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Building and application of pesticide environmental model in China

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2017.10

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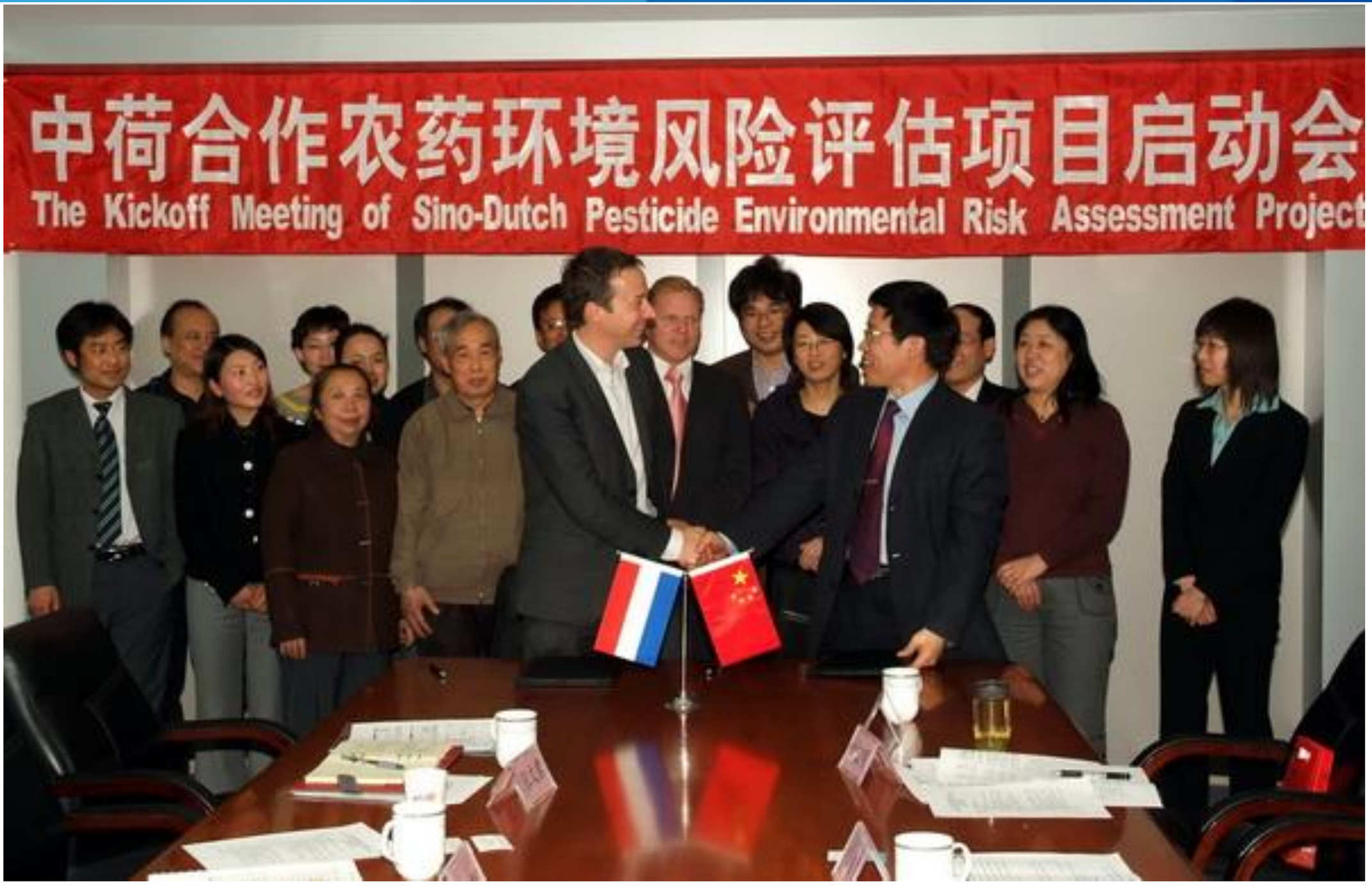
ERA R&D in China

Projects/Funding Agencies	Time
Asia Facility for China/5 Dutch ministries	2008-2010
Dutch MOA & Embassy in China	2006-2009
Introduction of Foreign Advanced Technology /SAFEA	2007-2010
Pesticide Safety Monitoring and Evaluation /MOA	2009-2012
Sino-Us Cooperation/Chinese MOA & USEPA, USDA	2007-2011
Scientific Research for public welfare/MOA & MOST	2009-2013
11^{th}, 12^{th} science & technology Pillar Program/MOST	2005-2015
Agriculture standardization project/MOA	2014-2016
Pesticide usage reduce project/MOST	2016-2020

Sino-Dutch Pesticide Environmental Risk Assessment Project

PERAP
Pesticide Environmental Risk Assessement Project



Current guidance documents on ERA

- Aquatic Ecosystems
- Birds
- Honeybee
- Silkworm
- Ground water
- Non-target arthropod
- Soil organisms （Draft）

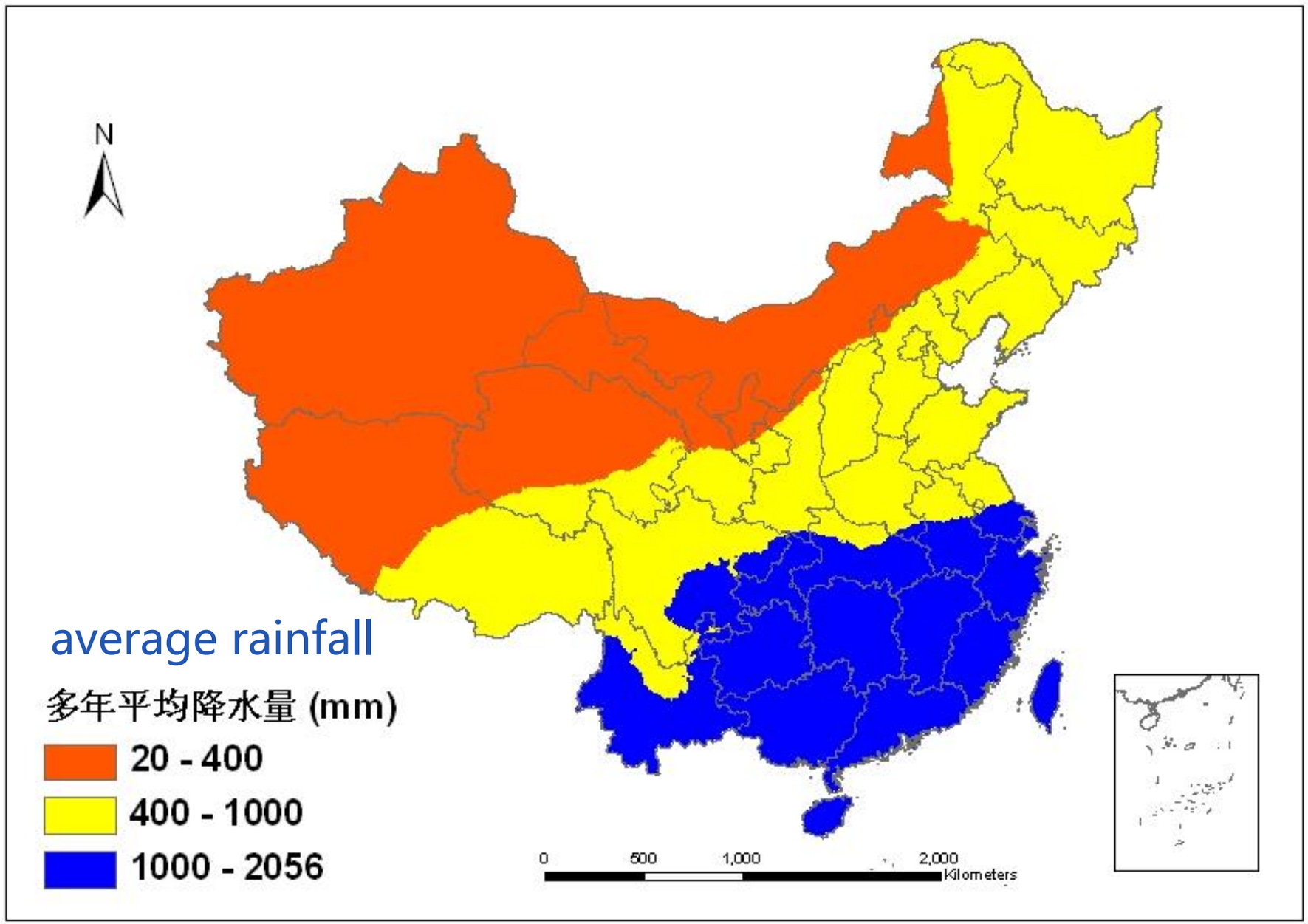
NY/T 2882.1-2016~NY/T 2882.7-2016 (issued by MOA in May 23rd, 2016

What is a model and why modelling?

- Model: simplified representation of reality
- Alternative are measurements
  - expensive and slow
  - large variation in soils, weather
- Advantage of modelling
  - cheap and fast
  - knowledge from one pesticide applicable to others
  - effects of other conditions
  - based on laboratory studies (available in dossiers)
- Scenario
  - A set of fixed input parameters in a pesticide fate model

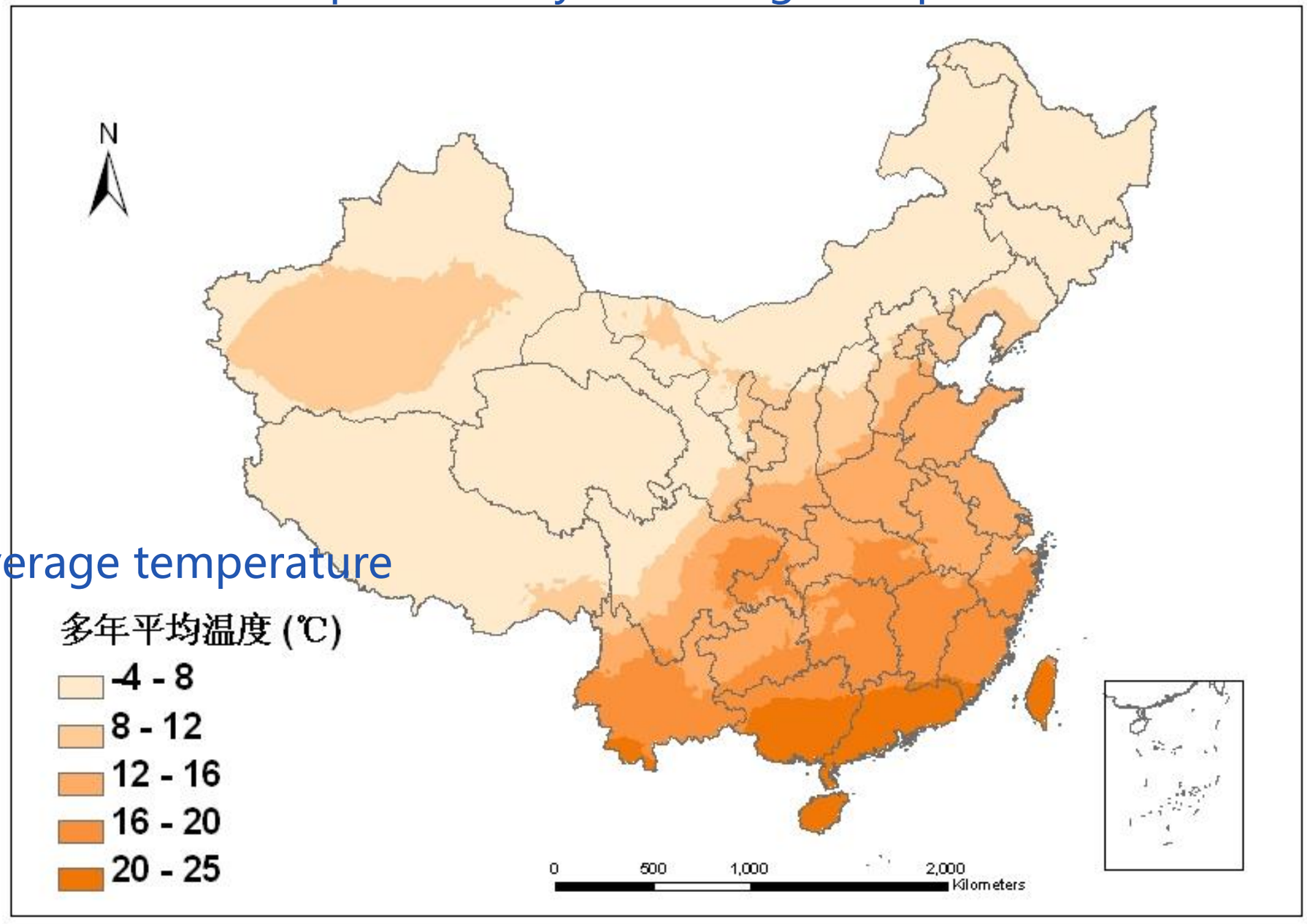
Groundwater scenario zone

Distribution map of Multi-year average rainfall



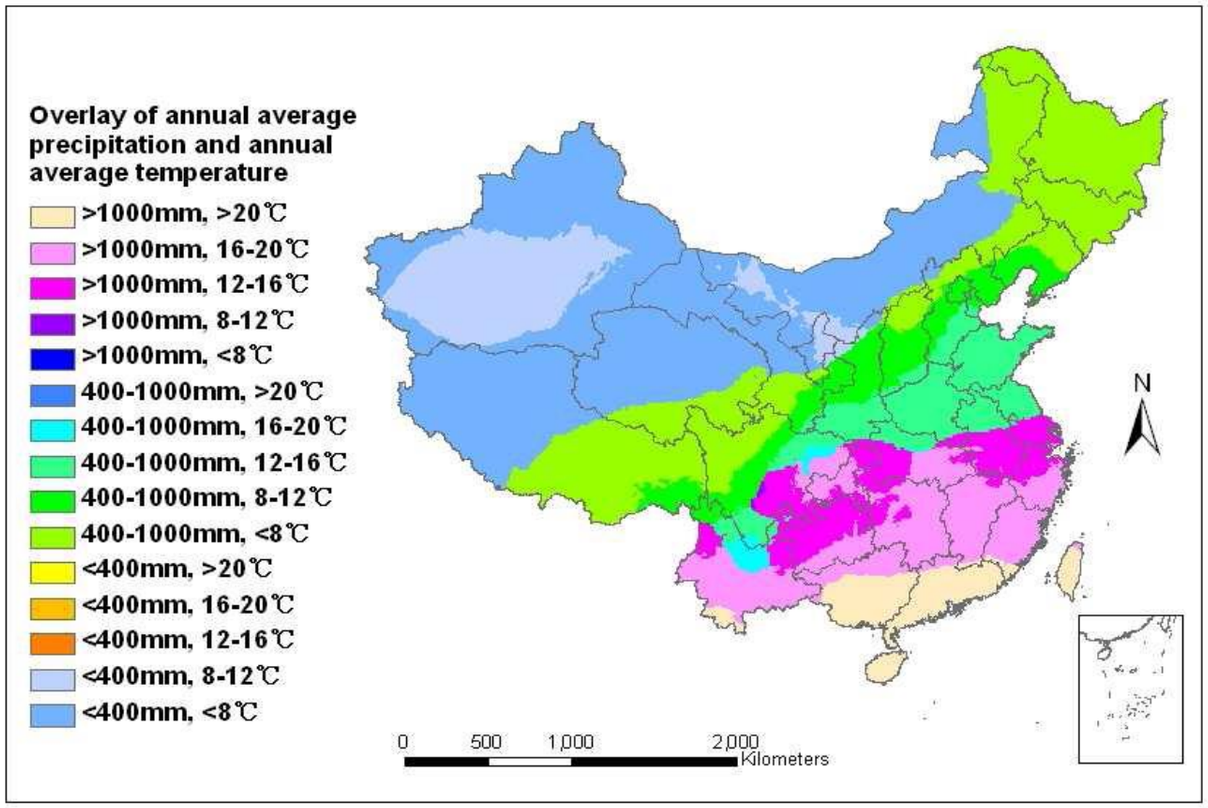
Groundwater scenario zone

Distribution map of Multi-year average temperature

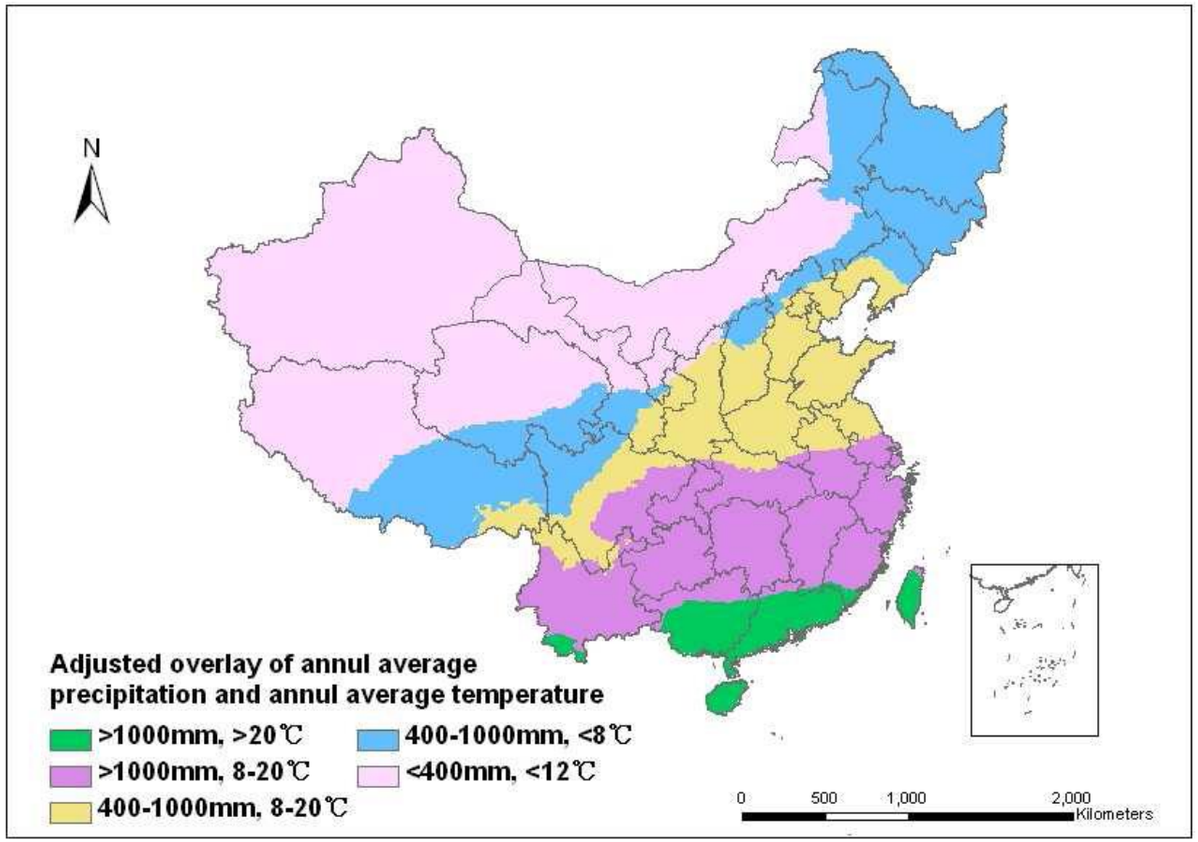


average temperature

Groundwater scenario zone

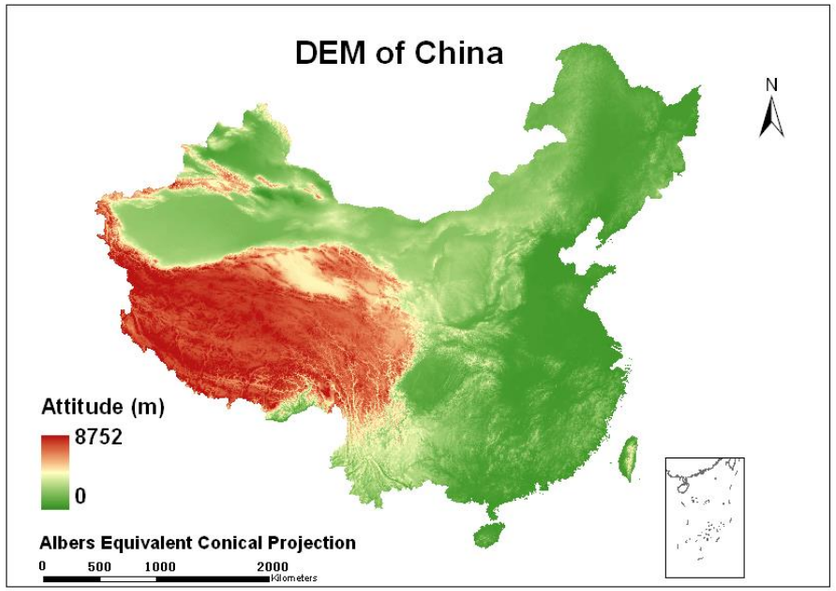


Overlay the two maps

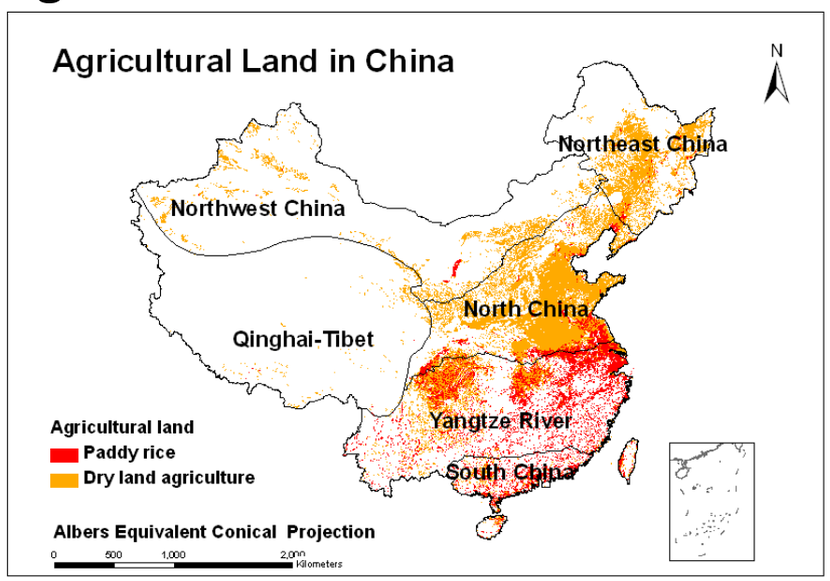


Groundwater scenario zone

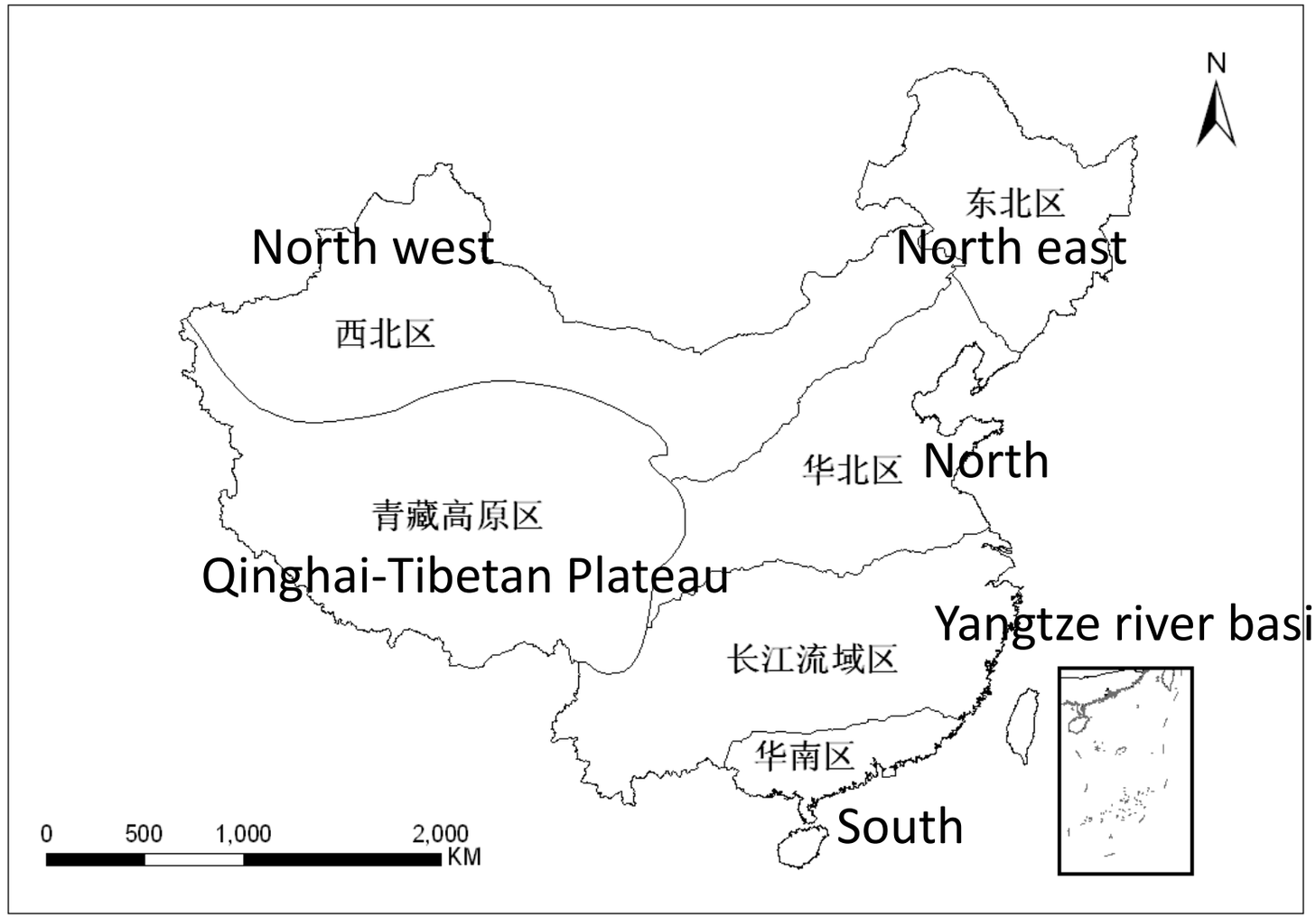
Digital Elevation Model, DEM



Agricultural land

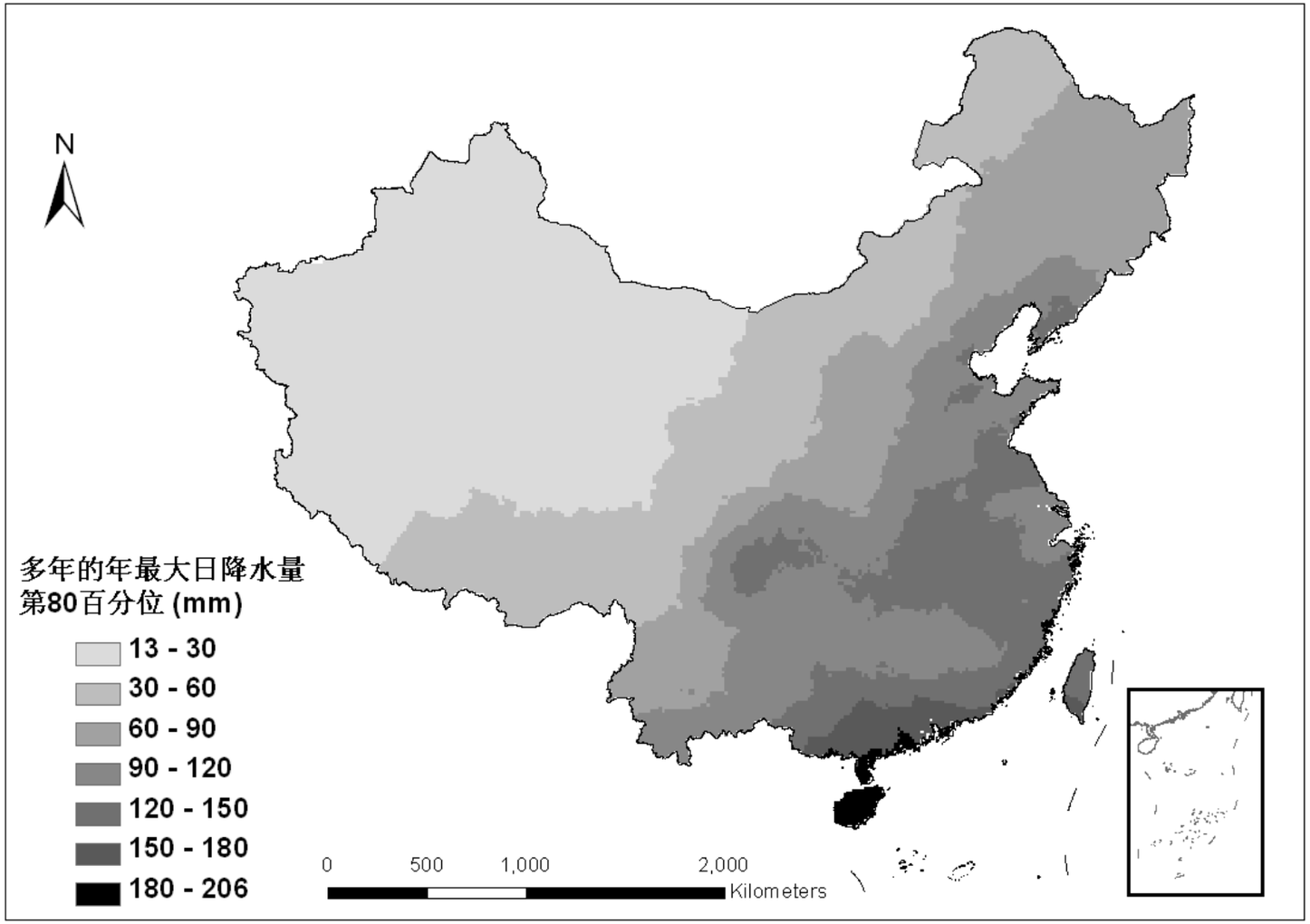


Ground water scenario zone:



Surface water scenario zone

Distribution map of Multi-year 80th maximum daily rainfall

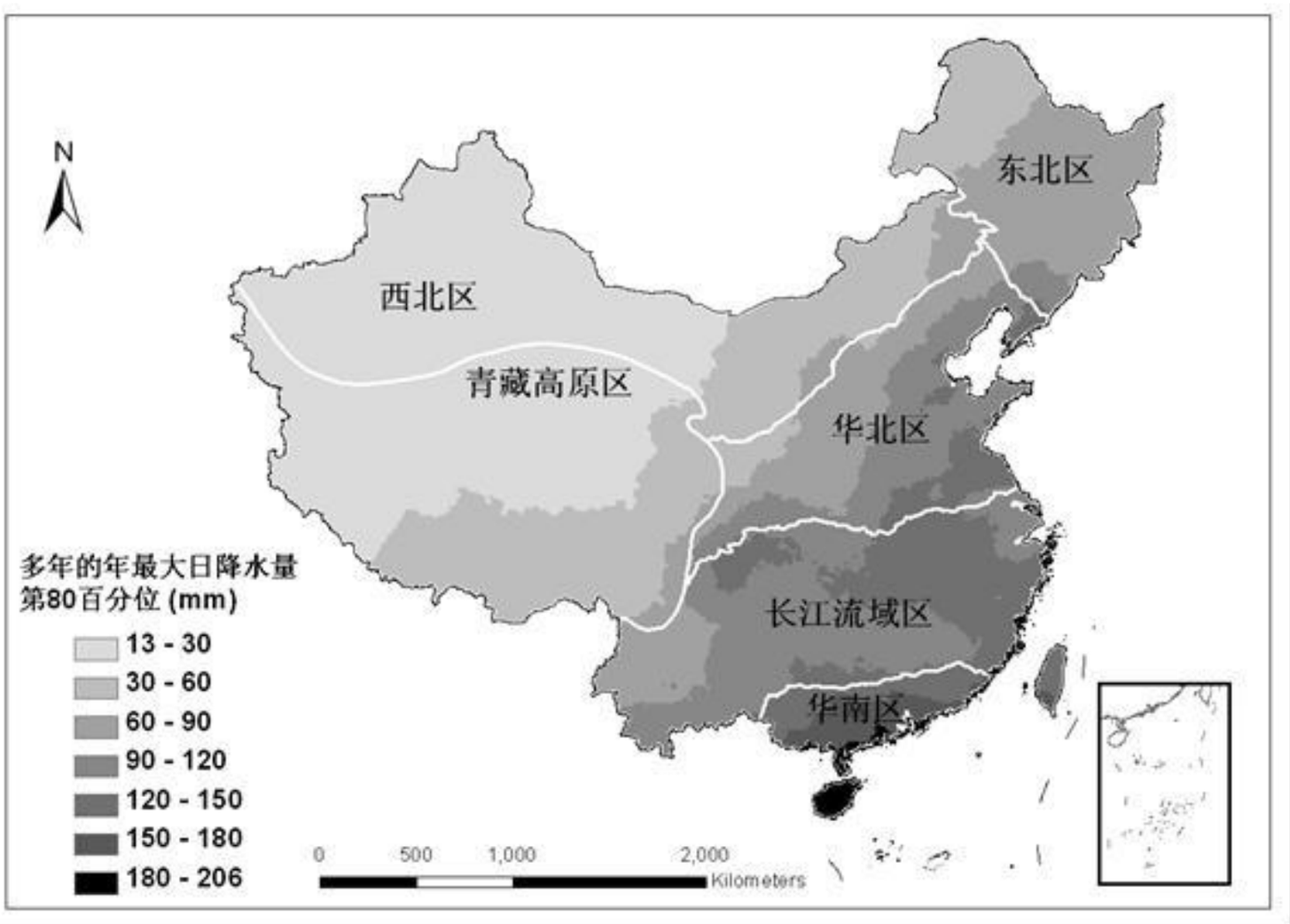


30 years meteorological data from 580 meteo station

ArcGIS® Desktop 9.2.

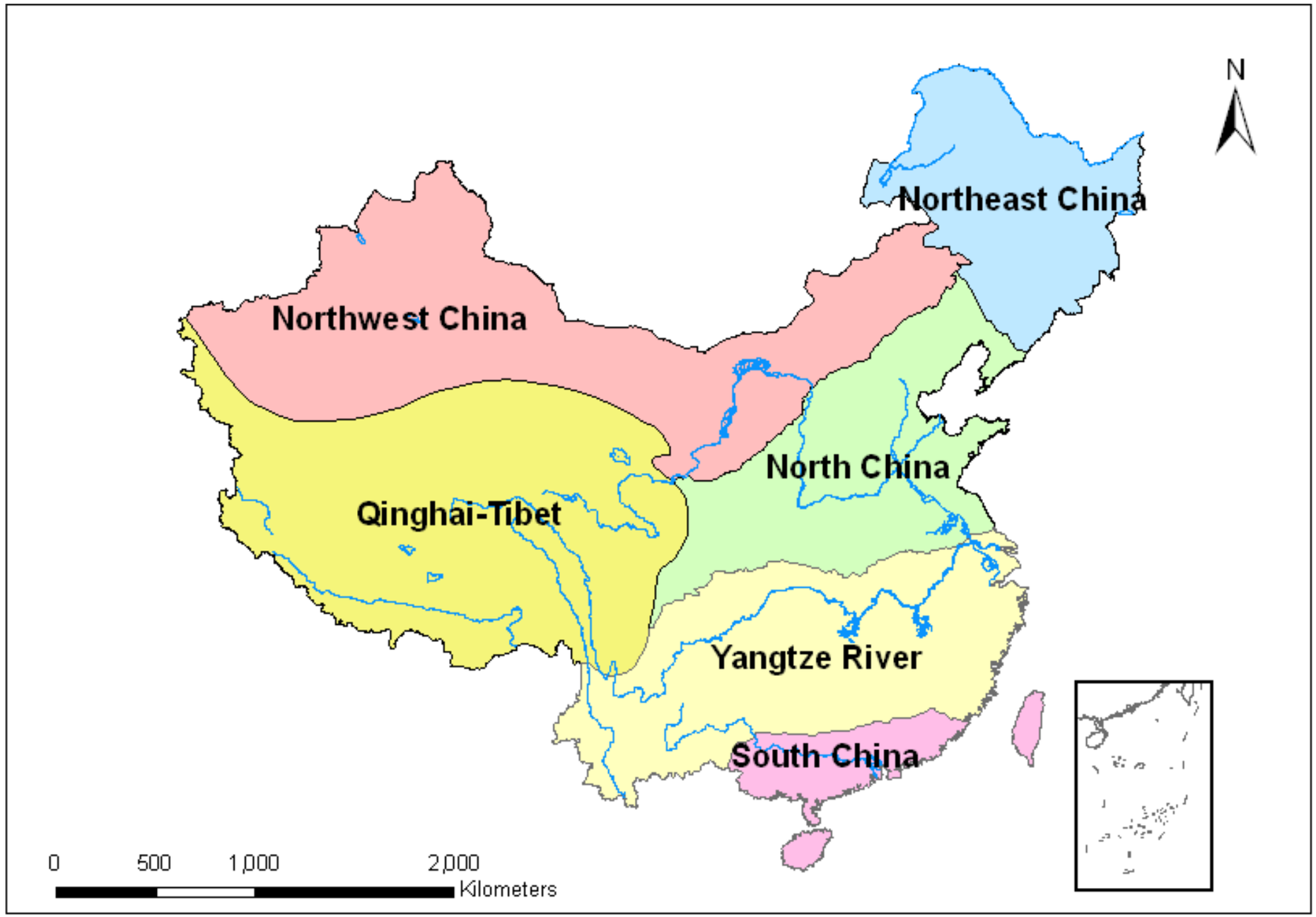
Surface water scenario zone

Overlay of Multi-year 80th maximum daily rainfall Distribution map and groundwater scenario zone

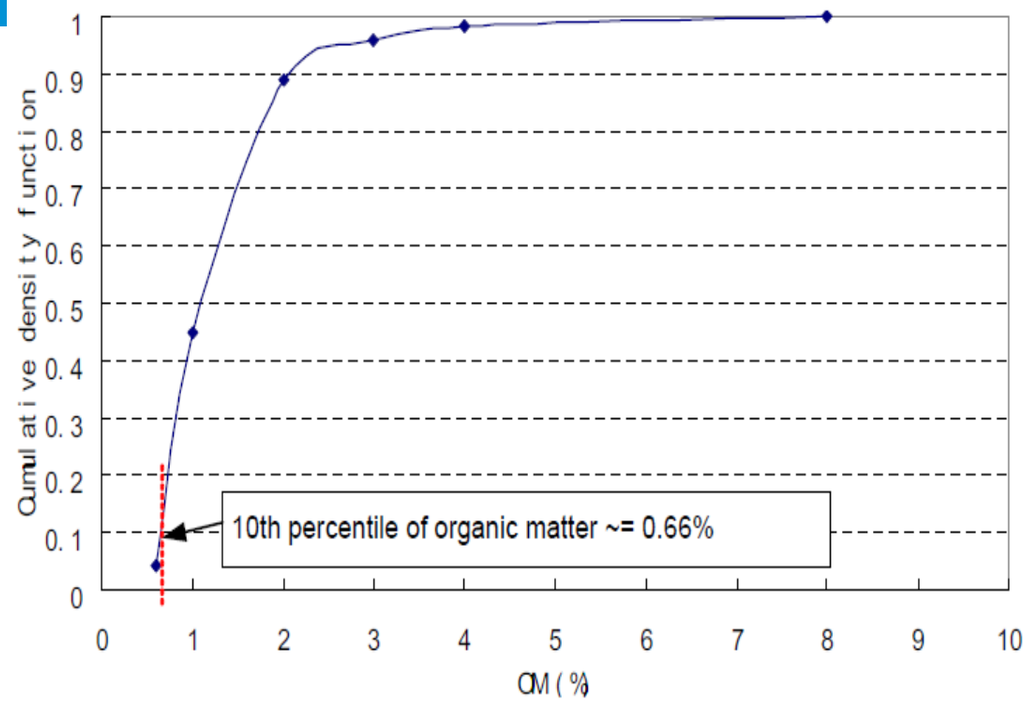


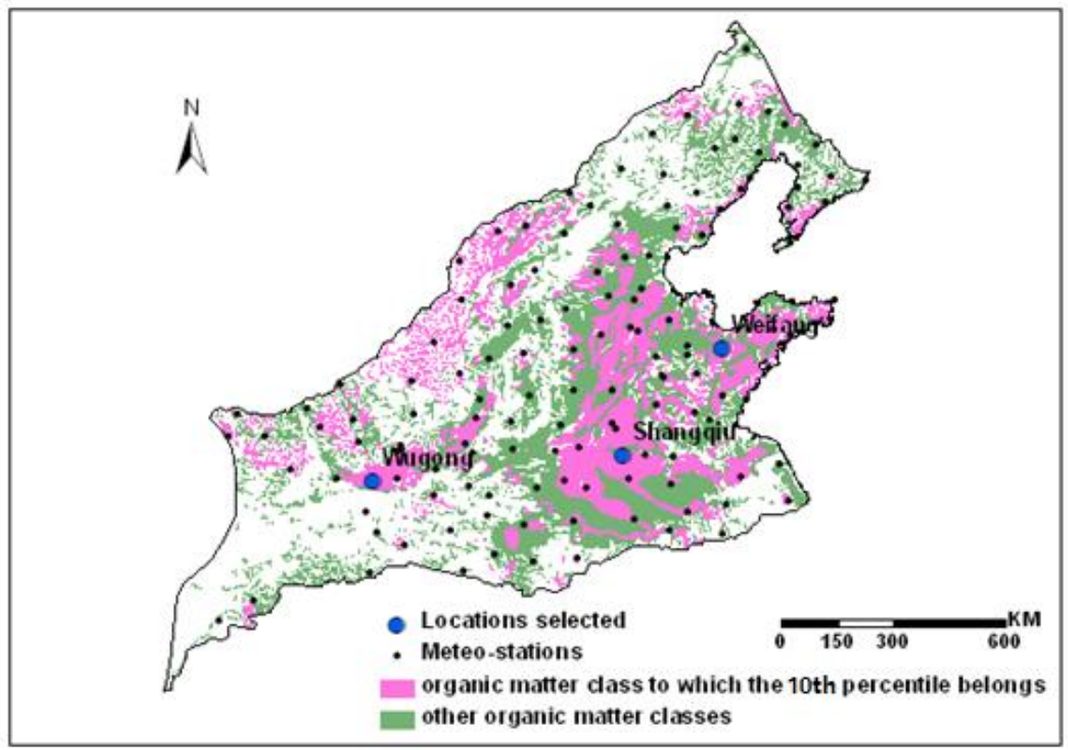
Surface water and groundwater can use the same scenario zone

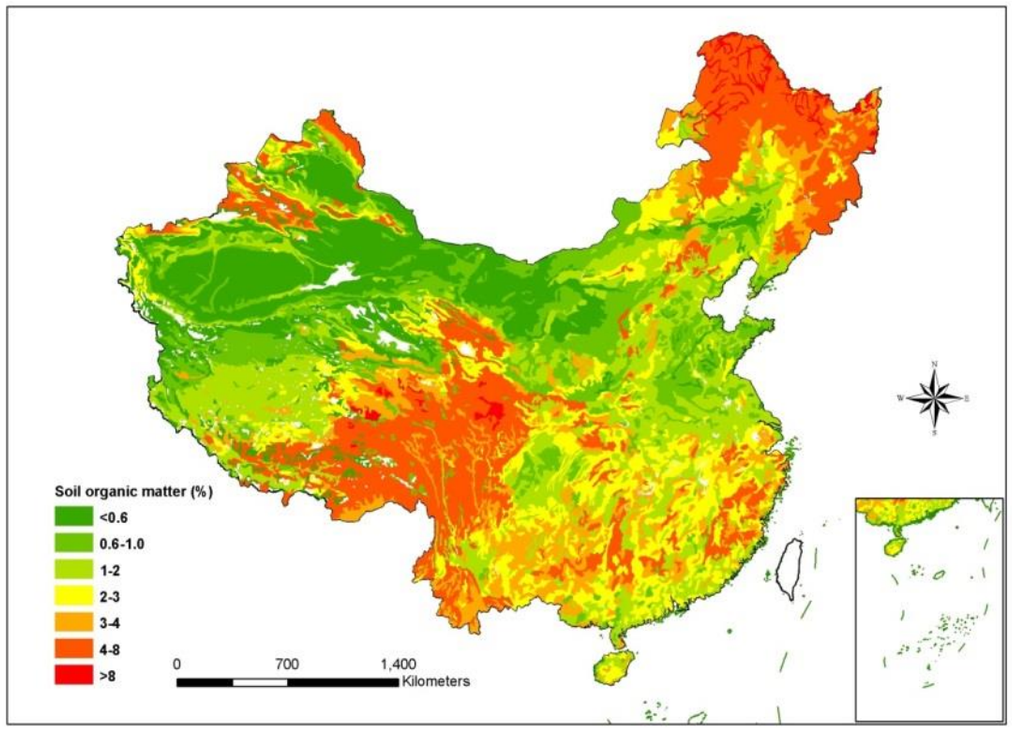
Scenario zone

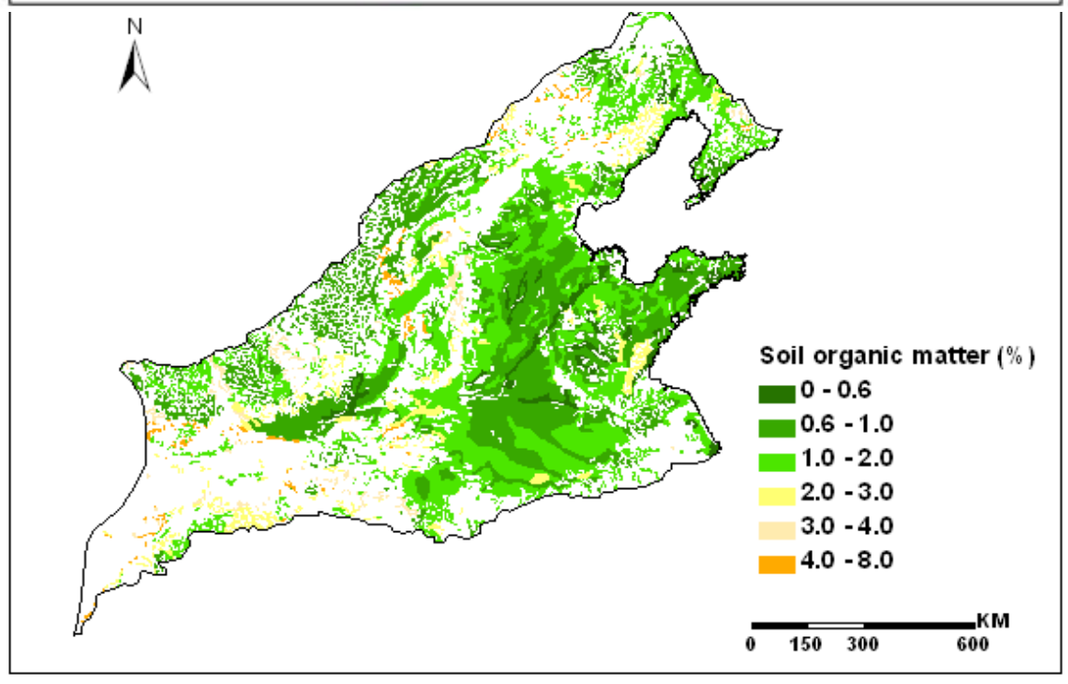


Groundwater scenario

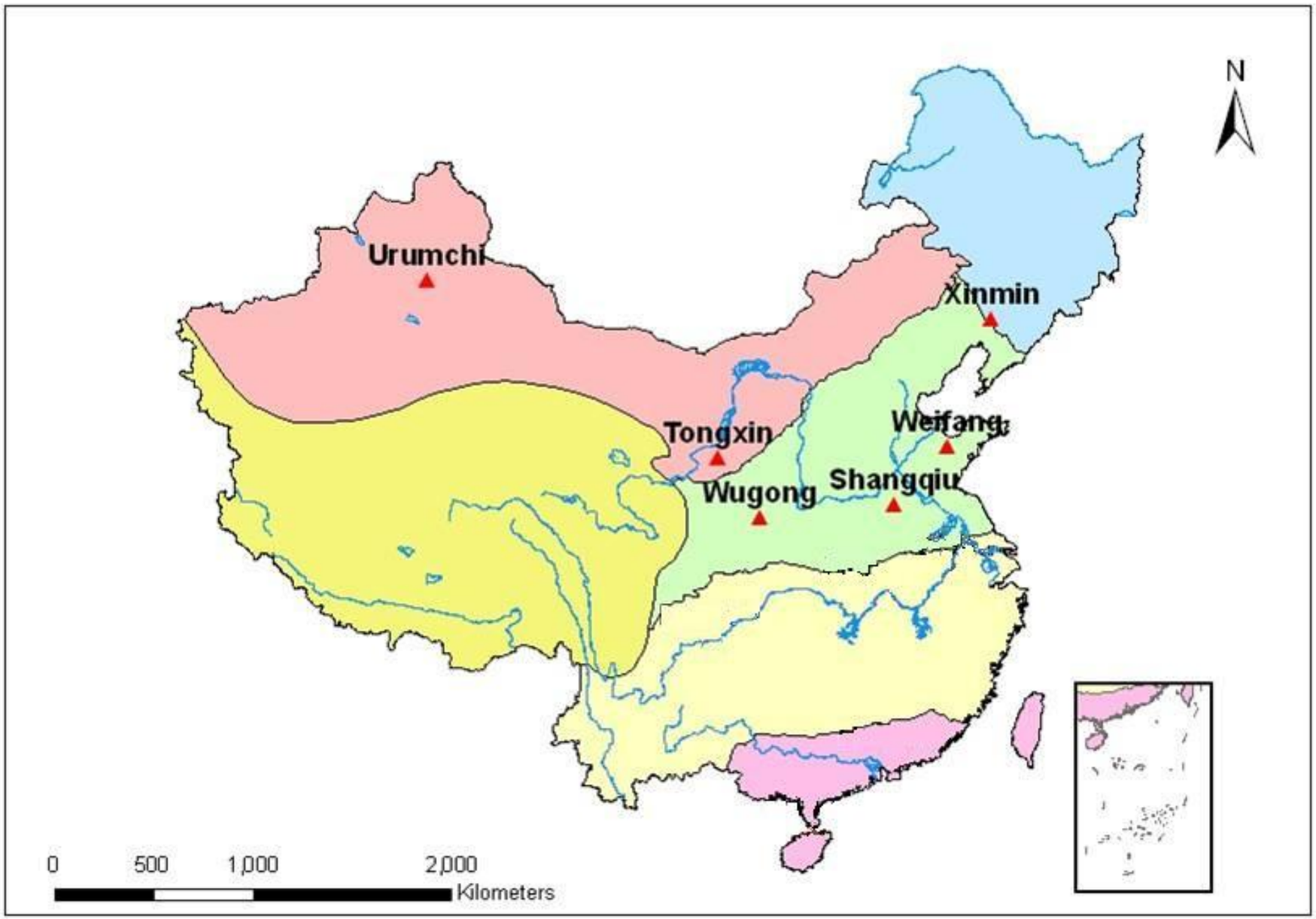




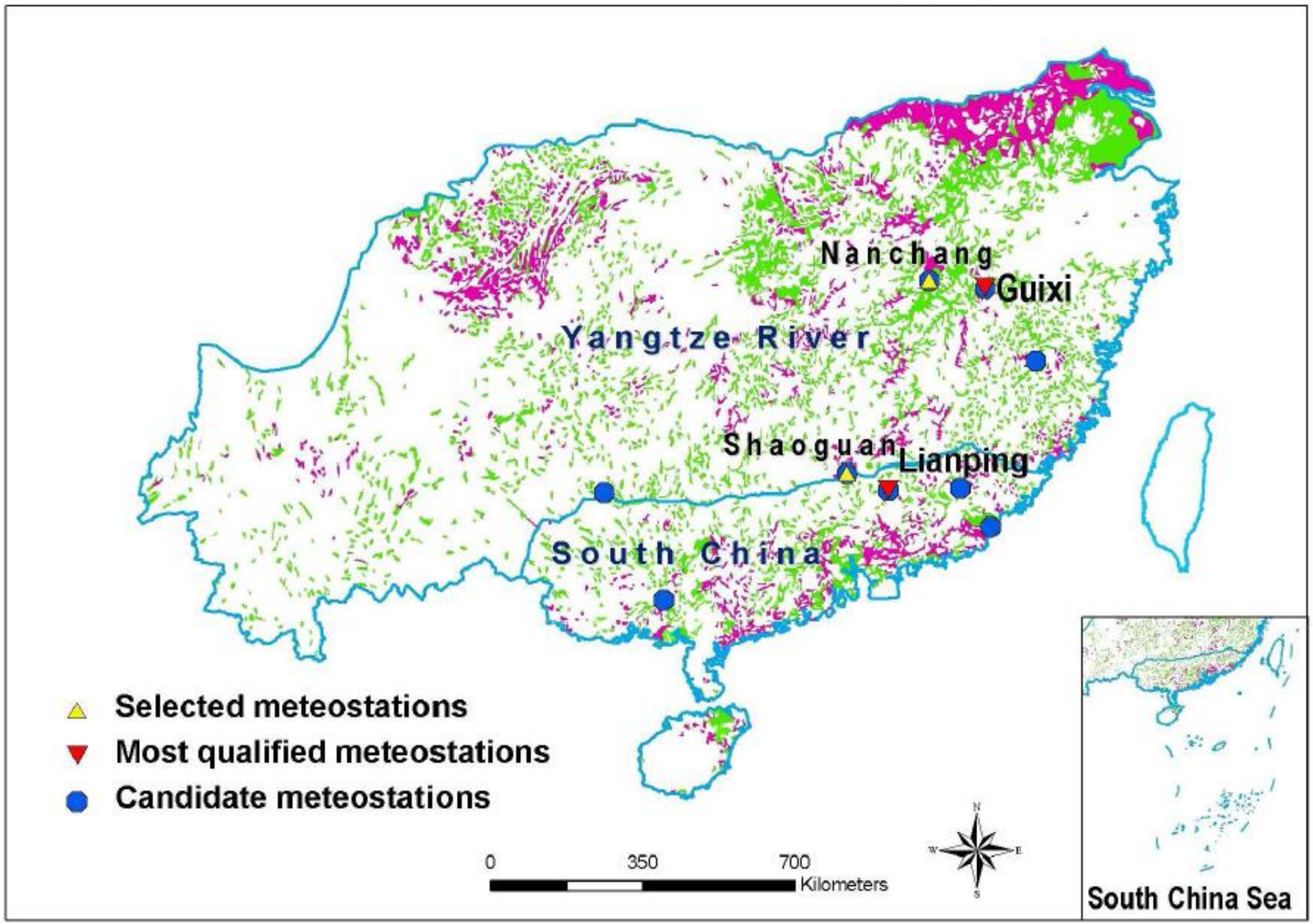




Dry land groundwater scenario

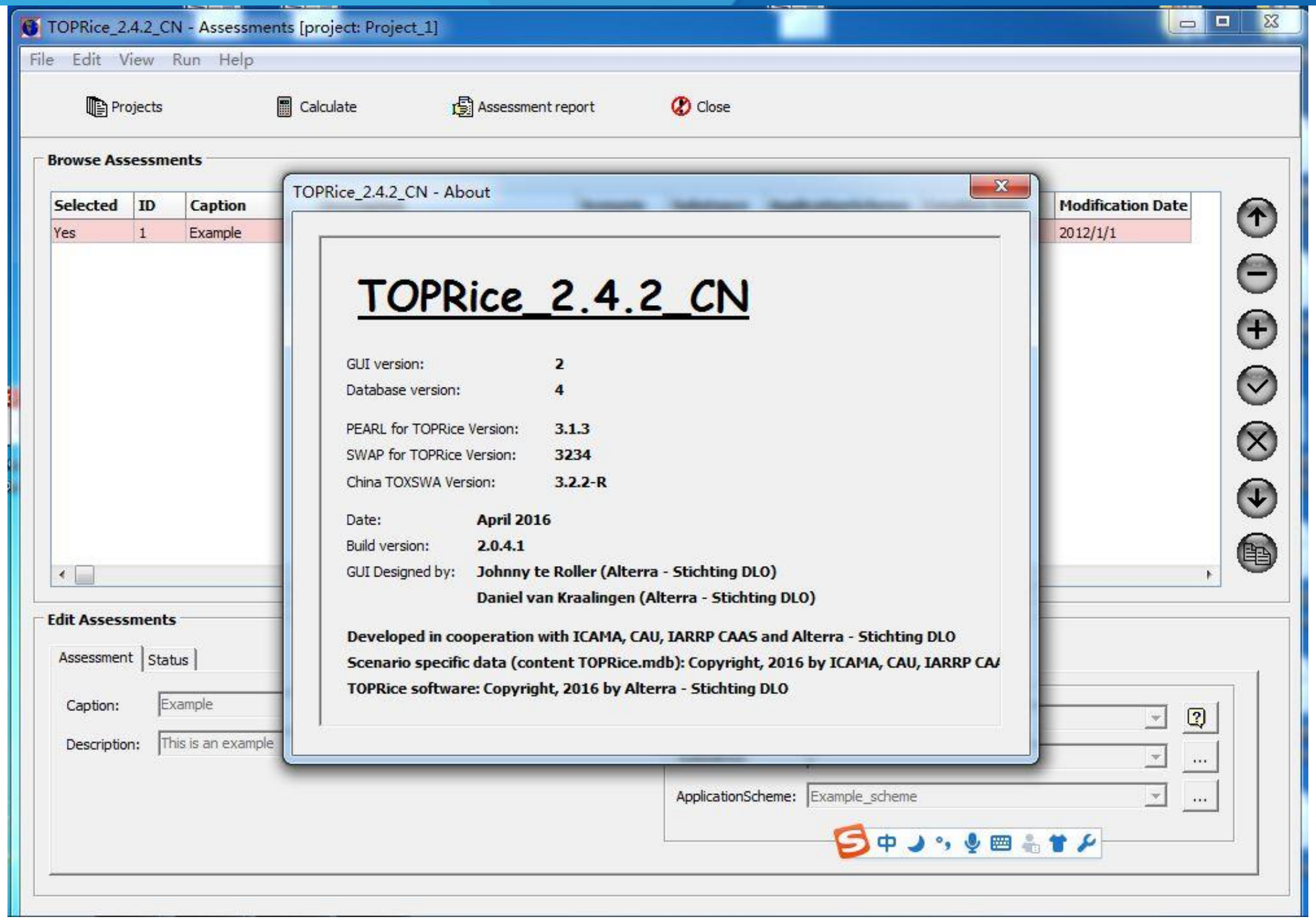


Paddy field groundwater and surface water scenario

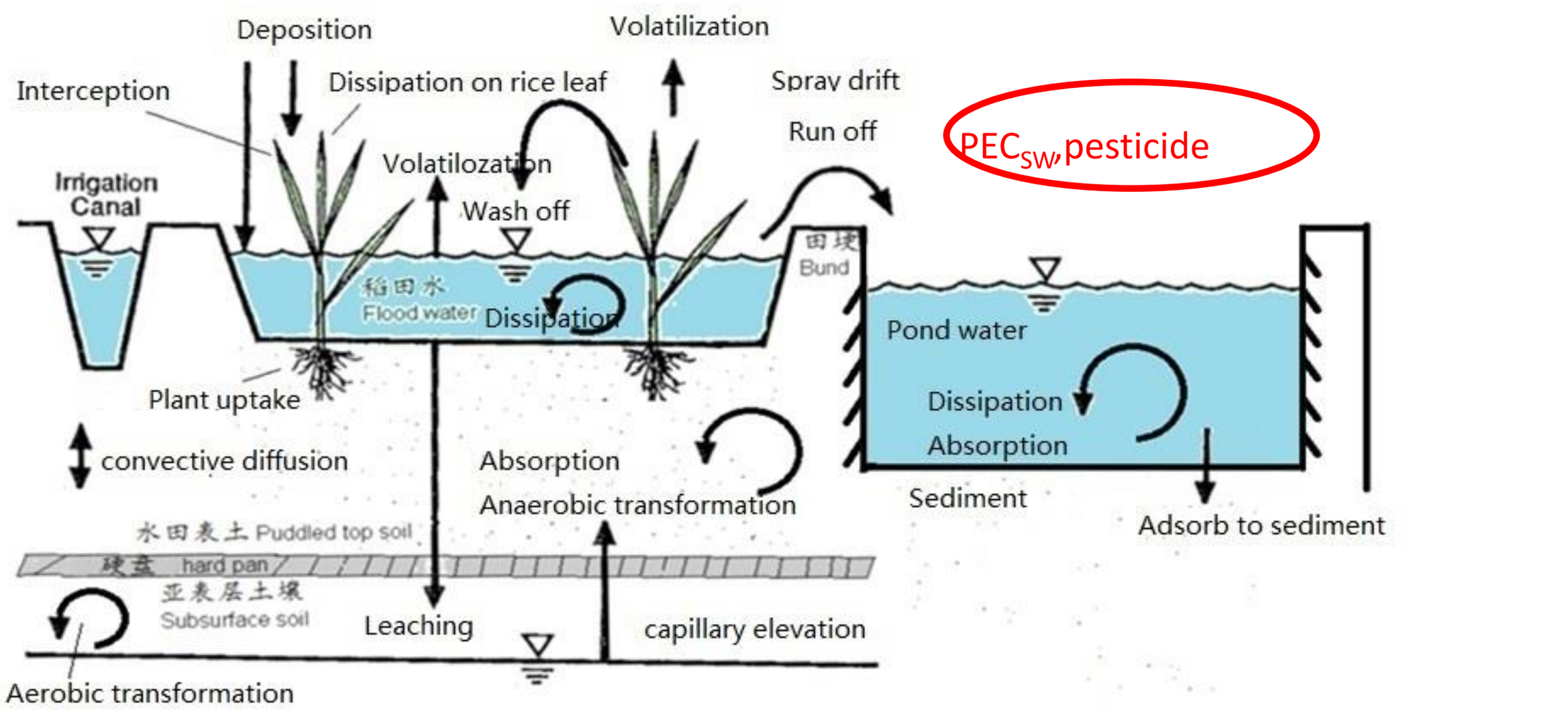


China-PEARL model

TOP-RICE model



TOP-RICE model



PEC_{sw},pesticide

PEC_{GW}， pesticide and metabolite

TOP-RICE: in comparison with PFAM

	Unit	A	B	C	D	E	F	G	H	I
Molecular mass	g/mol	300 for all compounds								
Vapour pressure	Pa at 20°C	1×10^{-7} for all compounds								
Solubility	mg/L at 20°C	1 for all compounds								
Koc	L/kg	10	10	1000	10	100	1000	10	100	1000
		0								
Freundlich 1/n	(-)	0.9 for all compounds								
Soil aerobic degradation	days	3	3	3	30	30	30	300	300	300
Soil anaerobic degradation	days	3	3	3	30	30	30	300	300	300
Water layer of water body	days	1	1	1	10	10	10	100	100	100
Water layer of paddy field	days	1	1	1	10	10	10	100	100	100
Half life at crop surface	days（20 ℃）	10 for all compounds								
Wash off factor	1/m	100 for all compounds								

TOP-RICE2 : in comparison with PFAM

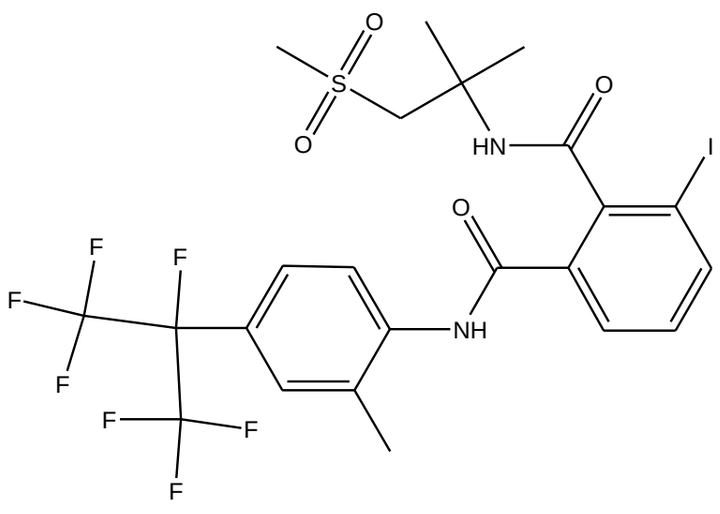
Chemical	Scenario	PEC $_{\text{TOP-RICE 2}}$ [µg/L]	PEC $_{\text{PFAM 1.103}}$ [µg/L]
A	Lianping	39.86	**56.25**
A	Nanchang	38.54	**58.80**
B	Lianping	39.86	**56.16**
B	Nanchang	38.54	**58.70**
C	Lianping	39.59	**55.21**
C	Nanchang	38.43	**57.69**
D	Lianping	**216.07**	168.61
D	Nanchang	**136.66**	103.94
E	Lianping	**215.87**	166.13
E	Nanchang	**136.46**	103.36
F	Lianping	**215.76**	113.95
F	Nanchang	**136.40**	101.06
G	Lianping	274.18	**338.99**
G	Nanchang	203.30	**260.74**
H	Lianping	274.14	**321.65**
H	Nanchang	203.10	**240.23**
I	Lianping	**274.08**	207.33
I	Nanchang	**202.97**	131.06

Application of exposure model

- From 2012, China-PEARL and TOP-RICE was used in pesticide registration.
  - China-PEARL: 33 chemicals
  - TOP-RICE: 34 chemicals, 17 shows an unacceptable risk

Example of application

- Insecticide: flubendiamide
- Pest： Striped stem borer, Rice leaf roller
- Dose： 20 -43.2 g a.i. /ha
- Application frequency ： 2-3 times, interval:10-30 days
- Application date: Tillering - Stem elongation



Example of application

2013

TOP-RICE Model +acute ecotoxicology study /mesocosm study, shows a unacceptable risk to invertebrates

2014

Monitoring data+ mesocosm study , shows a unacceptable risk to invertebrates. Modelling shows 5 to 8.5 times with monitoring data

2015-2016

Sept. 7 2015, MOA issue a notice to cancel flubendiamide products used on rice.

March 1st 2016, US EPA issue a notice of intent to cancel all flubendiamide products, because of the risk to aquatic invertebrates.

谢谢！

THANKS FOR ATTENTION