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## Developing CSHC Databases

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October 2005



## Topics



- **Data collection activities**
- **Meteorologic dataset**
- **Hydrologic dataset**
- **Static dataset**
- **Summary**



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## Met data interpolated

**We have produced monthly surfaces for 7 met variables for 252 month from January 1980 to December 2000 inclusive.**

**The interpolation is conducted using ANUSPLIN.**

### **Variables with monthly surfaces**

1. Tmax
2. Tmin
3. Precipitation
4. Wind
5. Rhumidity
6. Sunshine hours
7. Epan
8. Ea
9. VPD
10. Rn



## Met data interpolated

**We have produced monthly surfaces for 7 met variables for 252 month from January 1980 to December 2000 inclusive.**

### Variables

1. Albedo: 12 monthly surface based on 1986 landuse map;



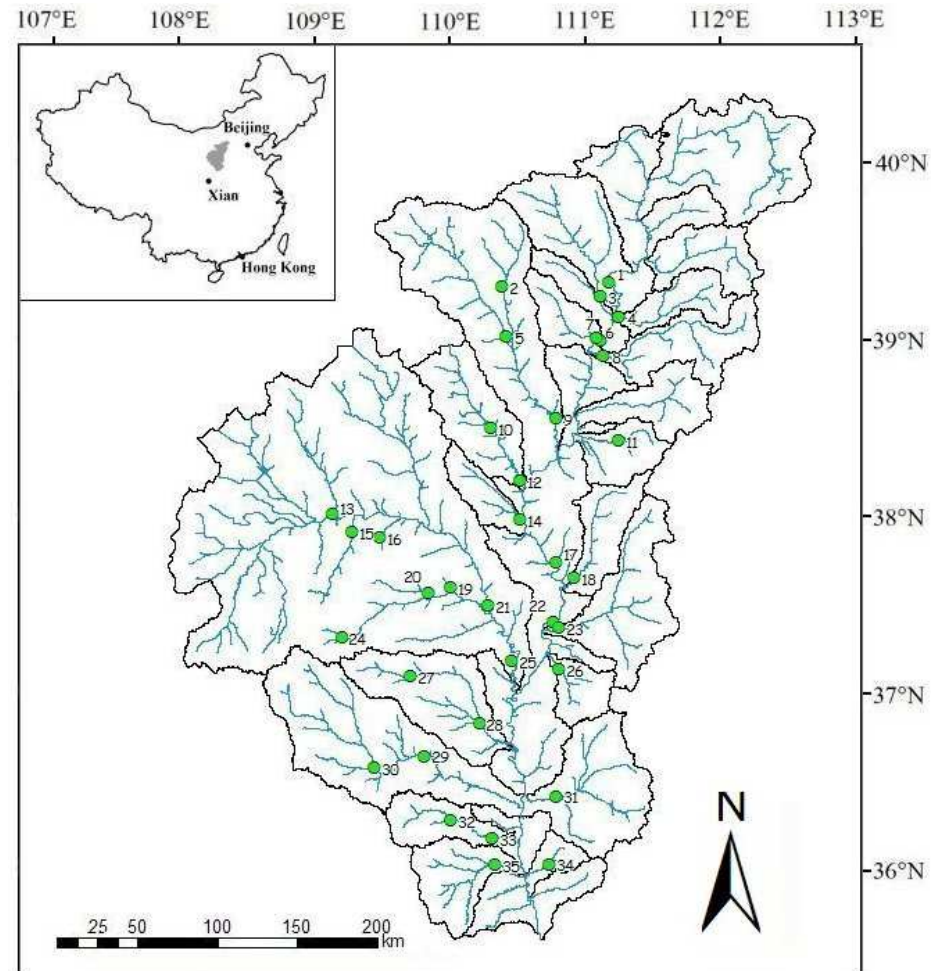


# Hydrological data obtained

**35 stations monthly data from 1980 to 2000 inclusive.**

## Variables:

1. Discharge
2. Sediment transport rate





## Data problem 1: Stations' positions

### Criteria

- A station should locate in the right county; and
- On river network (applicable only to hydro stations)

### Checking method: manually

- Overlay station location map on top of Loess Plateau county boundaries map to compare station names with county names; and
- Overlay hydro station location map on top of the CSHC river network map to check if they are on river channels

### Problems identified

- Two met stations (Lishi and FuGu) positions were incorrect
- Six hydro stations (Baijiachuan, Dianshi, Lijiahe, Wangdahengta, Xingxian and Zichang) positions were incorrect



# Data problem 2: data continuity and null data identification

## Purpose:

Check if data existed for each of the 252 months for a given variable and that the data had the correct sequence (chronological order)

## Checking method: computer program

- Each data file should contain 252 consecutive months from January 1980 through December 2000 inclusive
- No blank records should be found for any variables; and
- Year and month must increment in the correct sequence

## Problems identified

Both met data and hydro data have null data

Variable	Station#	Station name	Year, Month	Number of months with missing data
Discharge	5	WangDaoHengTa	All months from 1980 to 1989	120
	11	XingXian	All months from 1980 to 1985	72
	17	YangJiaPo	All months from 1980 to 1989	120
	18	LinJiaPing	All months in 2000	12
	20	LiJiaHe	All months from 1980 to 1989	120
	24	QingYangCha	All months from 1980 to 1989	120
Sediment	1	HeQu	All months from 1980 to 1989	120
	4	JiuXian	All months from 1980 to 1990	132
	8	ZhuJiaChuan	All months in 1990	12
	11	XingXian	All months from 1980 to 1990	132

Variable	Station	Year, Month (given as YYYYMM)	Number of months with missing data
Tmax	FangShan	8106	1
	FangShan	8106	1
Wind	HeShui	Every month	252
	HuanXian	Every month	252
	QingYang	Every month	252
	ZhenYuan	Every month	252
	GanQuan	12 months in 1980, 8109	13
	FangShan	8106, 8209	2
n	FangShan	8106	1
	YanChang	Every month	252
	HuangLong	Every month	252
Precip	TuoKeTuo	8012, 8212, 8712	3
	YuLin	8012	1
	FangShan	8106	1
R_humid	FangShan	8106	1
	Hengshan	8012	1
	FangShan	8106	1
Epan	FangShan	8106	1
	HangJinQi	9307	1





# Data problem 3: out of range data

All values for each variable fall in respective reasonable data ranges either

- Physically defined, or
- Defined by “common sense” of local experience

## Checking method: computer program

Set criteria for each variable

## Problems identified

Both met data and hydro data

Variable	Range
Tmax (°C)	-10.0 to 45.0
Tmin (°C)	-30.0 to 35.0
Precipitation (mm)	0.0 to 300.0
Wind (m s <sup>-1</sup> )	0.2 to 10.0
Relative Humidity (%)	0 to 100
Sunshine Hours (hours)	0.0 to 420.0
Epan (mm)	0.0 to 600.0

Station	Variable	Suspect data	Year, Month (given as YYMM)	Solution
ZiZhou	Precip	341.9 mm	9408	Keep
YiChuan	Precip	312.5 mm	8807	Keep
YanChuan	Wind	0.0 m s <sup>-1</sup>	9301	Keep
	Wind	0.0 m s <sup>-1</sup>	9512	Keep
YanAn	Precip	303.5 mm	8108	Keep
YanChang	Sunshine	0.0 hours	Every month	Null
LanXian	Precip	324.6 mm	8807	Keep
JiaoKou	Precip	336.3 mm	8807	Keep
HengShan	Precip	3,276.6 mm	8012	Null
FuXian	Precip	344.5 mm	8807	Keep
	Precip	316.3 mm	9208	Keep
FuGu	Precip	313.3 mm	9507	Keep
LiangCheng	Tmax	-10.3 °C	9301	Keep
	Wind	0.0 m s <sup>-1</sup>	9901	Keep
HangJinQi	Epan	0.0 mm	9307	Null

## Solution to problems

- Local stations / data providers contacted for suspected errors
- Confirmed errors either removed (make null) or corrected



# Data problem 3: out of range data

All values for each variable fall in respective reasonable data ranges either

- Physically defined, or
- Defined by “common sense” of local experience

## Checking method: computer program

Set criteria for each variable

Variable	Range
Discharge (m <sup>3</sup> s <sup>-1</sup> ):	>= 0
Sediment Transport Rate (kg s <sup>-1</sup> ):	>= 0
Runoff_H (mm)	< 100
Sediment_R (t.km <sup>-2</sup> .month <sup>-1</sup> )	0 to 15,000 and Runoff_H < 300 mm

## Problems identified

Both met data and hydro data

Station	Month	Discharge (m <sup>3</sup> s <sup>-1</sup> )	Runoff_H (mm)	Sediment (t s <sup>-1</sup> )	Sediment_R (t.km <sup>-2</sup> .month <sup>-1</sup> )	Solution
FuGu (7)	9803	772.0	5.1	6,490	43,023	Divide 98 sediment by 1,000
	9807	418.0	2.8	9,410	62,380	Divide 98 sediment by 1,000
	9808	357.0	2.4	2,360	15,645	Divide 98 sediment by 1,000
WuBu (22)	9803	758.0	4.7	10,300	63,637	Divide 98 sediment by 1,000
	9807	517.0	3.2	37,300	230,452	Divide 98 sediment by 1,000
	9808	463.0	2.9	7,760	47,944	Divide 98 sediment by 1,000

Station	Month	Discharge (m <sup>3</sup> s <sup>-1</sup> )	Runoff_H (mm)	Sediment (kg s <sup>-1</sup> )	Sediment_R (t.km <sup>-2</sup> .month <sup>-1</sup> )	Solution
CaoPing (19)	9408	3.3	47.0	1,640	23,490	Keep
GaoShiYa (6)	8808	28.7	60.9	11,300	23,964	Keep
HuangPuChuan (3)	8107	54.4	45.9	24,900	21,005	Keep
	8808	71.4	60.2	36,100	30,454	Keep
	8907	53.0	44.7	23,500	19,824	Keep
JiuXian (4)	9507	13.2	22.6	9,460	16,221	Keep
LiJiaHe (20)	9408	16.1	53.4	9,410	31,231	Keep
ZhuJiaChuan (8)	8205	0.1	0.1	-1	-1	Change to 0

Station	Month	Discharge (m <sup>3</sup> s <sup>-1</sup> )	Runoff_H (mm)	Correct solution
HanJiaMao (13)	8501	2,452.0	2,678.4	3.20
	8511	737.0	465.7	6.12
HouDaCheng (23)	8512	408.0	266.4	4.27
	9801	345.0	241.1	0.45



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## Data problem 4: miscellaneous errors

### Checking method:

- Data pattern problems: manually
- Station contributing area: computer program

Station name	Discharge	Solution
BaiJiaChuan (25)	Data repeat for 1990 and after	New dataset for 21 years provided by ISWC
DingJiaGou (21)	Data repeat for 1990 and after	New dataset for 21 years provided by ISWC
GanGuYi (29)	Data repeat for 1990 and after	New dataset for 21 years provided by ISWC
HuangPuChuan (3)	Data repeat for 1989 and after	New dataset for 21 years provided by ISWC
WenJiaChuan (9)	Data repeat for 1990 and after	New dataset for 21 years provided by ISWC
YanAn (30)	Rainfall data provide as discharge data	New dataset for 21 years provided by ISWC
ZiChang (27)	Data is 0 for 1985	New dataset for 1985 provided by ISWC

Station	Area in Info file (km <sup>2</sup> )	Area in Data file (km <sup>2</sup> )	Remarks
BaiJiaChuan (25)	30,217	29,662	
LiJiaHe (20)	807	0	
LinJiaPing (18)	1,873	0	just wrong for year 2000
QingYangCha (24)	662	0	
WangDaoHengTa (5)	3,833	0	
XingXian (11)	650	0	
YanAn (30)	3,208	0	
YanChuan (28)	3468	0	
YangJiaPo (17)	283	0	
ZhuJiaChuan (8)	2,901	0	

Station name	Sediment	Solution
BaiJiaChuan (25)	Data repeat for 1990 and after; Data are too low	New dataset for 21 years provided by ISWC
CaoPing (19)	Too small for 1996, 1997	Multiply 1996 and 1997 data by 1,000
DaCun (35)	Too small for 1996, 1997	Multiply 1996 and 1997 data by 1,000
DaNing (31)	Too small for 1996, 1997	Multiply 1996 and 1997 data by 1,000
DianShi (16)	Too small for 1996, 1997	Multiply 1996 and 1997 data by 1,000
DingJiaGou (21)	Data repeat for 1990 and after; Data are too low	New dataset for 21 years provided by ISWC
FuGu (7)	Too high for 1998	Divide 1998 data by 1,000
GanGuYi (29)	Data repeat for 1990 and after	New dataset for 21 years provided by ISWC
GaoJiaBu (10)	Data too small for 1996, 1997	Multiply 1996 and 1997 data by 1,000
GaoJiaChuan (12)	Data too small for 1996, 1997	Multiply 1996 and 1997 data by 1,000
GaoShiYa (6)	Data too small for 1996, 1997	Multiply 1996 and 1997 data by 1,000
HanJiaMao (13)	Data too small for 1996, 1997	Multiply 1996 and 1997 data by 1,000
HengShan (15)	Data too small for 1996, 1997	Multiply 1996 and 1997 data by 1,000
HouDaCheng (23)	Too small for 1996, 1997	Multiply 1996 and 1997 data by 1,000
HuangPuChuan (3)	Too small for 1996, 1997	New dataset for 21 years provided by ISWC
JiuXian (4)	Too small for 1996, 1997	Multiply 1996 and 1997 data by 1,000
JiXian (34)	Too small for 1996, 1997	Multiply 1996 and 1997 data by 1,000
LiJiaHe (20)	Too small for 1996, 1997 and 1999	Multiply 1996 and 1997 data by 1,000, keep 1999 as it is
LinJiaPing (18)	Too small for 1996, 1997	Multiply 1996 and 1997 data by 1,000
LinZhen (32)	Too small for 1996, 1997	Multiply 1996 and 1997 data by 1,000
PeiGou (26)	Too small for 1996, 1997	Multiply 1996 and 1997 data by 1,000
QingYangCha (24)	Too small for 1996, 1997	Multiply 1996 and 1997 data by 1,000
ShenJiaWan (14)	Too small for 1996, 1997	Multiply 1996 and 1997 data by 1,000
WangDaoHengDa (5)	Too small for 1996, 1997	Multiply 1996 and 1997 data by 1,000
WenJiaChuan (9)	Data repeat for 1990 and after; Data are too low	New dataset for 21 years provided by ISWC
WuBu (22)	Too high for 1998	Divide 1998 data by 1,000
XingXian (11)	Too small for 1996, 1997	Multiply 1996 and 1997 data by 1,000
XinMiao (2)	Too small for 1996, 1997	Multiply 1996 and 1997 data by 1,000
XinShiHe (33)	Too small for 1996, 1997	Multiply 1996 and 1997 data by 1,000
YanAn (30)	Data repeat for 1990 and after	New dataset for 21 years provided by ISWC
YanChuan (28)	Too small for 1996, 1997	Multiply 1996 and 1997 data by 1,000
YangJiaPo (17)	Too small for 1996, 1997	Multiply 1996 and 1997 data by 1,000
ZhuJiaChuan (8)	Too small for 1996, 1997	Multiply 1996 and 1997 data by 1,000
ZiChang (27)	Too small for 1996, 1997	Multiply 1996 and 1997 data by 1,000

### Problems identified

- Suspected errors in one station for sun hour, 7 stations for sediment and 33 stations for discharge data caught by eye
- Contributing areas in the information file and the data file are different for 10 stations

Year	Month	sunshine
1980	1	183.3
1980	2	166.9
1980	3	183.3
1980	4	175.2
1980	5	183.3
1980	6	175.2
1980	7	183.3
1980	8	183.3
1980	9	175.2
1980	10	183.3
1980	11	175.2
1980	12	183.3
1981	1	183.3
1981	12	183.3
...	....	...
2000	9	175.2
2000	10	183.3
2000	11	175.2
2000	12	183.3



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## Further explorations

### Data plots for hydro data

- Inspecting the relationships among precipitation, runoff and sediment to identify any anomalous data. That is, any discrepancy between the expected relationships could potentially necessitate a correction to the database, or the deleting (making values null) of certain data

### Two attempts

- Plot hydro data against the precipitation data recorded by the nearest metrological station
- Plot precipitation vs. runoff, precipitation vs. sediment yield, and runoff vs. sediment yield for each station  
define contributing area for each hydro station  
derive monthly area-average precipitation data for each hydro station



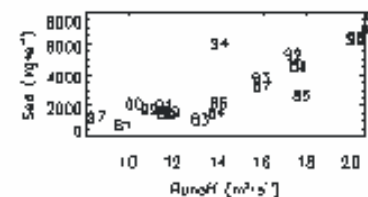
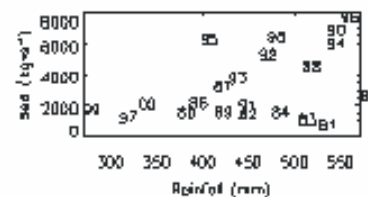
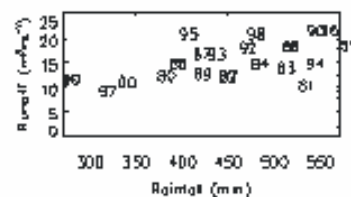
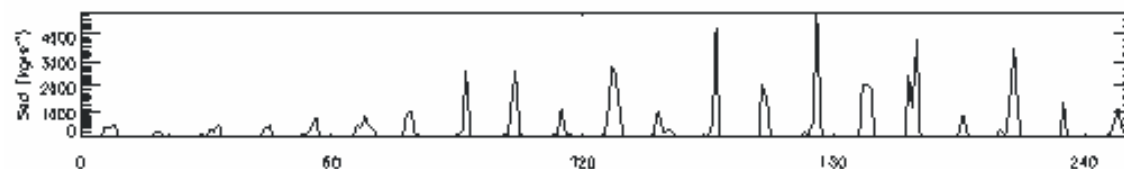
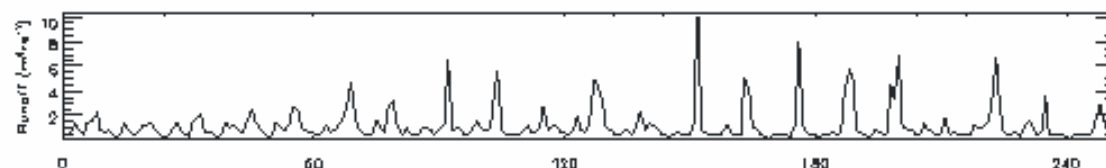
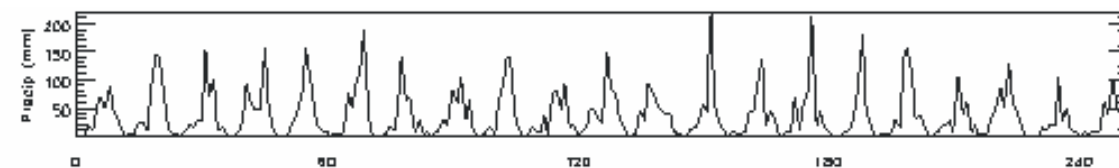
# Further explorations



## Attempt 1: Zichang

Plot hydro data against the precipitation data recorded by the nearest metrological station.

- Met station is 4 km away from hydro station
- No missing data



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# Further explorations

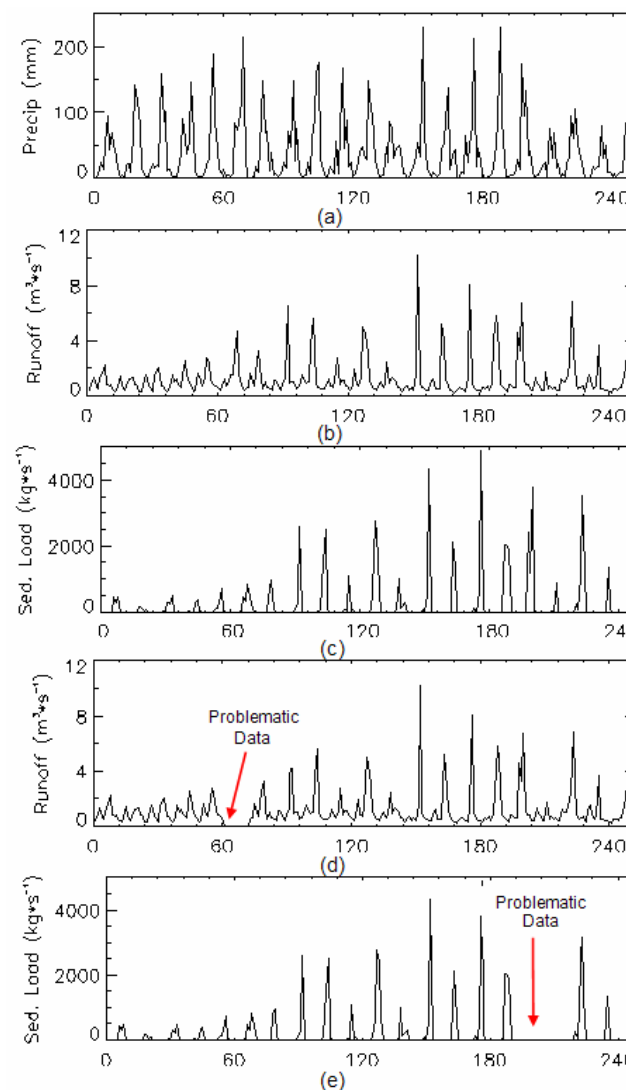
## Attempt 2: Zichang

Plot precipitation vs. runoff, precipitation vs. sediment yield, and runoff vs. sediment yield for each station

- define contributing area for each hydro station
- derive monthly area-average precipitation data for each hydro station



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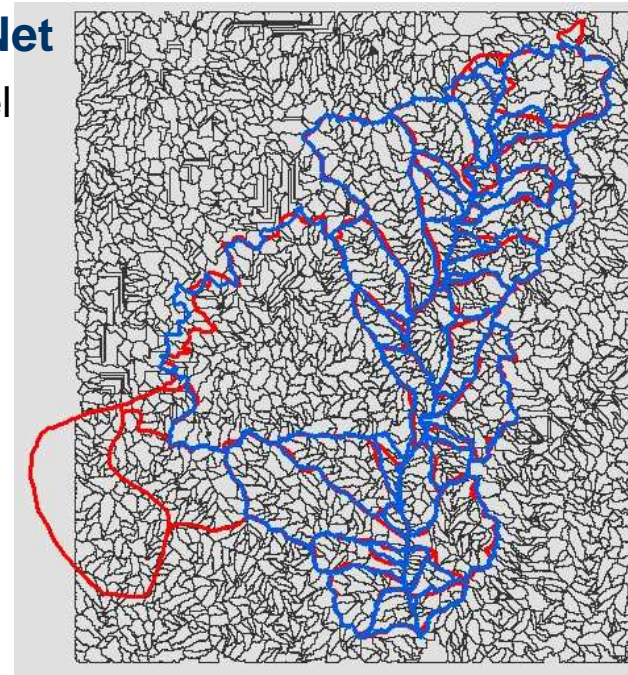


# Contributing area and catchment boundary

## Generate polygons of the contributing area for each hydro station using SedNet

- Move hydro station to nearest river channel
- Generate polygons using SedNet
- From hydrological correct DEM

Rec#	Name	Contributing Area (km <sup>2</sup> )			Albers East (m)		Albers North (m)		Offset (m)
		Old	New	%diff	Old	New	Old	New	
2	XinMiao	1,527	1,520	0.46	74,778.3	75,249.9	4,148,927.8	4,148,989.3	475.6
3	HuangPuChuan	3,175	3,168	0.22	136,732.3	137,102.7	4,142,326.8	4,142,897.3	680.2
4	JiuXian	1,562	1,576	-0.90	148,477.6	148,460.8	4,129,596.8	4,129,049.8	537.3
5	WangDaoHengTa	3,839	3,803	0.78	77,950.2	78,050.0	4,117,527.0	4,117,550.0	102.4
6	GaoShiYa	1,263	1,265	-0.16	134,273.7	133,712.1	4,116,399.8	4,116,387.8	561.7
8	ZhuJiaChuan	2,901	2,834	2.31	138,790.0	138,580.4	4,105,379.0	4,105,150.3	310.3
9	WenJiaChuan	8,645	8,253	4.53	108,939.7	106,928.6	4,086,097.0	4,085,872.3	2,023.6
10	GaoJiaBu	2,095	2,098	-0.14	68,315.5	68,250.0	4,080,116.8	4,080,121.8	65.6
11	XingXian	650	623	4.15	148,417.2	148,537.7	4,051,910.3	4,051,837.3	140.9
12	GaoJiaChuan	3,253	3,257	-0.12	86,099.4	85,982.9	4,026,990.3	4,026,917.5	137.3
13	HanJiaMiao	2,452	2,495	-1.75	-30,720.5	-30,350.1	4,006,258.3	4,006,272.8	370.7
14	ShenJiaWan	1,121	1,122	-0.09	86,346.8	86,134.9	4,002,947.0	4,002,764.8	279.5
15	HengShan	2,415	1,236	48.82	-19,042.8	-19,049.9	3,995,126.3	3,995,126.5	7.1
16	DianShi	327	244	25.38	-1,465.8	-1,650.0	3,991,405.5	3,991,407.0	184.2
17	YangJiaPo	283	284	-0.35	108,656.3	108,585.4	3,975,459.3	3,975,485.5	75.6
18	LinJiaPing	1,873	1,862	0.59	120,535.0	121,349.9	3,966,371.8	3,966,140.3	847.2
19	CaoPing	187	183	2.14	42,657.2	42,051.2	3,960,068.8	3,959,749.0	685.2
20	LiJiaHe	807	804	0.37	29,432.2	29,150.3	3,956,312.8	3,955,850.0	541.8
21	DingJiaGou	23,422	24,496	-4.59	66,279.4	66,650.8	3,949,122.5	3,949,349.8	435.4
23	HouDaCheng	4,102	4,052	1.22	110,657.1	110,657.1	3,934,788.5	3,934,850.5	62.0
24	QingYangCha	662	683	-3.17	-25,099.4	-25,117.4	3,928,553.0	3,928,982.5	429.9
25	BaiJiaChuan	30,217	30,739	-1.73	81,344.5	81,650.0	3,914,107.8	3,914,050.0	310.9
26	PeiGou	1,023	1,048	-2.44	110,995.8	111,481.6	3,908,894.5	3,909,318.5	644.8
27	ZiChang	913	916	-0.33	17,767.3	17,824.7	3,904,488.0	3,904,024.8	466.8
28	YanChuan	3,468	3,467	0.03	60,917.0	61,050.0	3,875,091.8	3,875,209.8	177.8
29	GanGuYi	5,891	5,858	0.56	26,808.3	27,049.8	3,854,570.5	3,855,150.3	628.0
30	YanAn	3,208	3,198	0.31	-4,472.2	-4,499.8	3,847,131.0	3,847,099.8	41.7
31	DaNing	3,992	3,923	1.73	109,048.5	109,050.6	3,829,329.0	3,828,449.8	879.3
32	LinZhen	1,121	1,121	0.00	43,396.1	43,450.1	3,813,948.8	3,814,849.8	902.6
33	XinShiHe	1,662	1,651	0.66	68,924.6	68,950.2	3,803,019.3	3,803,149.8	133.0
34	JiXian	436	446	-2.29	105,086.2	104,850.3	3,786,740.3	3,787,150.0	472.8
35	DaCun	2,141	2,130	0.51	70,559.0	70,533.7	3,786,388.0	3,786,366.3	33.4



## Generate catchment boundary

- Derive river network and catchments from DEM using SedNet
- Merge polygons in ArcGIS to generate 42 catchments in the CSHC
- From hydrological correct DEM



## Work conducted

### 1. CSHC boundary

- Redefine the 42 catchments and entire CSHC boundary

### 2. Hydro station contributing area

- Generate polygons for 35 hydro stations' contributing area

### 3. Met data correction

- 14 of the final 58 meteorological stations (or 24%) corrected

### 4. Hydro data correction

- All 32 hydrology stations (100%) not on the main Yellow River channel needed some action to correct the dataset



## Summary



**The QC procedure vastly improved the base data quality used for the ACIAR project.**

**The identification and correction of gross scale errors served as a first order improvement that will eliminate complicitous errors in the output models derived from these base data, and therefore make the research and management recommendations of the project more relevant.**

**The time investment in performing this QC not only increases the confidence in the subsequent use and modelling results achieved when using the databases described here, but also provides a basic template for identifying and correcting future met and hydro data in China, and thereby serves as a major part of technology transfer for our project**



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谢谢

Thank You

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