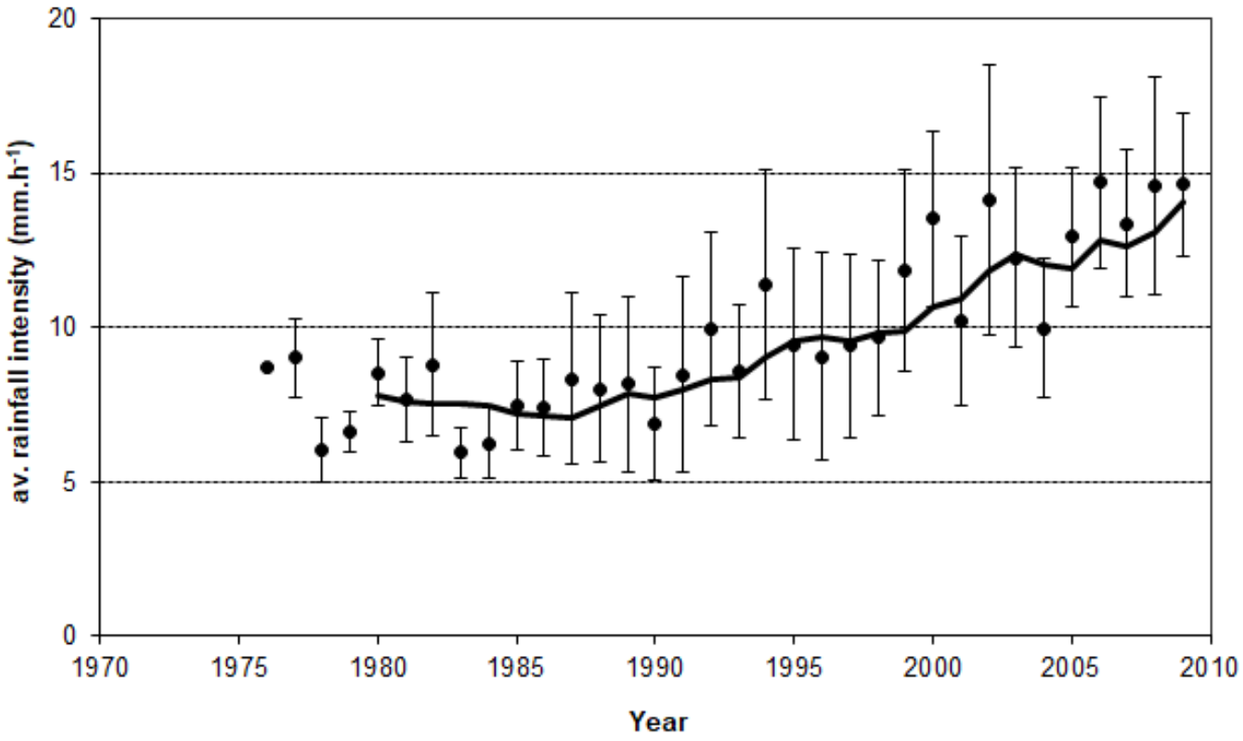
This project is co-funded by the European Union
Project: 773903

This project is co-funded by the Chinese Ministry of Science & Technology under CFM (China-EU Co-Funding Mechanism)

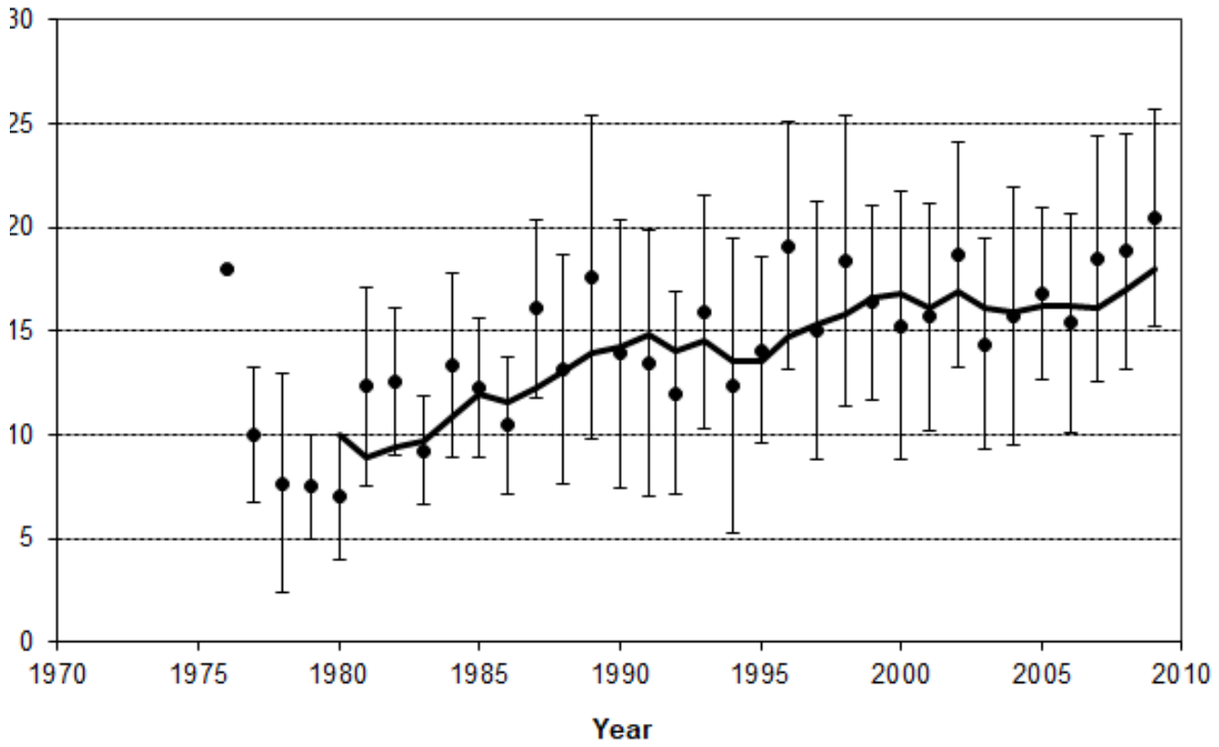
Rainfall erosivity

Managing water scarcity in European and Chinese cropping systems

Average max 30-min rainfall intensity



Number of erosive events



Klik and Konecny (2012). Trans. ASABE

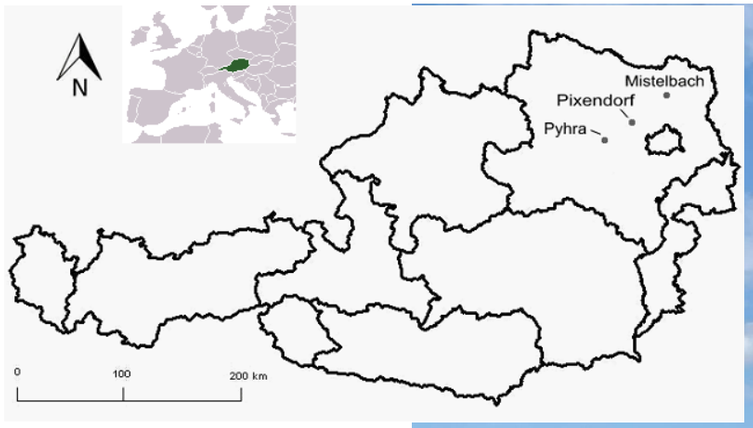
This project is co-funded by the European Union
Project: 773903

This project is co-funded by the Chinese Ministry of Science & Technology under CFM (China-EU Co-Funding Mechanism)

Understanding complex processes that occur over prolonged periods

SHui

Managing water scarcity in European and Chinese cropping systems



This project is co-funded by the European Union

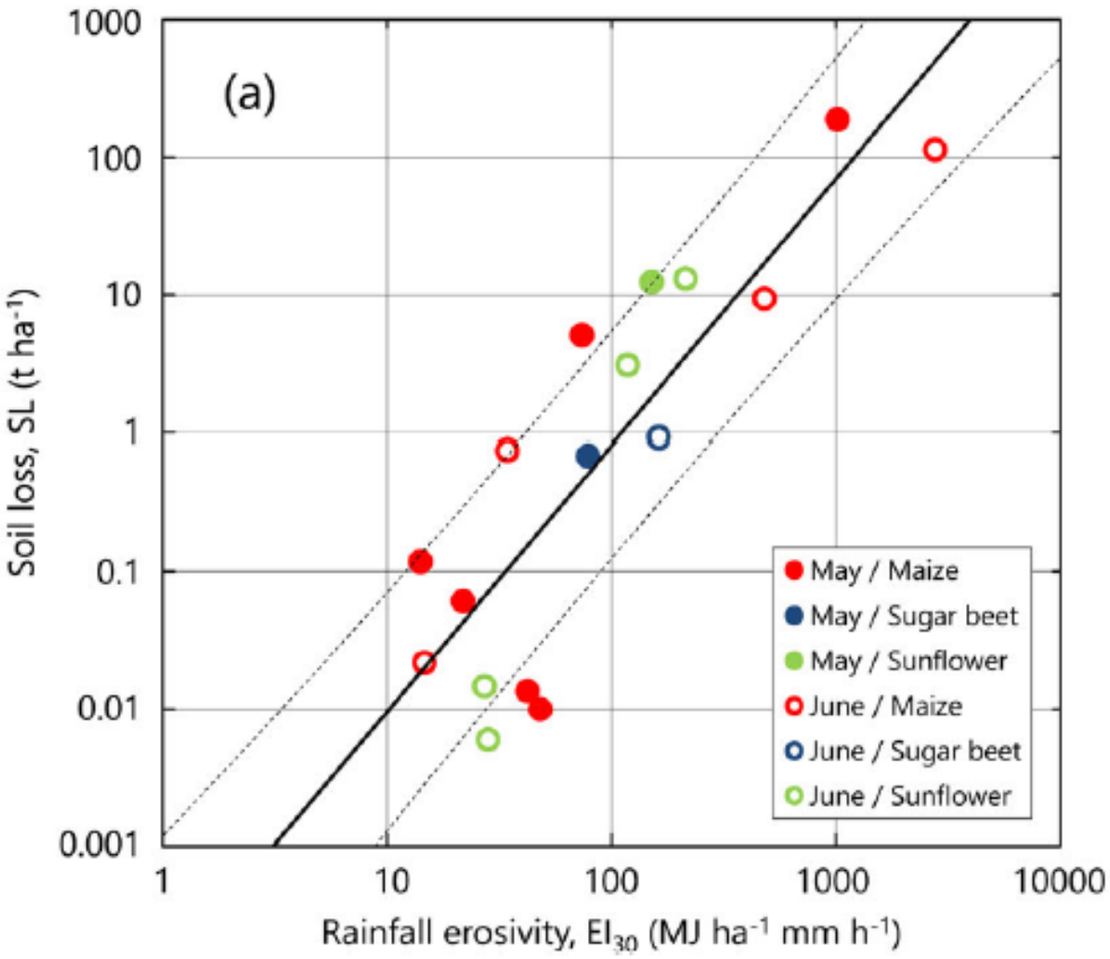
Project: 773903

This project is co-funded by the Chinese Ministry of Science & Technology under CFM (China-EU Co-Funding Mechanism)

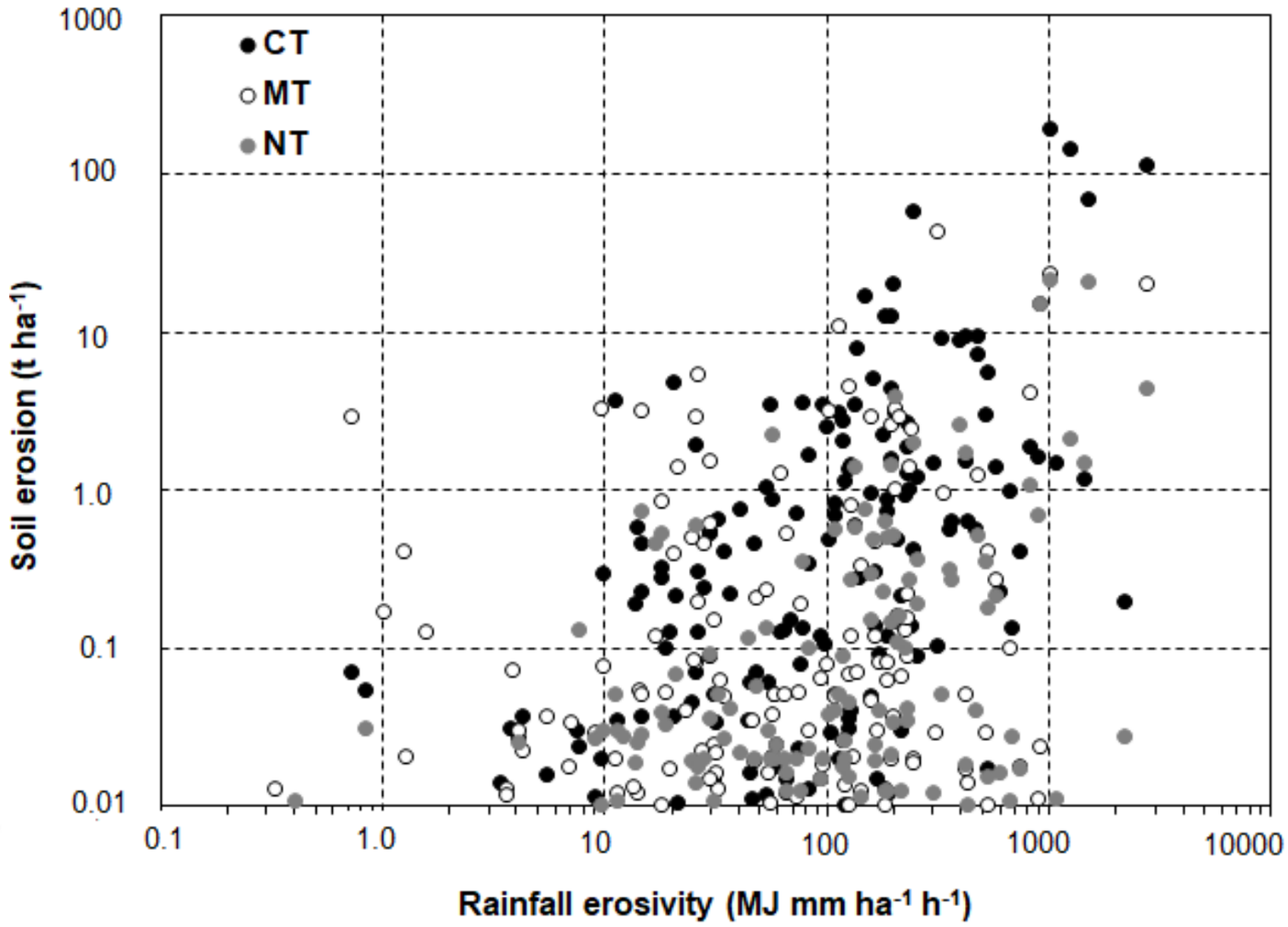
Understanding complex processes that occur over prolonged periods

Managing water scarcity in European and Chinese cropping systems

Relationship between rainfall erosivity and soil erosion



Strohmeier et al. (2014). LDD



Klik and Rosner (2020). Soil & Till Res. 203

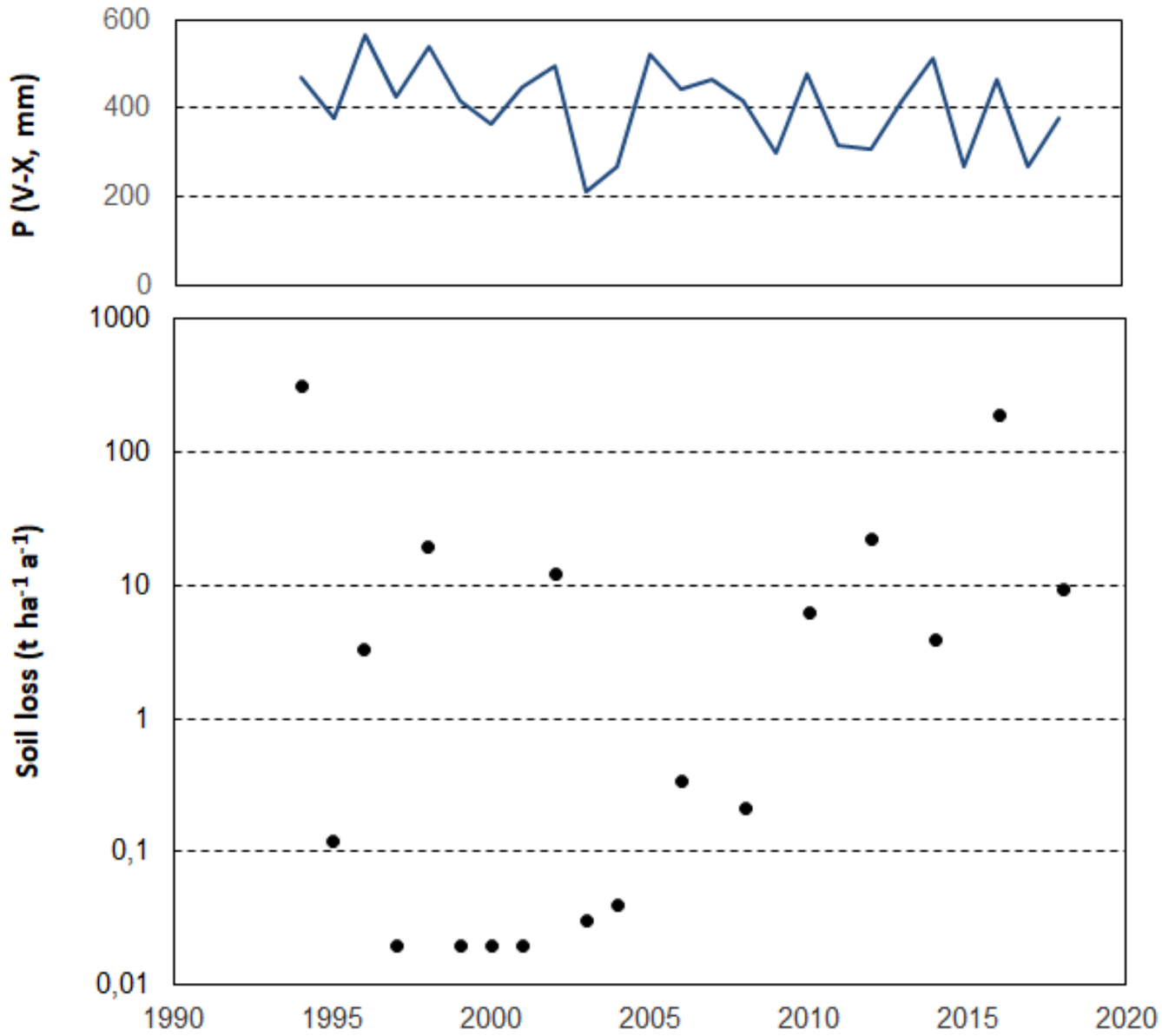
This project is co-funded by the European Union
Project: 773903

This project is co-funded by the Chinese Ministry of Science & Technology under CFM (China-EU Co-Funding Mechanism)

Understanding processes that occur over prolonged periods

Managing water scarcity in European and Chinese cropping systems

1994 – 2018
84 erosive events



This project is co-funded by the European Union
Project: 773903

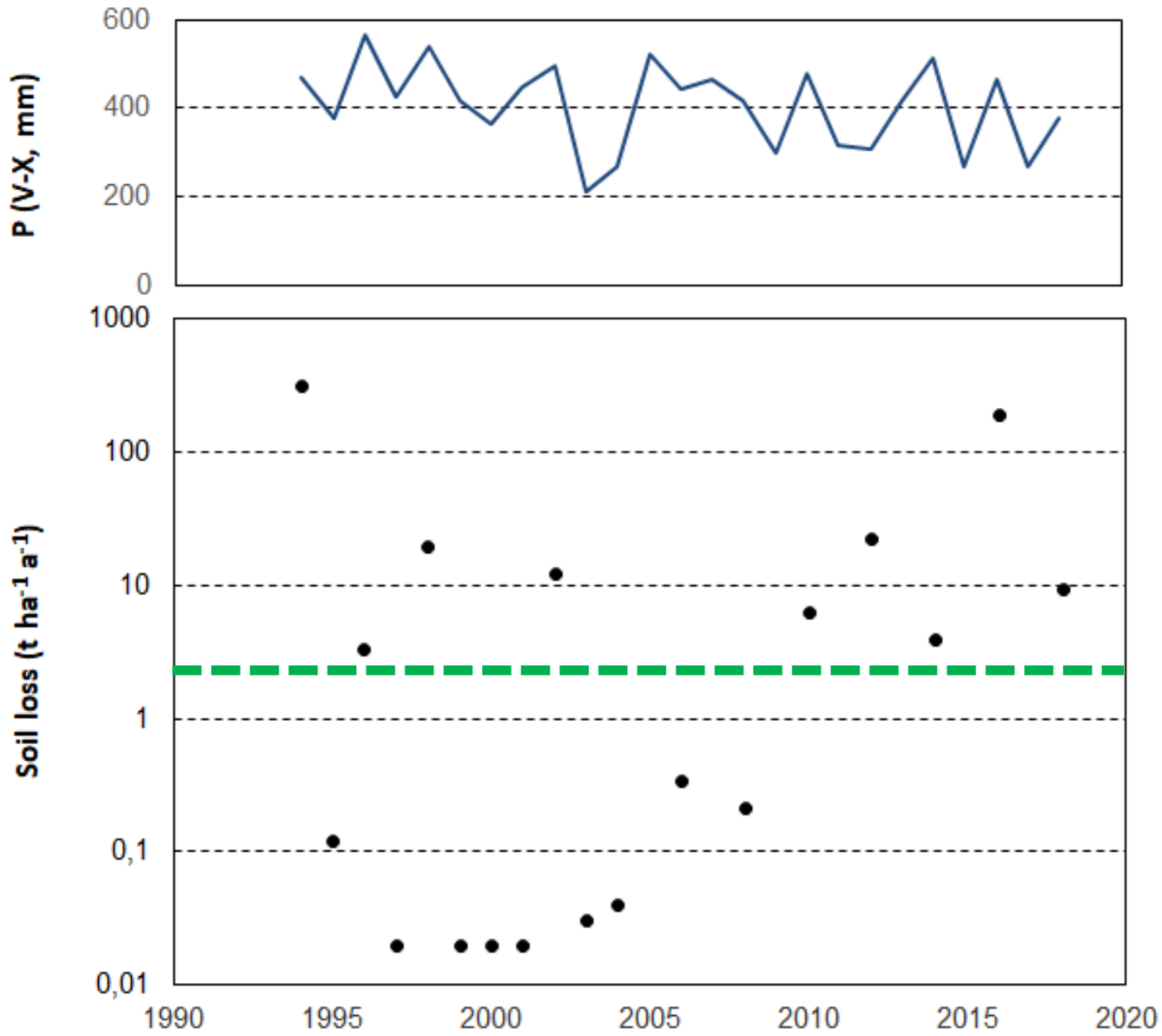
This project is co-funded by the Chinese Ministry of Science & Technology under CFM (China-EU Co-Funding Mechanism)

Understanding processes that occur over prolonged periods

Managing water scarcity in European and Chinese cropping systems

1994 – 2018
84 erosive events

50 % of years
> 2,5 t.ha^{-1}.a^{-1}



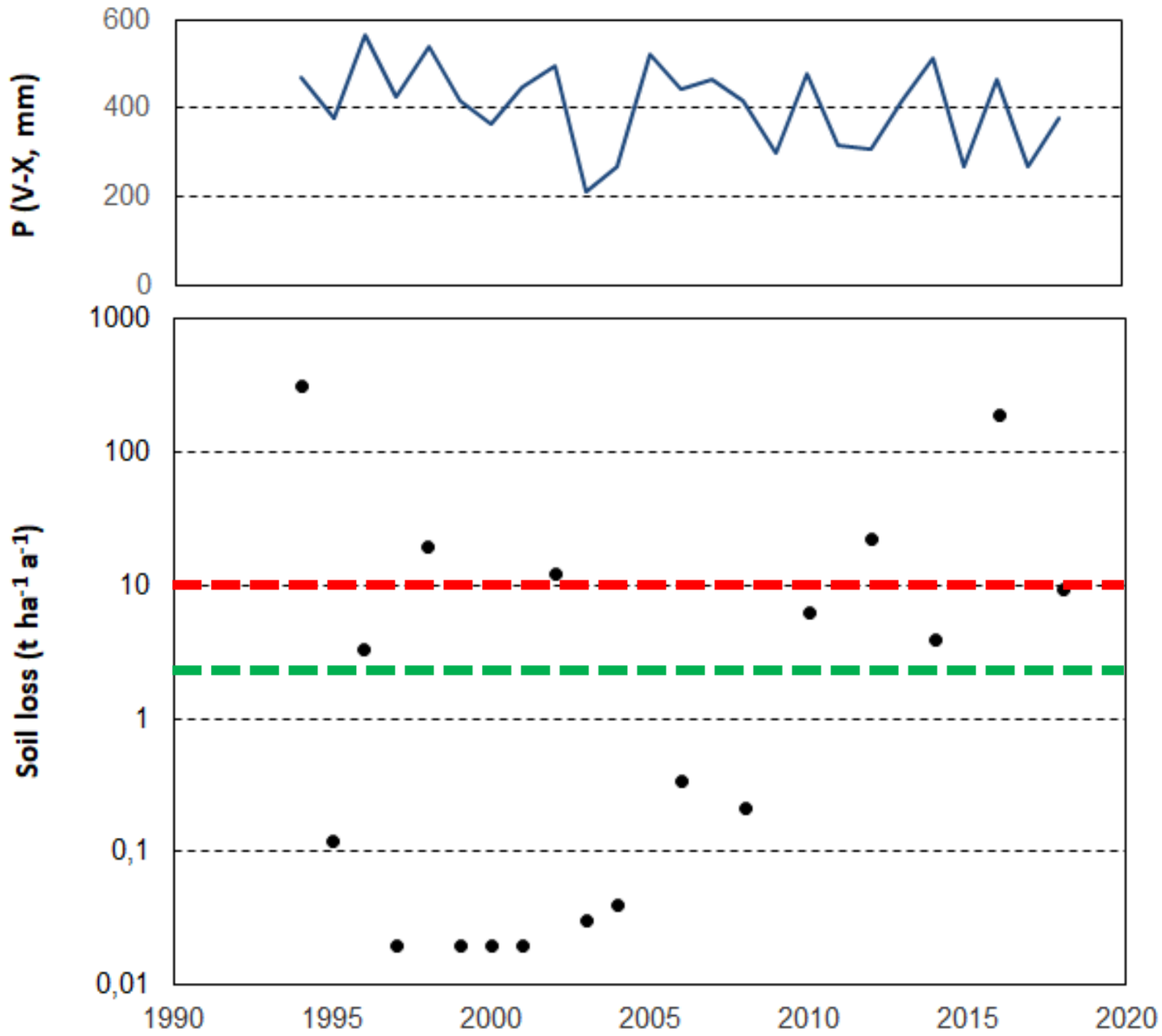
This project is co-funded by the European Union
Project: 773903

This project is co-funded by the Chinese Ministry of Science & Technology under CFM (China-EU Co-Funding Mechanism)

Understanding complex processes that occur over prolonged periods

1994 – 2018
84 erosive events

28 % of years
> 10 t.ha^{-1}.a^{-1}



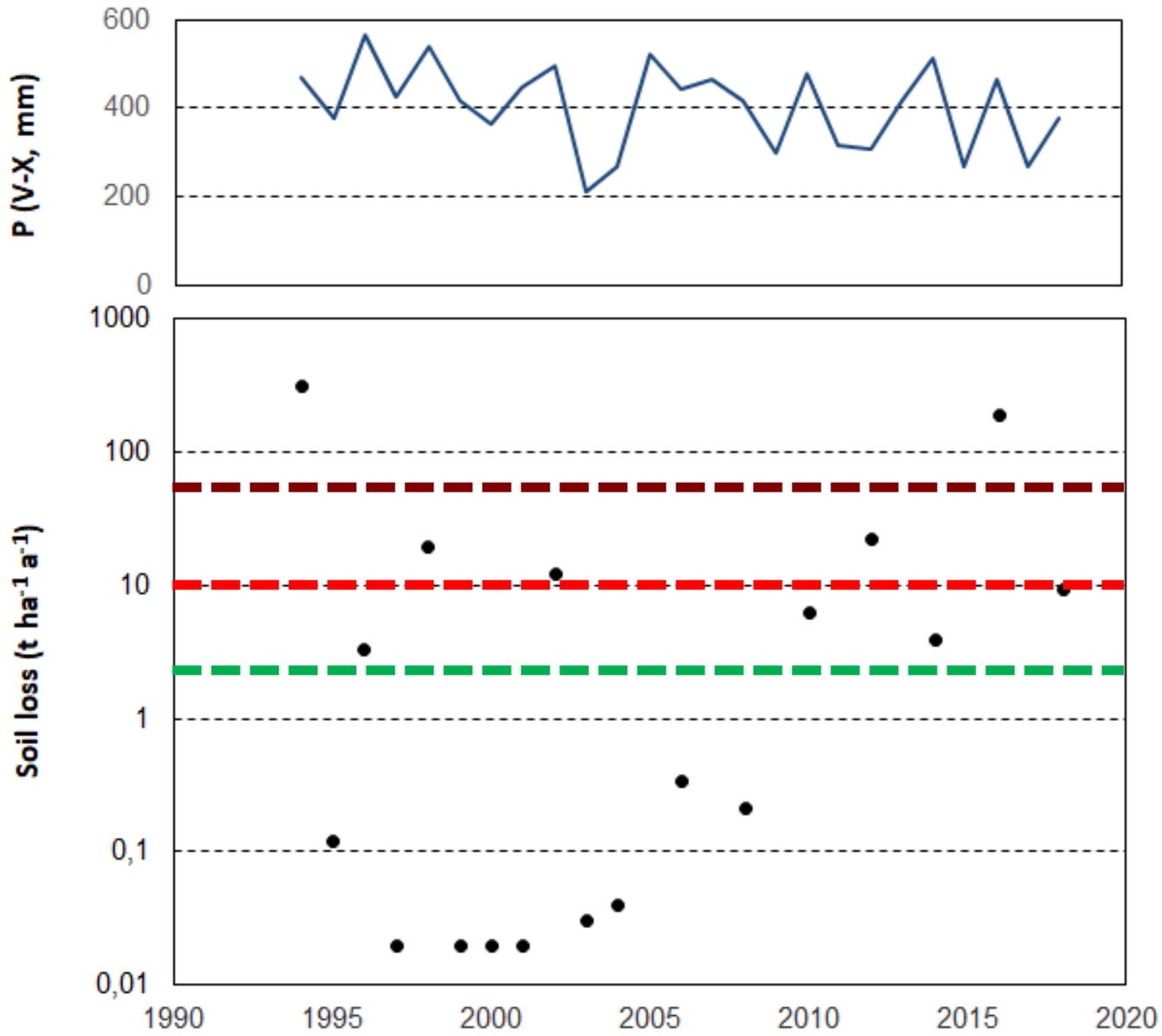
This project is co-funded by the European Union
Project: 773903

This project is co-funded by the Chinese Ministry of Science & Technology under CFM (China-EU Co-Funding Mechanism)

Understanding complex processes that occur over prolonged periods

1994 – 2018
84 erosive events

10 % of years
> 50 $t.ha^{-1}.a^{-1}$

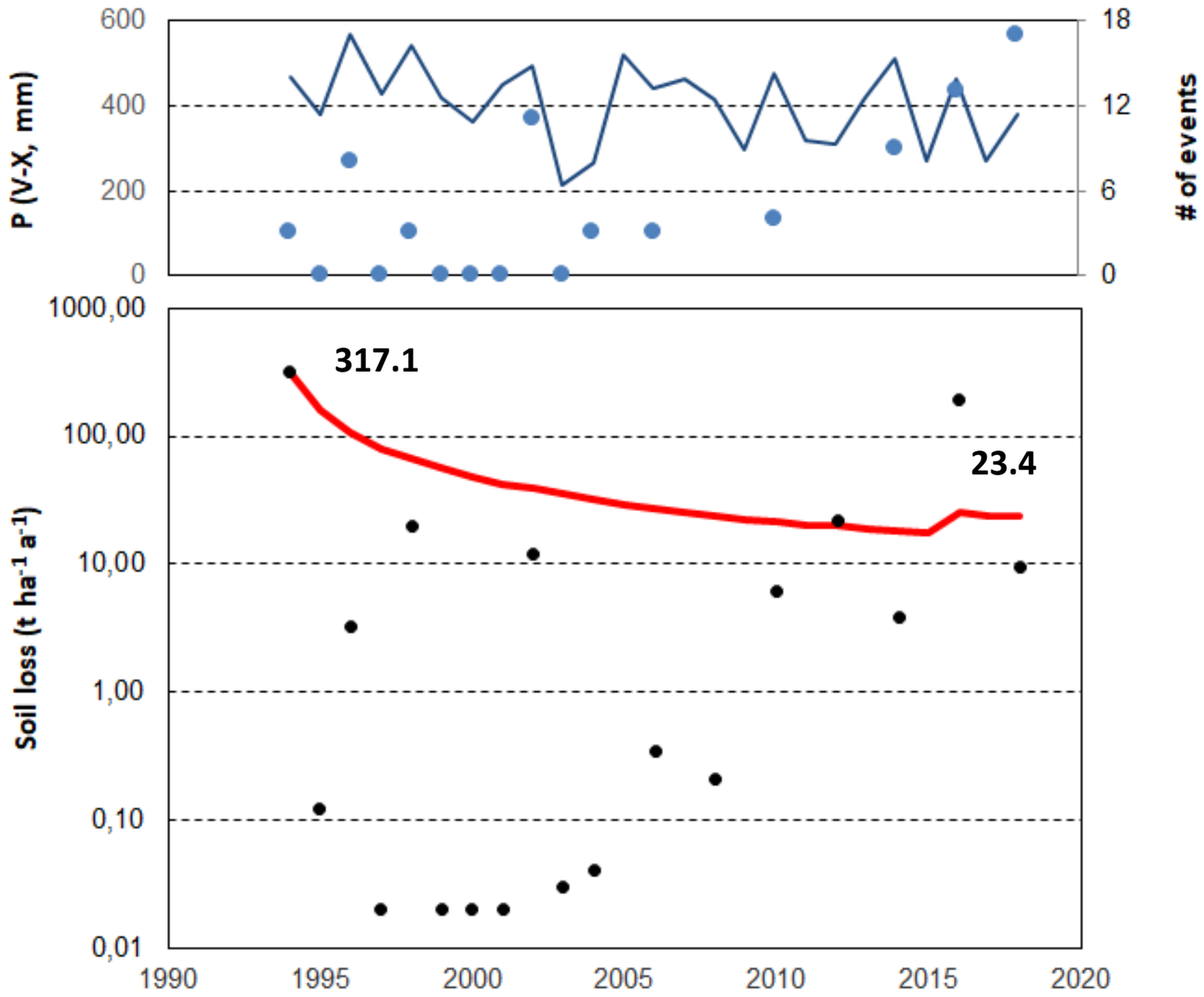


This project is co-funded by the European Union
Project: 773903

This project is co-funded by the Chinese Ministry of Science & Technology under CFM (China-EU Co-Funding Mechanism)

Understanding complex processes that occur over prolonged periods

Managing water scarcity in European and Chinese cropping systems

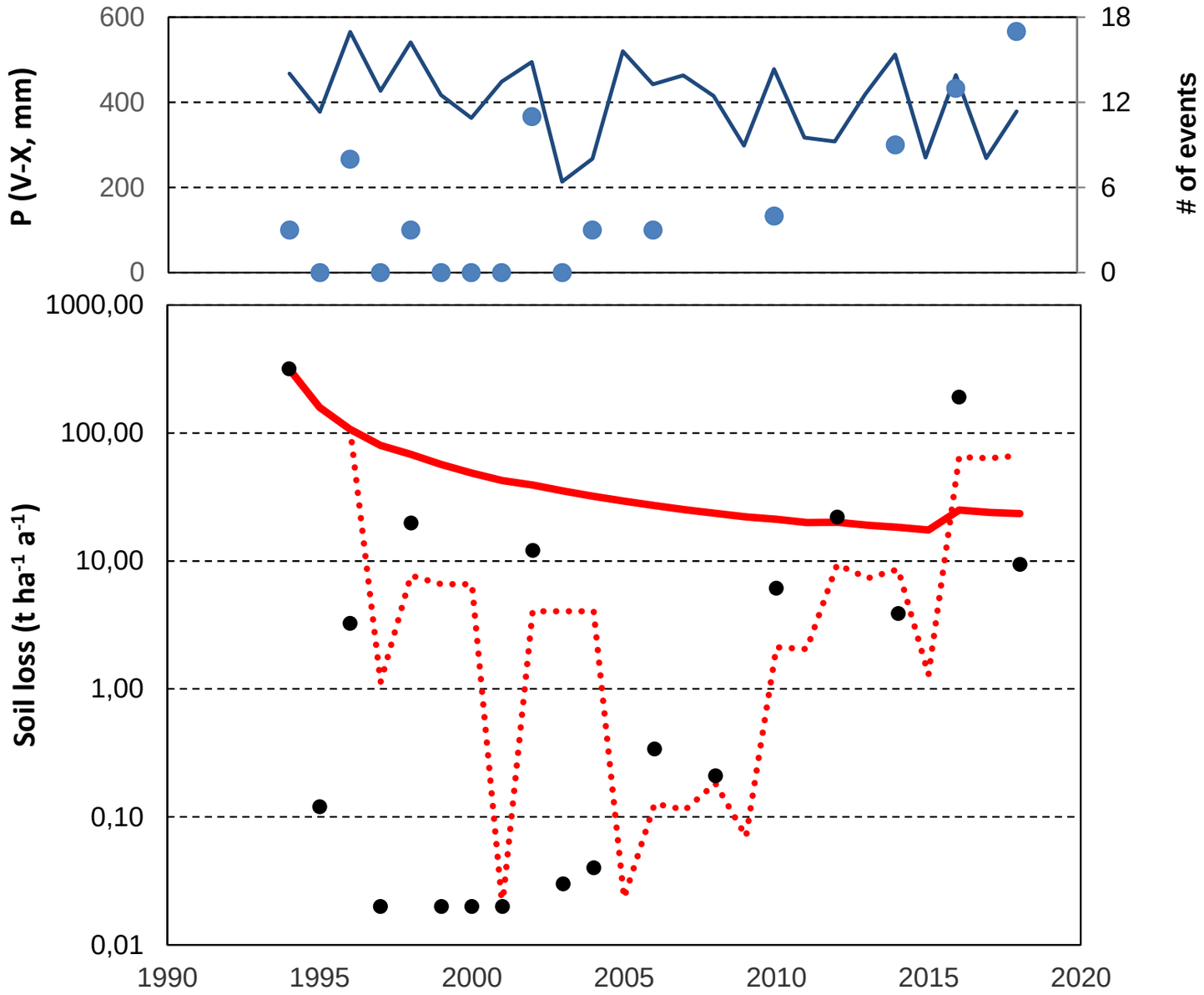


This project is co-funded by the European Union
Project: 773903

This project is co-funded by the Chinese Ministry of Science & Technology under CFM (China-EU Co-Funding Mechanism)

Understanding complex processes that occur over prolonged periods

Managing water scarcity in European and Chinese cropping systems

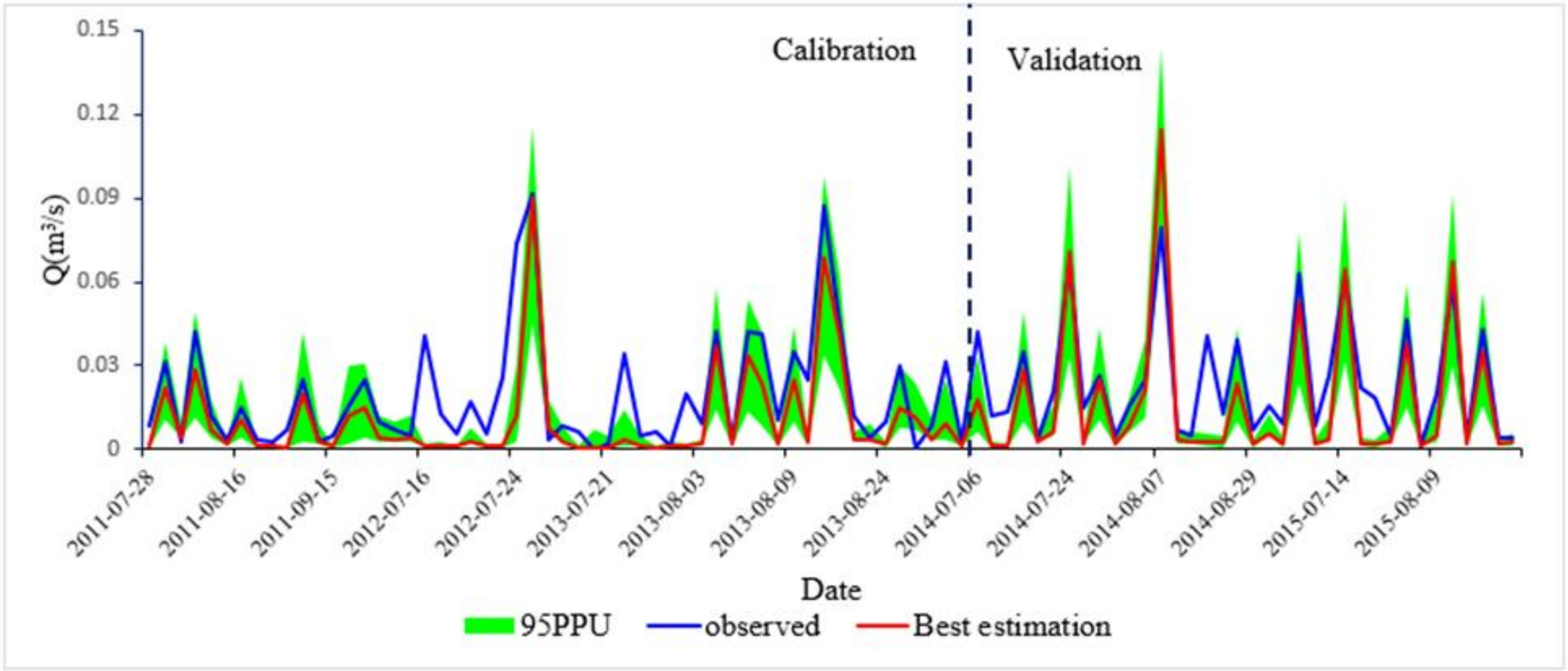


This project is co-funded by the European Union
Project: 773903

This project is co-funded by the Chinese Ministry of Science & Technology under CFM (China-EU Co-Funding Mechanism)

Providing core data to develop, parameterize and validate simulation models

Managing water scarcity in European and Chinese cropping systems



Goodness of fit:

Nash-Sutcliff coefficient (NSE)

Wilmott index (WI)

Root Mean Square Error (RMSE)

Melaku et al. (2019). Catena

Range and variability of data

This project is co-funded by the European Union

Project: 773903

This project is co-funded by the Chinese Ministry of Science & Technology under CFM (China-EU Co-Funding Mechanism)

Providing data at scales relevant to management, and supporting evidence-based policy and decision

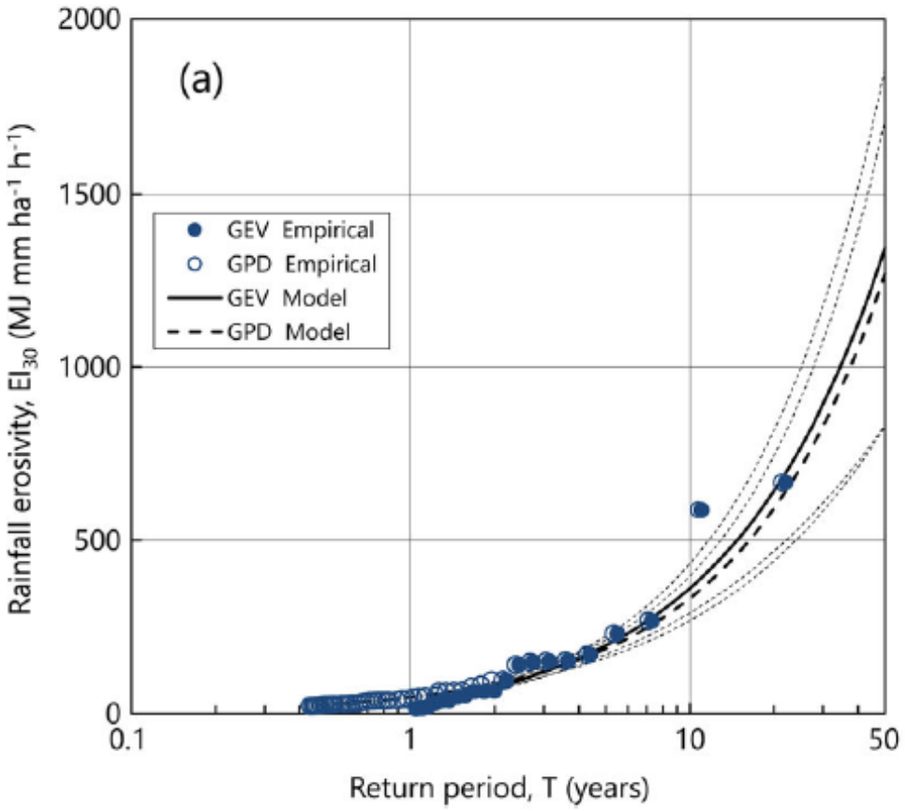
SHui

Managing water scarcity in European and Chinese cropping systems

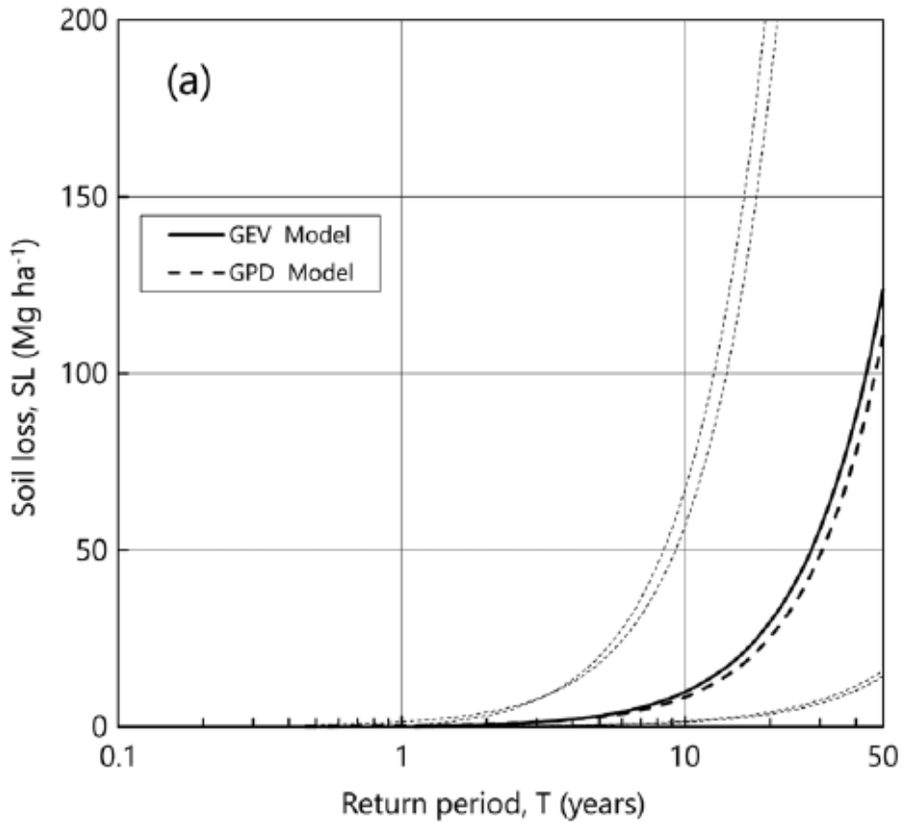
Risk of soil loss
Mistelbach

Return periods of

Rainfall erosivity



Soil loss



Strohmeier et al. (2014). LDD

This project is co-funded by the European Union
Project: 773903

This project is co-funded by the Chinese Ministry of Science & Technology under CFM (China-EU Co-Funding Mechanism)

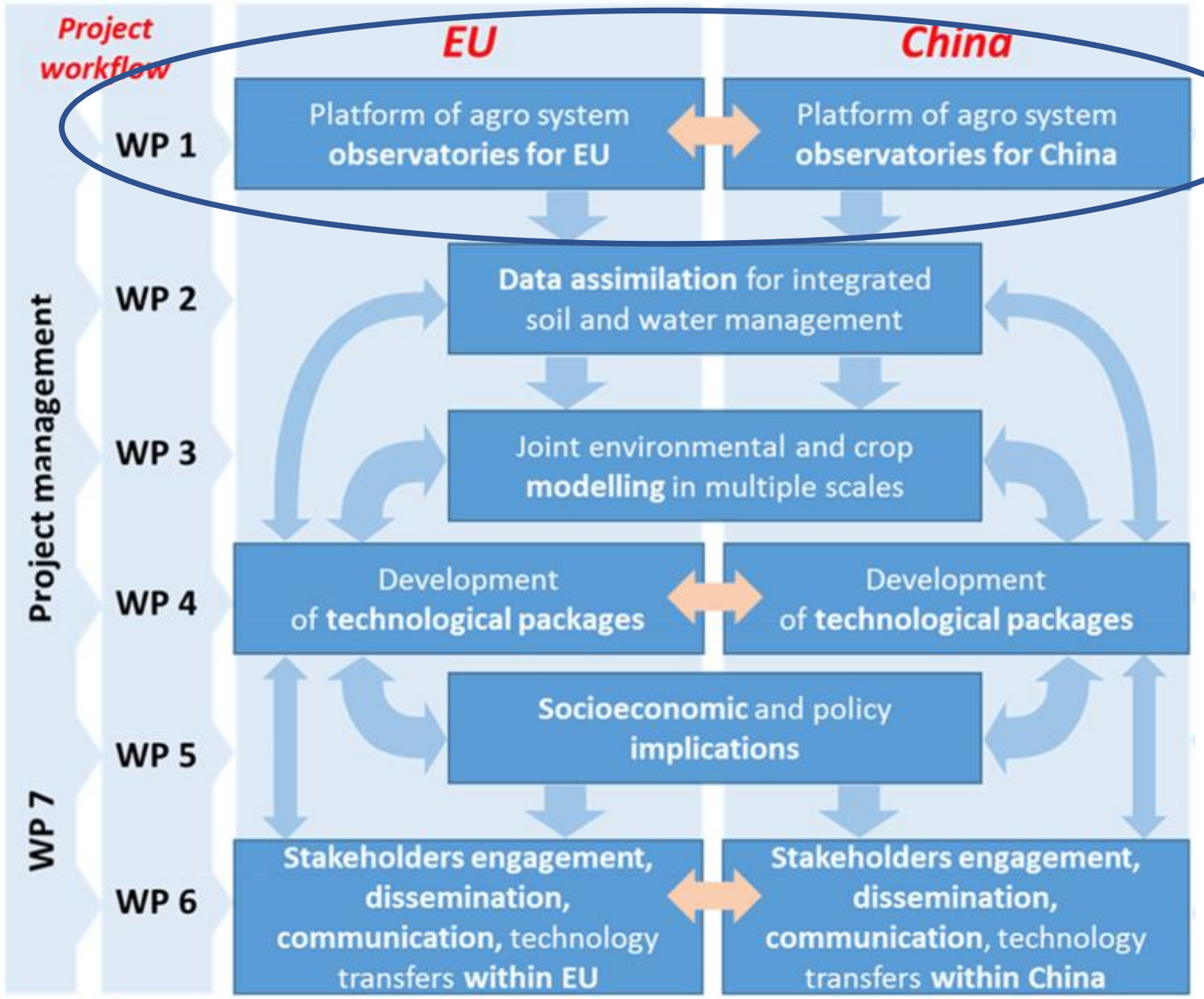
Acting as platforms for collaborative studies

Soil Hydrology research platform underpinning innovation to manage water scarcity in European and Chinese cropping systems

Gomez et al. (2020)

SHui

Managing water scarcity in European and Chinese cropping systems



This project is co-funded by the European Union
Project: 773903

This project is co-funded by the Chinese Ministry of Science & Technology under CFM (China-EU Co-Funding Mechanism)

Bundesamt
für Wasserwirtschaft

Managing water scarcity in European and Chinese cropping systems

Exploring the value of long-term data sets to develop and evaluate agricultural management practices

Webinar, June 23rd 2021

Speakers:

Prof. Andreas Klik – University of Natural Resources and Life Sciences Vienna (BOKU)

Dr. Peter Strauss – Federal Agency for Water Management, Austria

Gunther Liebhard, MSc - University of Natural Resources and Life Sciences Vienna (BOKU)

This project is co-funded by the European Union

Project: 773903

This project is co-funded by the Chinese Ministry of Science & Technology under CFM (China-EU Co-Funding Mechanism)

Bundesamt
für Wasserwirtschaft

Managing water scarcity in European and Chinese cropping systems

Exploring the value of long-term data sets to develop and evaluate agricultural management practices

Webinar, June 23rd 2021

Speakers:

Prof. Andreas Klik – University of Natural Resources and Life Sciences Vienna (BOKU)

Dr. Peter Strauss – Federal Agency for Water Management, Austria

Gunther Liebhard, MSc - University of Natural Resources and Life Sciences Vienna (BOKU)

This project is co-funded by the European Union

Project: 773903

This project is co-funded by the Chinese Ministry of Science & Technology under CFM (China-EU Co-Funding Mechanism)

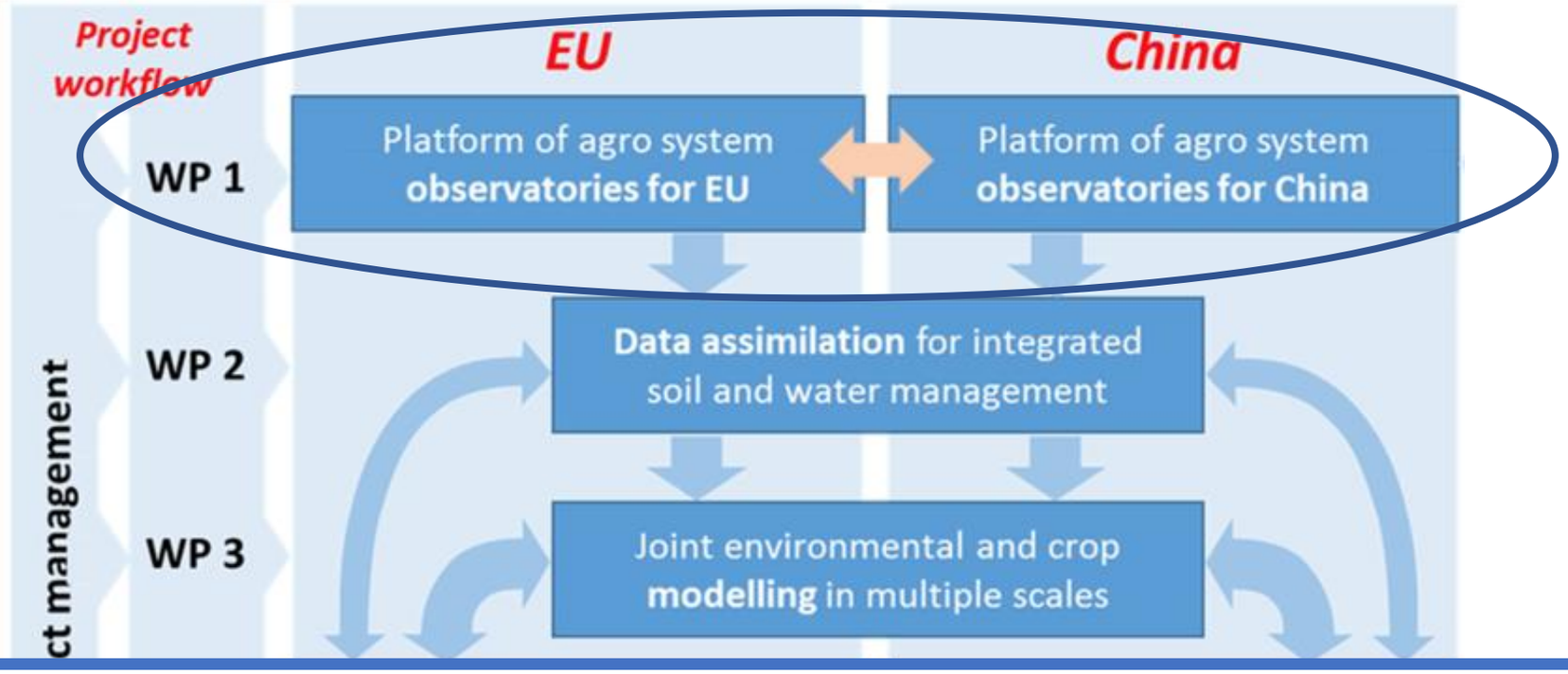
Acting as platforms for collaborative studies

Soil Hydrology research platform underpinning innovation to manage water scarcity in European and Chinese cropping systems

Gomez et al. (2020)

SHui

Managing water scarcity in European and Chinese cropping systems



Calibrating Crop, Hydrology and Soil Erosion models with data from long-term experiments

e.g. AquaCrop, RUSLE, WATEM/SEDEM, WEPP, Hydrus, SWAT, …

→ **How can I use SHui data for agro-environmental modeling?**

cooperations, queries, additional data, …?

This project is co-funded by the European Union
Project: 773903

This project is co-funded by the Chinese Ministry of Science & Technology under CFM (China-EU Co-Funding Mechanism)

SHui database

Managing water scarcity in European and Chinese cropping systems

shui.boku.ac.at/shui/public/start

Copy CSV Excel PDF Print

S

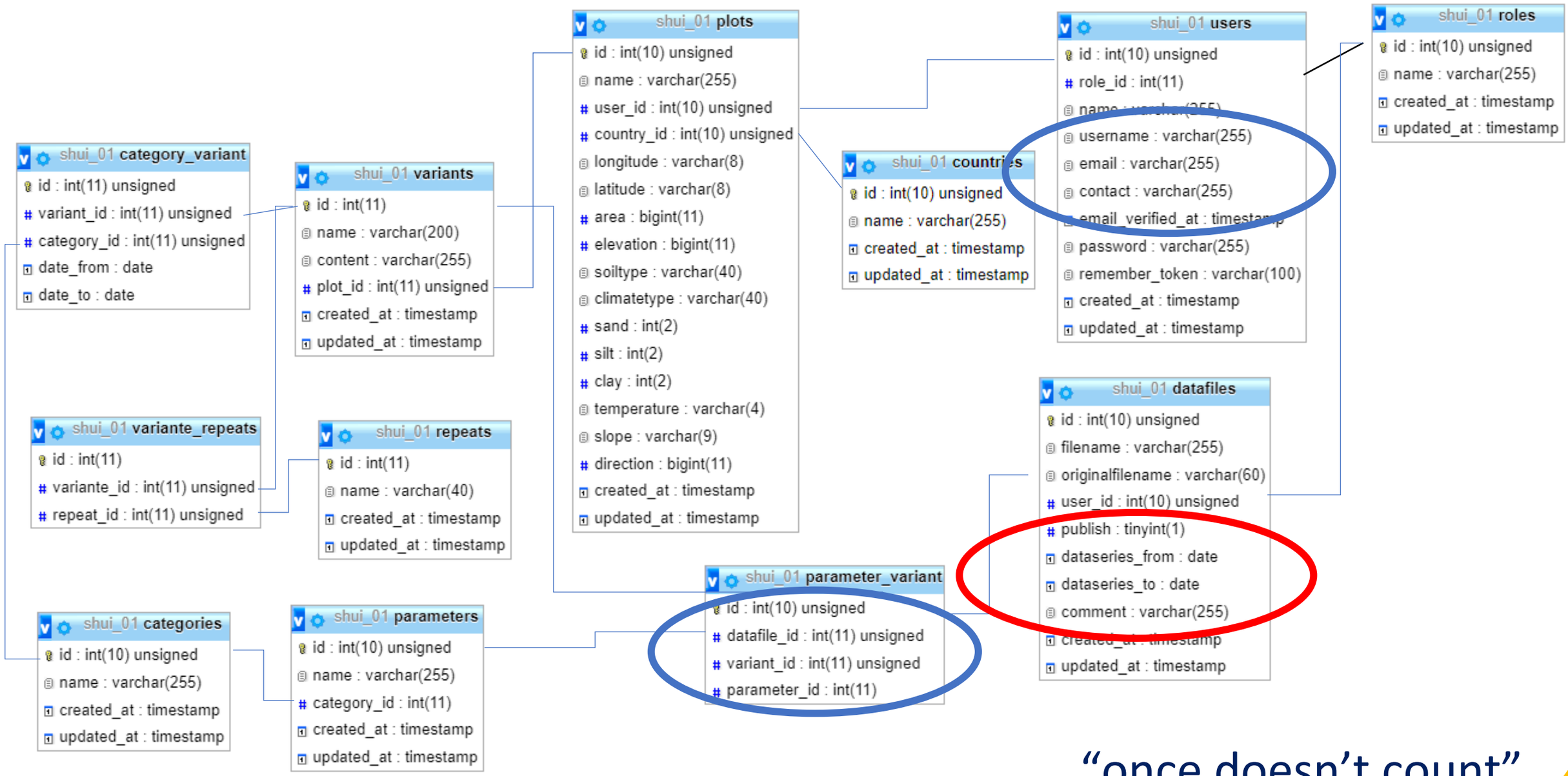
Country	Site	Treatment (Overall research interest)	Area in m^2	Sand	Silt	Clay	Annual precipitation in mm	Average temperature in °C
Austria	Mistelbach	Erosion	360	9	68	23	645	9.6
Austria	Mistelbach	Erosion	360	9	68	23	645	9.6

This project is co-funded by the European Union
Project: 773903

This project is co-funded by the Chinese Ministry of Science & Technology under CFM (China-EU Co-Funding Mechanism)

SHui database - structure

Managing water scarcity in European and Chinese cropping systems



"once doesn't count"

This project is co-funded by the European Union
Project: 773903

This project is co-funded by the Chinese Ministry of Science & Technology under CFM (China-EU Co-Funding Mechanism)

Experiment runtime

Managing water scarcity in European and Chinese cropping systems

Data set for treatment **Erosion**

Crop

You uploaded following file: MB - V5 - Crop.csv
Start dataseries: 1994-01-01
End dataseries: 2017-04-17
Gap filling method and comment:

Status: Published

Download

Management

You uploaded following file: MB - V5 - Management.csv
Start dataseries: 1995-08-01
End dataseries: 2018-09-10
Gap filling method and comment:

Status: Published

Download

Runoff

Soil Characteristics

This project is co-funded by the European Union
Project: 773903

This project is co-funded by the Chinese Ministry of Science & Technology under CFM (China-EU Co-Funding Mechanism)

Data exploitation

Managing water scarcity in European and Chinese cropping systems

Water Flux ✓

Weather ✓

Catchment

Additional information

ADD FILE

Durchsuchen... Keine Datei ausgewählt.

Comment

SUBMIT

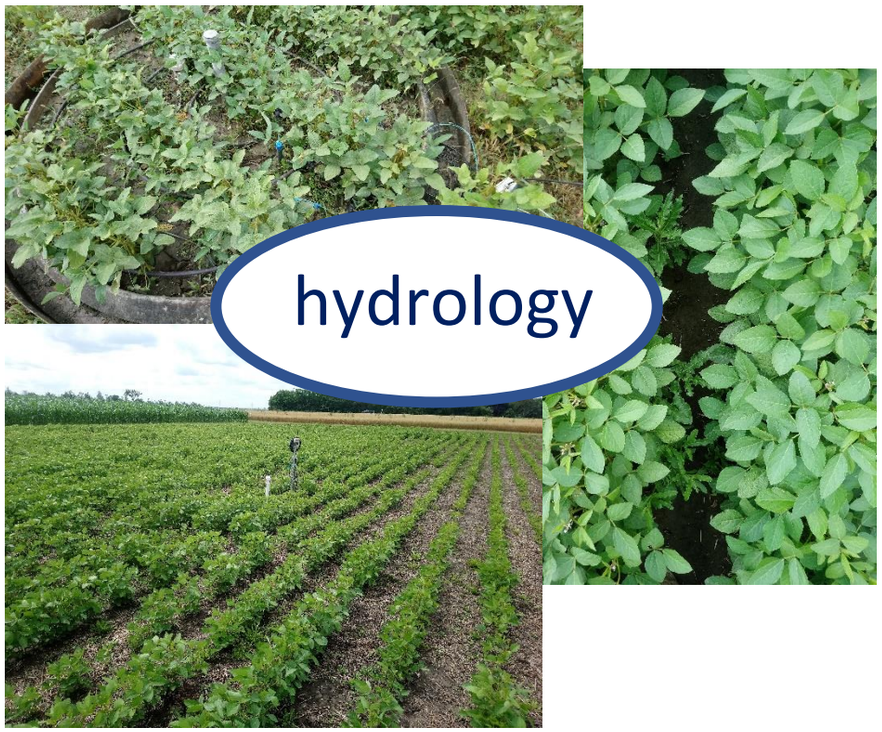
This project is co-funded by the European Union
Project: 773903

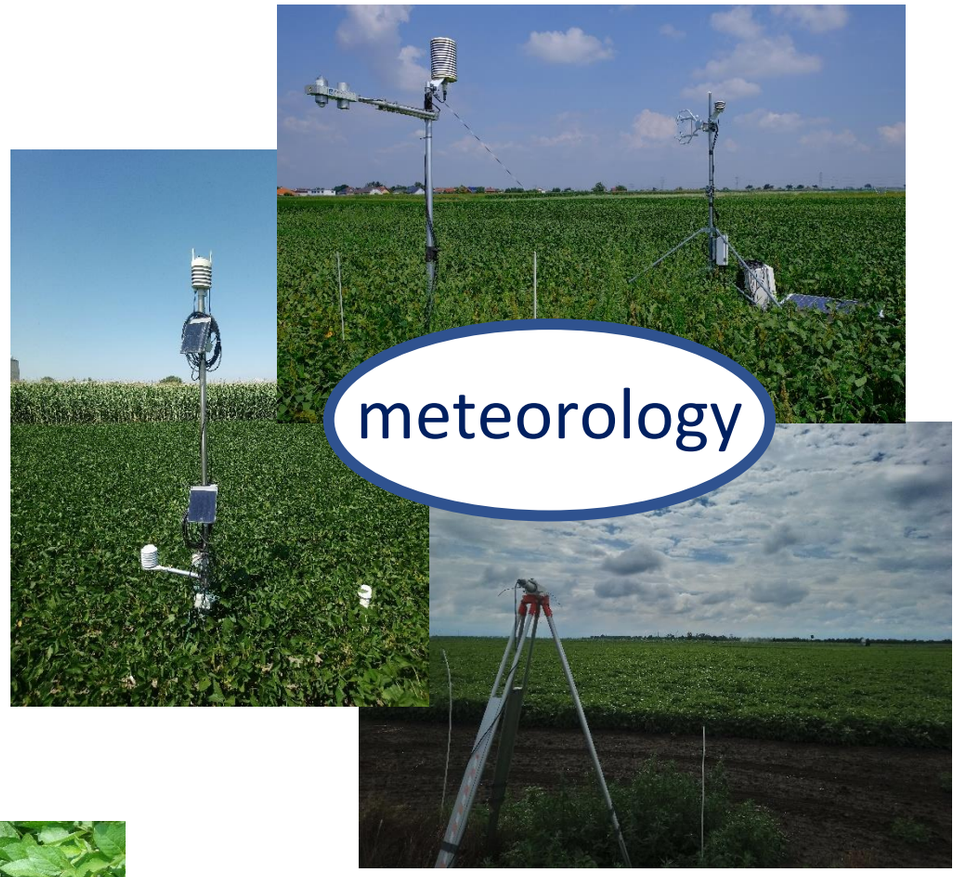
This project is co-funded by the Chinese Ministry of Science & Technology under CFM (China-EU Co-Funding Mechanism)

Data exploitation – example I

Managing water scarcity in European and Chinese cropping systems

Crop growth data from Marchfeld, Austria



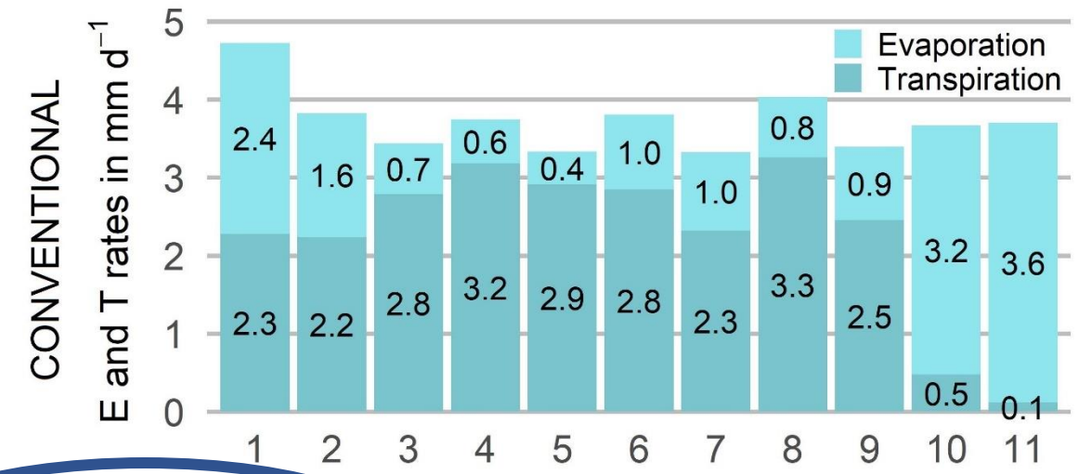


Data exploitation – example I

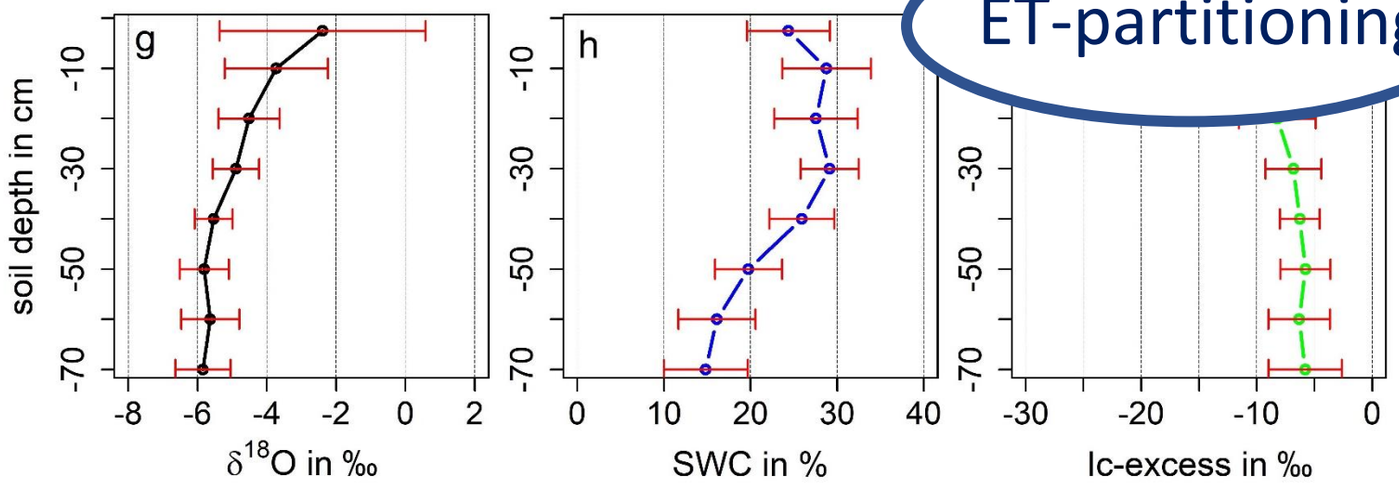
Managing water scarcity in European and Chinese cropping systems

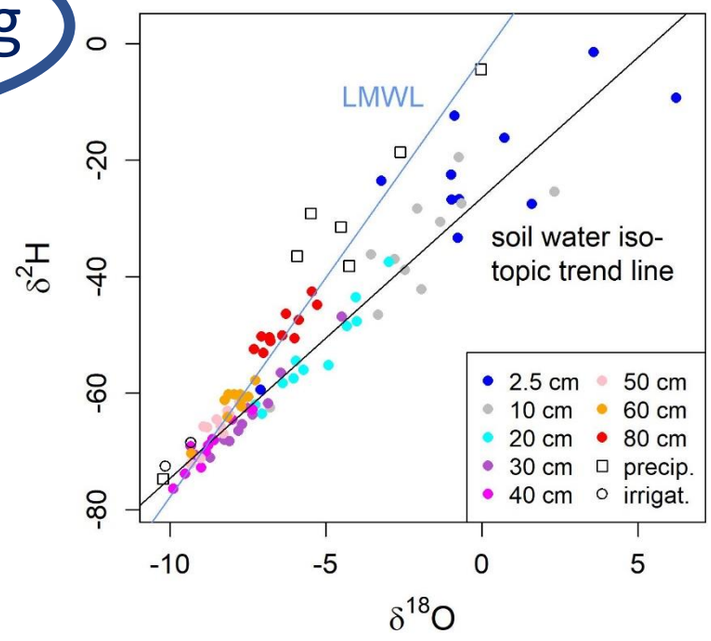
Crop growth data from Marchfeld, Austria

Original exploitation:



ET-partitioning





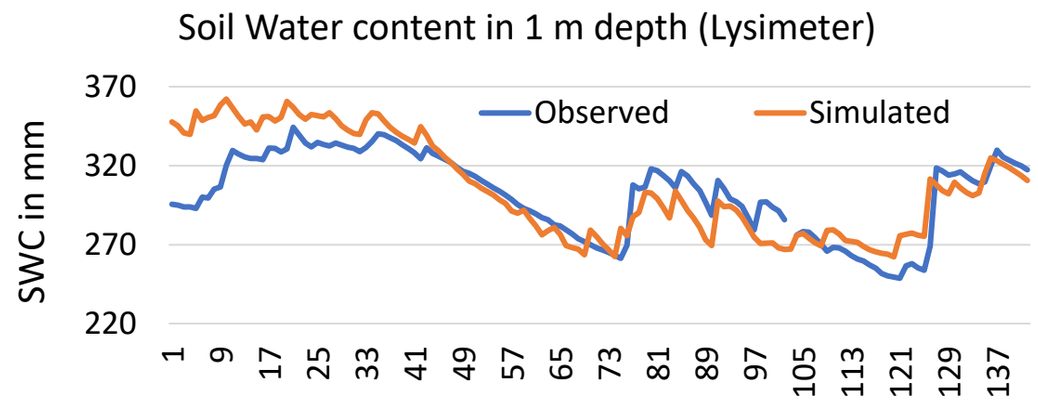
This project is co-funded by the European Union
Project: 773903

This project is co-funded by the Chinese Ministry of Science & Technology under CFM (China-EU Co-Funding Mechanism)

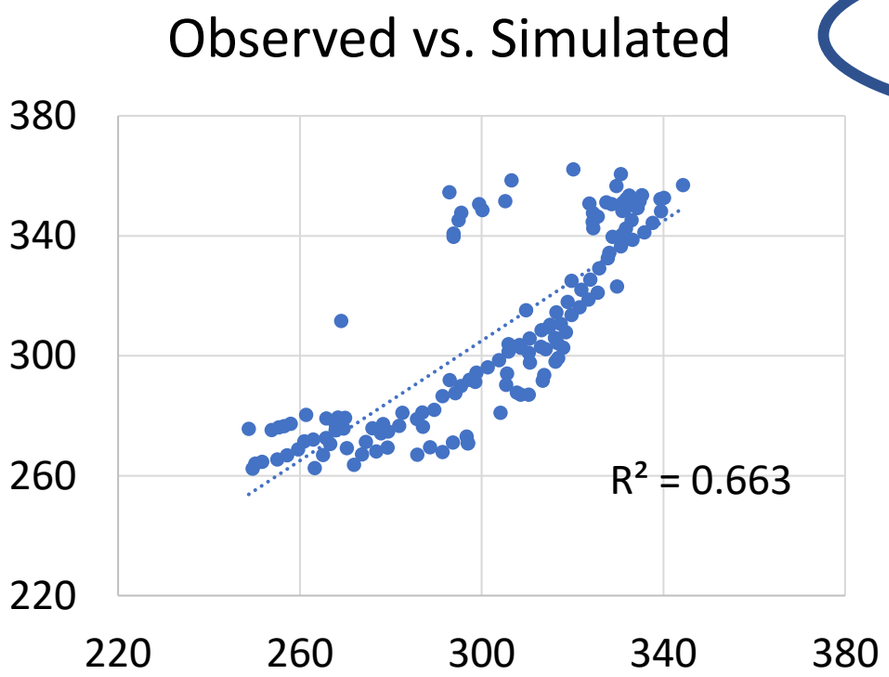
Data exploitation – example I

Managing water scarcity in European and Chinese cropping systems

Crop growth data from Marchfeld, Austria



Database exploitation:



AquaCrop modeling

Crop parameter	Annex AquaCrop	Calibrated Soybean Leanka 2019	
	GDD	GDD	DAYS
CCo (%)	0.004-0.005	2.25	
		98	
		0.500	
Emergence	150-300	147	18
Ccmax	N/A	1048	74
Max. rooting depth	N/A	1085	75
Senescence	1600-2400	1640	106
Maturity	2000-3000	2081	139
Flowering	1000-1500	860	61
Lenght HI	N/A	1208	78
Duration flowering	400 - 800	710	42
HI (%)	40	25	

Data exploitation – example II

Managing water scarcity in European and Chinese cropping systems

Long-term catchment data,
Xichuan River Catchment (719 km^2), China

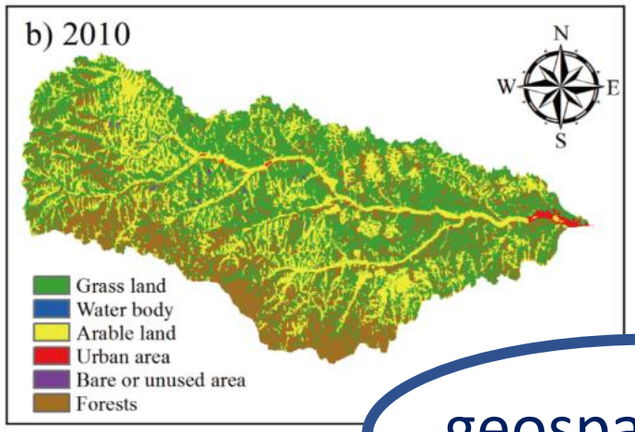
subcatchment close to Ansai

Experiment runtime (measured periods): 1970-1990 & 2006-2010

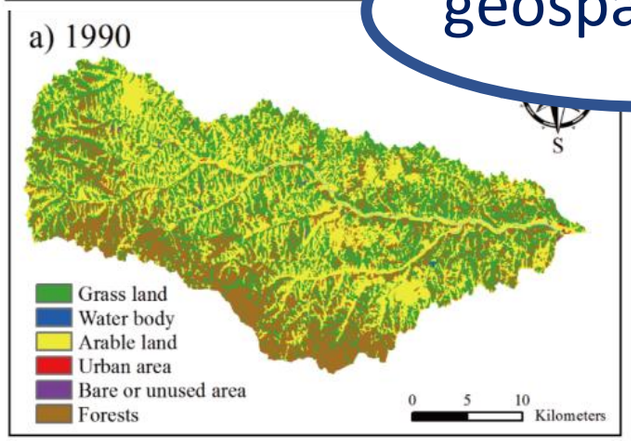
DailyFlow-Zaoyuan
DailyRai
DailyRain
DailyRain-Zhuanyaowan

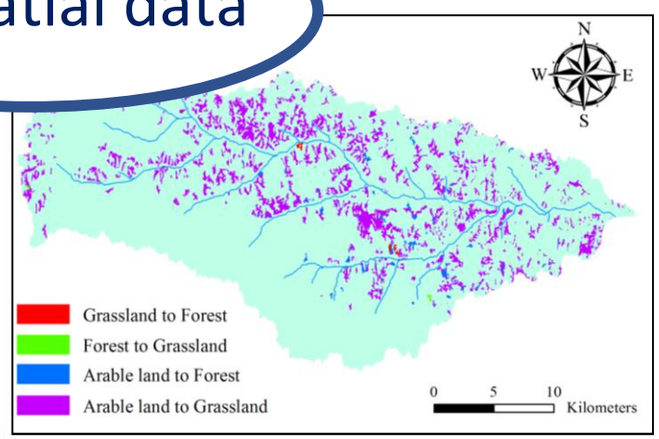
meteorology

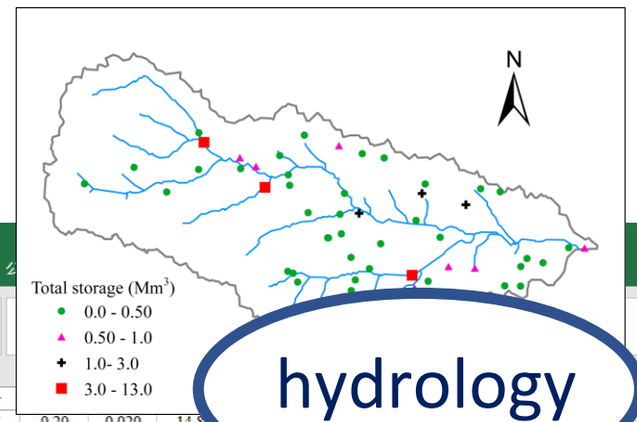
runoff & sediment load



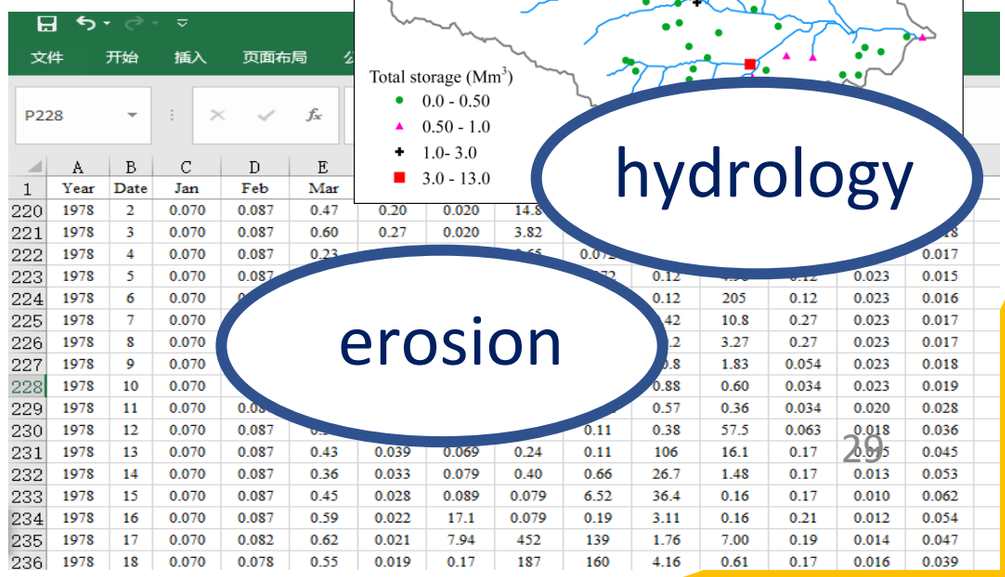
geospatial data







hydrology



	A	B	C	D	E							
1	Year	Date	Jan	Feb	Mar							
220	1978	2	0.070	0.087	0.47	0.20	0.020	14.8				
221	1978	3	0.070	0.087	0.60	0.27	0.020	3.82				
222	1978	4	0.070	0.087	0.23							0.017
223	1978	5	0.070	0.087						0.12		0.023	0.015
224	1978	6	0.070							0.12	205	0.12	0.023	0.016
225	1978	7	0.070							42	10.8	0.27	0.023	0.017
226	1978	8	0.070							.2	3.27	0.27	0.023	0.017
227	1978	9	0.070							.8	1.83	0.054	0.023	0.018
228	1978	10	0.070							0.88	0.60	0.034	0.023	0.019
229	1978	11	0.070	0.08						0.57	0.36	0.034	0.020	0.028
230	1978	12	0.070	0.087					0.11	0.38	57.5	0.063	0.018	0.036
231	1978	13	0.070	0.087	0.43	0.039	0.069	0.24	0.11	106	16.1	0.17	0.015	0.045
232	1978	14	0.070	0.087	0.36	0.033	0.079	0.40	0.66	26.7	1.48	0.17	0.013	0.053
233	1978	15	0.070	0.087	0.45	0.028	0.089	0.079	6.52	36.4	0.16	0.17	0.010	0.062
234	1978	16	0.070	0.087	0.59	0.022	17.1	0.079	0.19	3.11	0.16	0.21	0.012	0.054
235	1978	17	0.070	0.082	0.62	0.021	7.94	452	139	1.76	7.00	0.19	0.014	0.047
236	1978	18	0.070	0.078	0.55	0.019	0.17	187	160	4.16	0.61	0.17	0.016	0.039

erosion

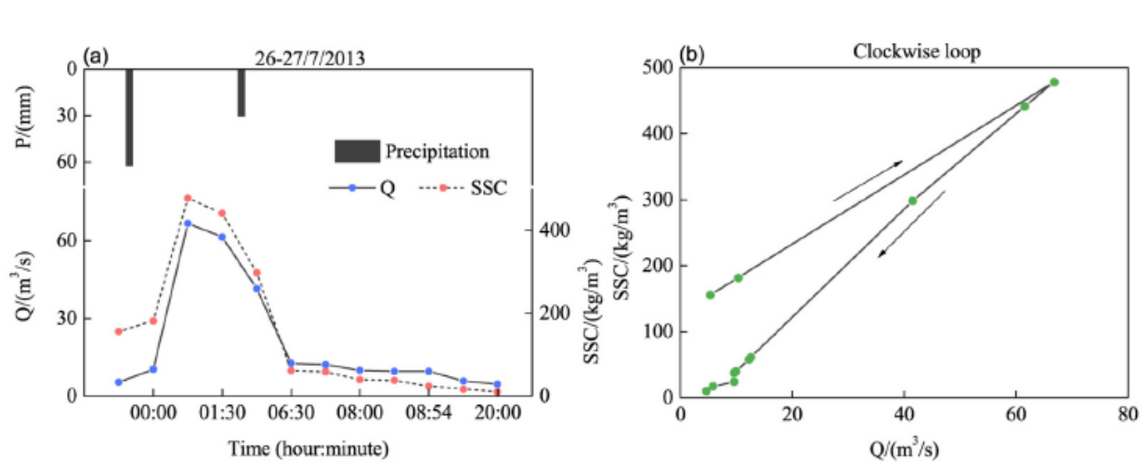
Data exploitation – example II

Managing water scarcity in European and Chinese cropping systems

Long-term catchment data, Xichuan River Catchment (719 km^2), China

Original exploitation:

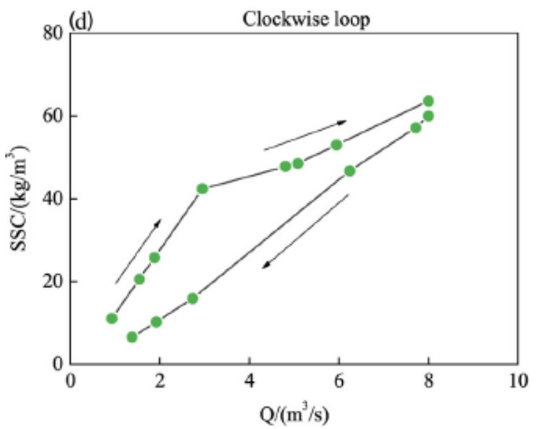
- flood patterns
- characteristic of flood events
- hysteretic loops
- …



Runoff-sediment dynamics under different flood patterns in a Loess Plateau catchment, China

Jinfei Hu[b,c], Peng Gao[a,b,*], Xingmin Mu[a,b], Guangju Zhao[a,b], Wenyi Sun[a,b], Pengfei Li[b], Limei Zhang[a]

[a] State Key Laboratory of Soil Erosion and Dryland Farming on the Loess Plateau, Northwest A&F University, Xinong Road 26, Yangling 712100, Shaanxi Province, China
[b] Institute of Soil and Water Conservation, Chinese Academy of Sciences & Ministry of Water Resources, Xinong Road 26, Yangling 712100, Shaanxi Province, China
[c] University of Chinese Academy of Sciences, Beijing 100049, China



Data exploitation – example II

Managing water scarcity in European and Chinese cropping systems

Long-term catchment data,
Xichuan River Catchment (719 km^2), China

Database exploitation:

- Hydrologic modeling?
- Erosion model calibration?
- Remediation management evaluation?
- Loess plateau investigation?

Data exploitation – example III

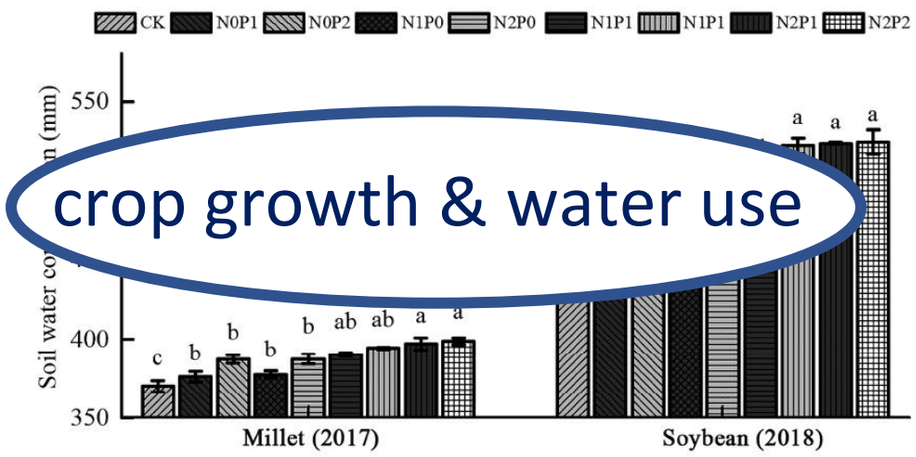
Managing water scarcity in European and Chinese cropping systems

Long-term field plot experiment data, Ansai experimental station, Yanhe River Basin, China

Experiment runtime (measured periods): 2001-2019

precipitation	Temperature	T max. daily	T min. daily	air humidity	w
rain					
mm time-	T	Tmax	Tmin	RH	u-
step-1	°C	°C	°C	%	m
0.9	-6		-16.4	51	
12.6			14	51	
40.8				61	
3.2				35	
34.6				37	
67.3	21.		8.6	58	
103.6	22	35.3	13.3	67	
62.1	22.6	34.4	12	67	

meteorology



crop growth & water use

Figure 5. Soil water consumption under different fertilization regimes. Notes: bars with the same letter

management

Experimental plot layout.								
1	2	3	4	5	6	7	8	9
CK	N0P1	N0P2	N1P0	N1P1	N1P2	N2P0	N2P1	N2P2
10	11	12	13	14	15	16	17	18
N2P2	N2P1	N2P0	N1P2	N1P1	N1P0	N0P2	N0P1	CK
			22	23	24	25	26	27
			1P0	N1P1	N1P2	N2P0	N2P1	N2P2

phosphorus applied;

kg/ha nitrogen and no phosphorus;

N2P0: 240 kg/ha nitrogen applied and no phosphorus;

N0P1: 45 kg P/ha phosphorus applied and no nitrogen;

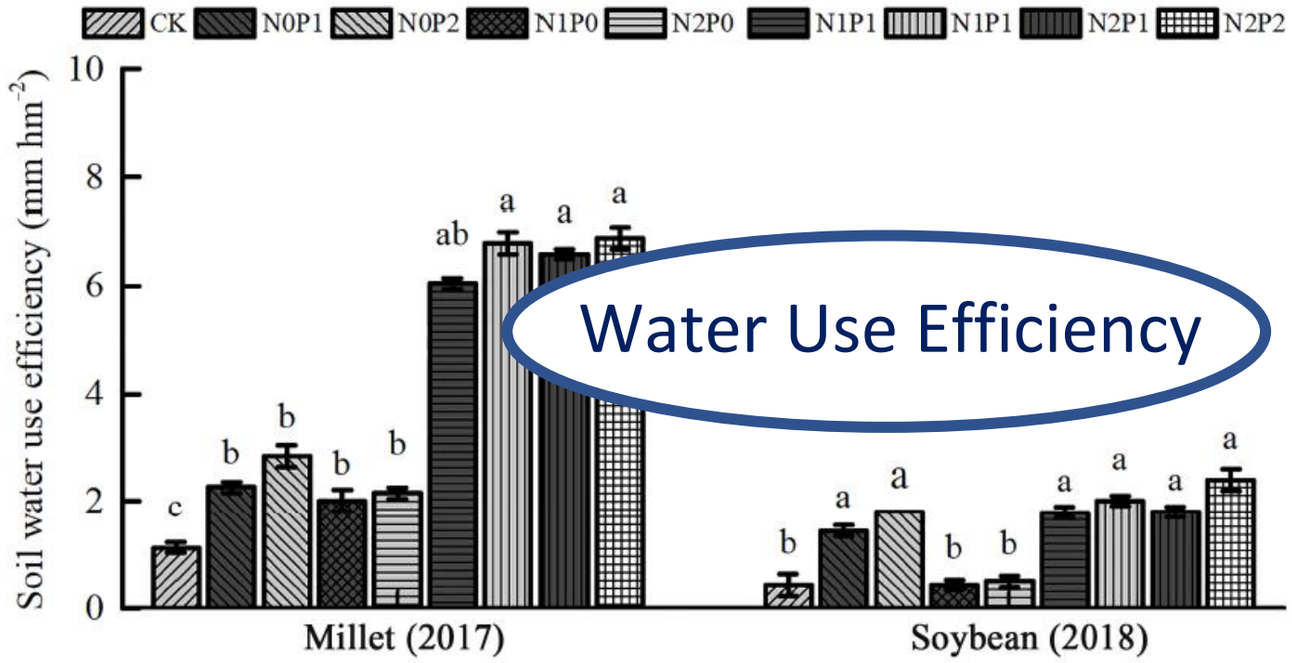
N0P2: 90 kg/ha phosphorus and no nitrogen;

Data exploitation III

Managing water scarcity in European and Chinese cropping systems

Long-term field plot experiment data, Ansai experimental station, Yanhe River Basin, China

Original exploitation:



sustainability

Article

Effects of Different Fertilization Regimes on Crop Yield and Soil Water Use Efficiency of Millet and Soybean

Qiang Liu [1,2], Hongwei Xu [1,2], Xingmin Mu [1,3,*], Guangju Zhao [1,3], Peng Gao [1,3] and Wenyi Sun [1,3]

Data exploitation – example III

Long-term field plot experiment data,
Ansai experimental station, Yanhe River Basin, China

Database exploitation:

AquaCrop modeling?

Further Water Use Efficiency approaches?

Give additional value!

Stakeholder feedback

What?

Honest and critical feedback regarding the database

Who?

Project partners and all persons who compiled/uploaded/downloaded/used the data

Really?

Yes, even if you have not used the data base so far!

This project is co-funded by the European Union
Project: 773903

This project is co-funded by the Chinese Ministry of Science & Technology under CFM (China-EU Co-Funding Mechanism)