EU-CHINA RIVER BASIN GOVERNANCE (RiBaGo)RESEARCH NETWORK

Third Workshop

August 29 to September 4, 2011

YELLOW RIVER FIELD TRIP

1979

September 3-4

In conjunction with

2006

THE EU-CHINA RIVER BASIN MANAGEMENT PROGRAMME

UNIVERSITY OF CAMBRIDGE

IRS

EU-CHINA

澳門基金會 FUNDAÇÃO MACAU

INSTITUTO INTERNACIONAL MACAU 澳門國際研究所

The Xiaolangdi Dam and the Yellow River

The Xiaolangdi Dam project was initiated in 1992 and completed in 2000. It controls sand and fine sediment delivery to the lower Yellow River, and this requires annual flushing of the dam in June and July. It also controls floods, and the conditions on the floodplain have become semi-permanently dry as a result; this has facilitated agricultural development on the floodplain. The following sequence of Landsat images shows the floodplain at Kouma in 1987, 1999, 2002 and 2006; the location of Kouma is shown in Figure 1. The river between the Xiaolangdi dam and Kouma in 2006 is shown in the image on the back cover. The Landsat images are all false colour composites of bands 4, 3 and 2, with original resolution of 30m (except the 1979 image on the front cover). Pink/red denotes vegetation, various grey and grey-blue colours show rock, built-up area, and bare soil/sediment, and black is water (lighter colour for water indicates high sediment load).

The Yellow River Wetland National Nature Reserve

The riparian and floodplain area formed a valuable wetland environment before the dam, subjected to frequent flooding and the maintenance of a high water table and wet conditions by vertical infiltration of floodwater. These wetlands had a rich flora and fauna, especially of resident and migrant birds. Small pockets of riverine wetland remain, with plants including *Typha angustifolia* Linn, *Scirpus triqueter* Linn, and *Phragmites communis Trin* Linn, and these have been designated as Nature Reserves. However, since the dam, flooding has been prevented, and the only mechanisms of groundwater recharge have been through local rainfall and lateral recharge during the flooding period, it has become much easier to cultivate. This has led to increasingly intensified agriculture; fish ponds, lotus, cereals and cotton. The application of fertilizer and pesticides has led to a loss of groundwater quality.

Groundwater monitoring (i) – groundwater dynamics

Observation wells were installed in a 650m transect from the river bank (see Figure 1; Zhao et al., 2011). Seasonal variation in the water table (Fig. 2a) shows that it no longer reaches the surface in this transect, remaining about 1m below the surface. The highest levels occur in late June during the dam flushing period, when the river level is just below the bank top. The dynamics of groundwater in the flushing period (Fig. 2b) show that water infiltrates laterally from the river to build a groundwater ridge that then temporarily prevents drainage of the floodplain groundwater, and causes the water table to rise to its maximum for a short period; when the flushing flows cease, the water table drops rapidly again.

Groundwater monitoring (ii) – groundwater quality

Analysis of the groundwater chemistry (electrical conductivity (EC), turbidity (TU), the permanganate index (COD(Mn)), and total Nitrogen (TN), shows that groundwater is becoming contaminated by agricultural pollutants; pesticide and herbicide concentrations are also likely to be higher, and in relation to some quality indicators the shallow groundwater is now not suitable for human use. The dynamics of water quality involve a complex interaction between seepage of water from different sources, draining towards and from the river (Figure 3).

Reference

Zhao, T., Richards, K.S., Xu, H. and Meng, H. (2011 in press) Interactions between dam-regulated river flow and riparian groundwater: a case study from the Yellow River, China. *Hydrological Processes*

Contact

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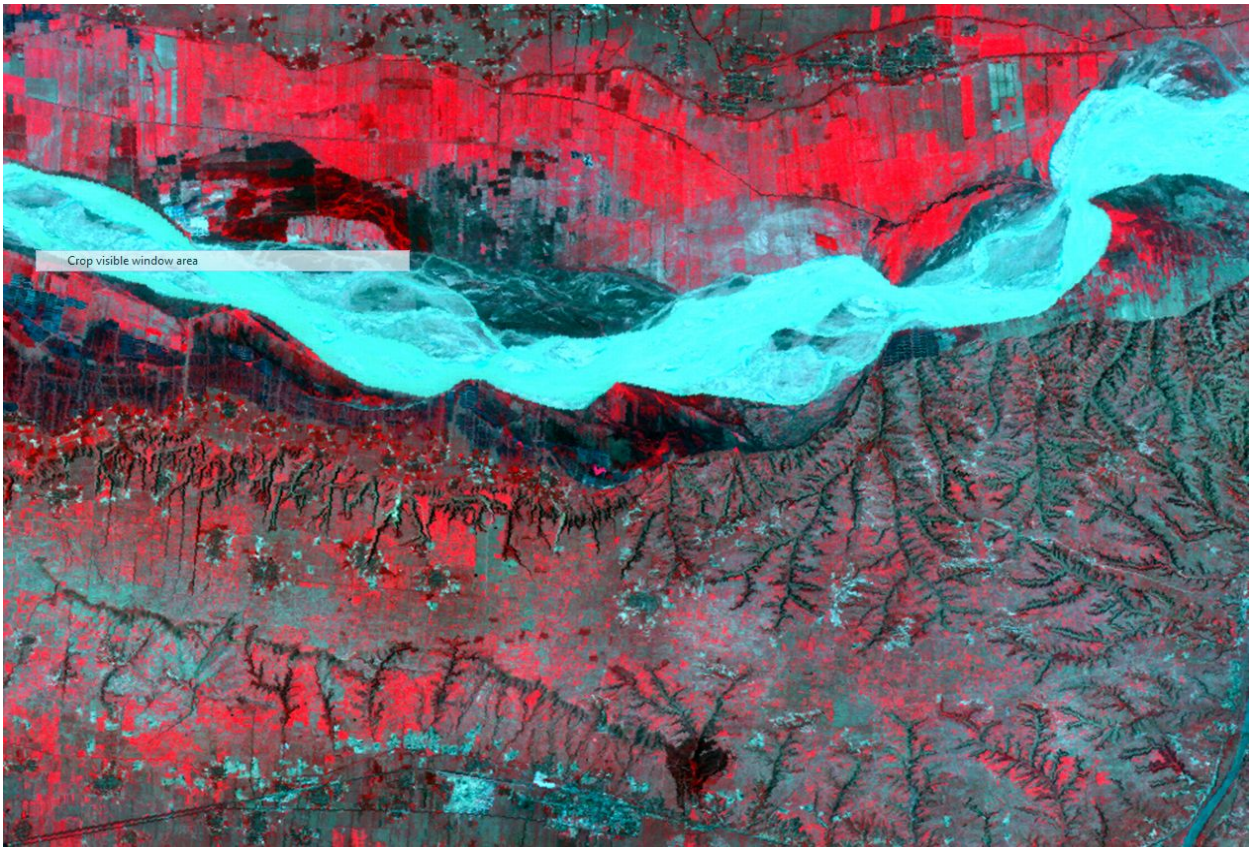
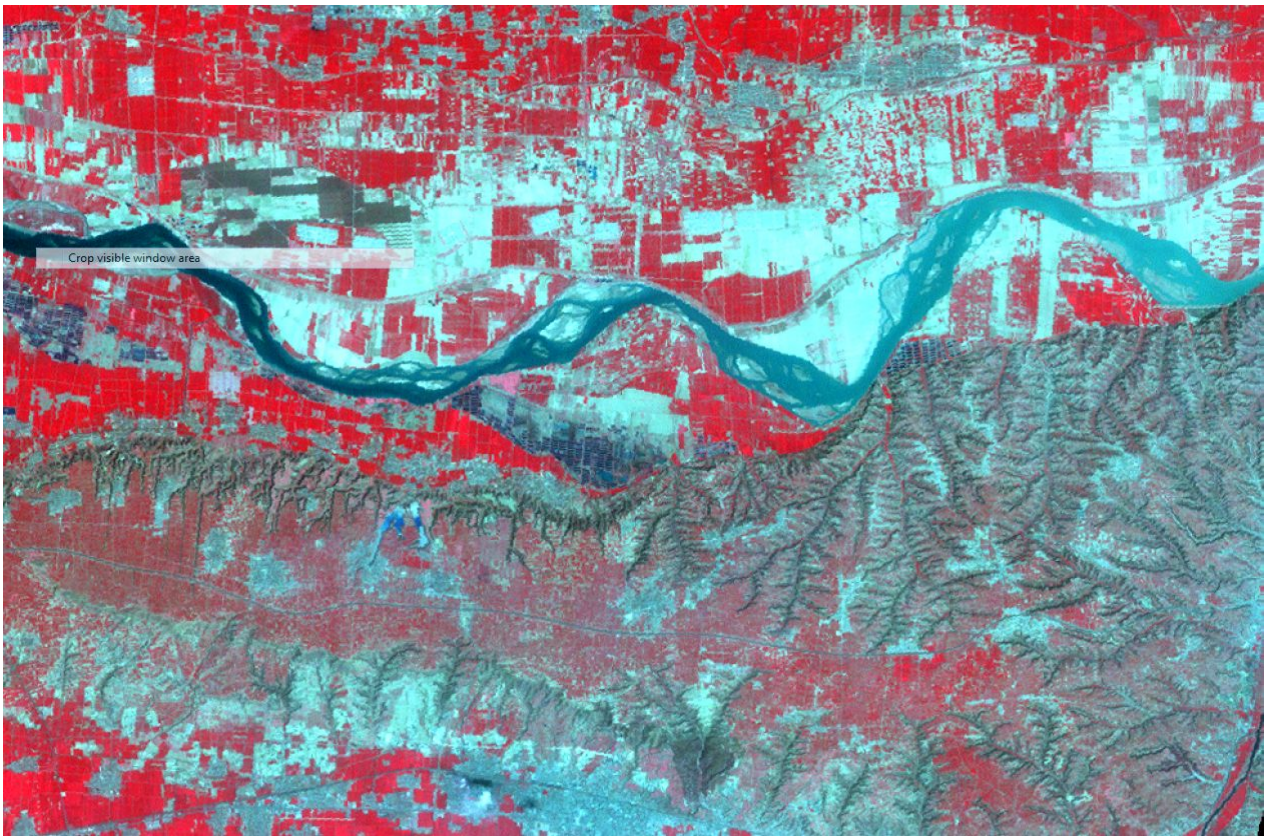
The Yellow River at Kouma, 1987-07-06

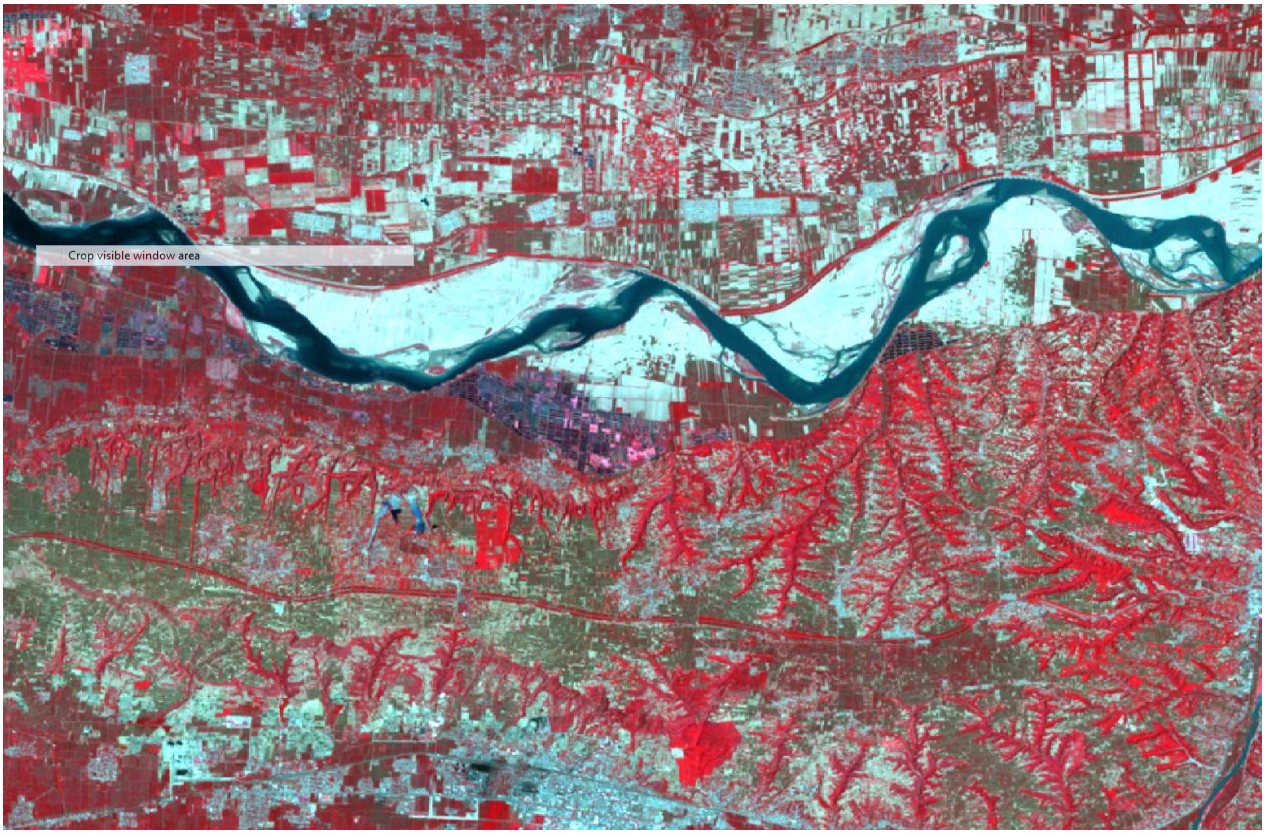


The Yellow River at Kouma, 1999-12-22

The Yellow River at Kouma, 2002-04-02



The Yellow River at Kouma, 2006-05-23



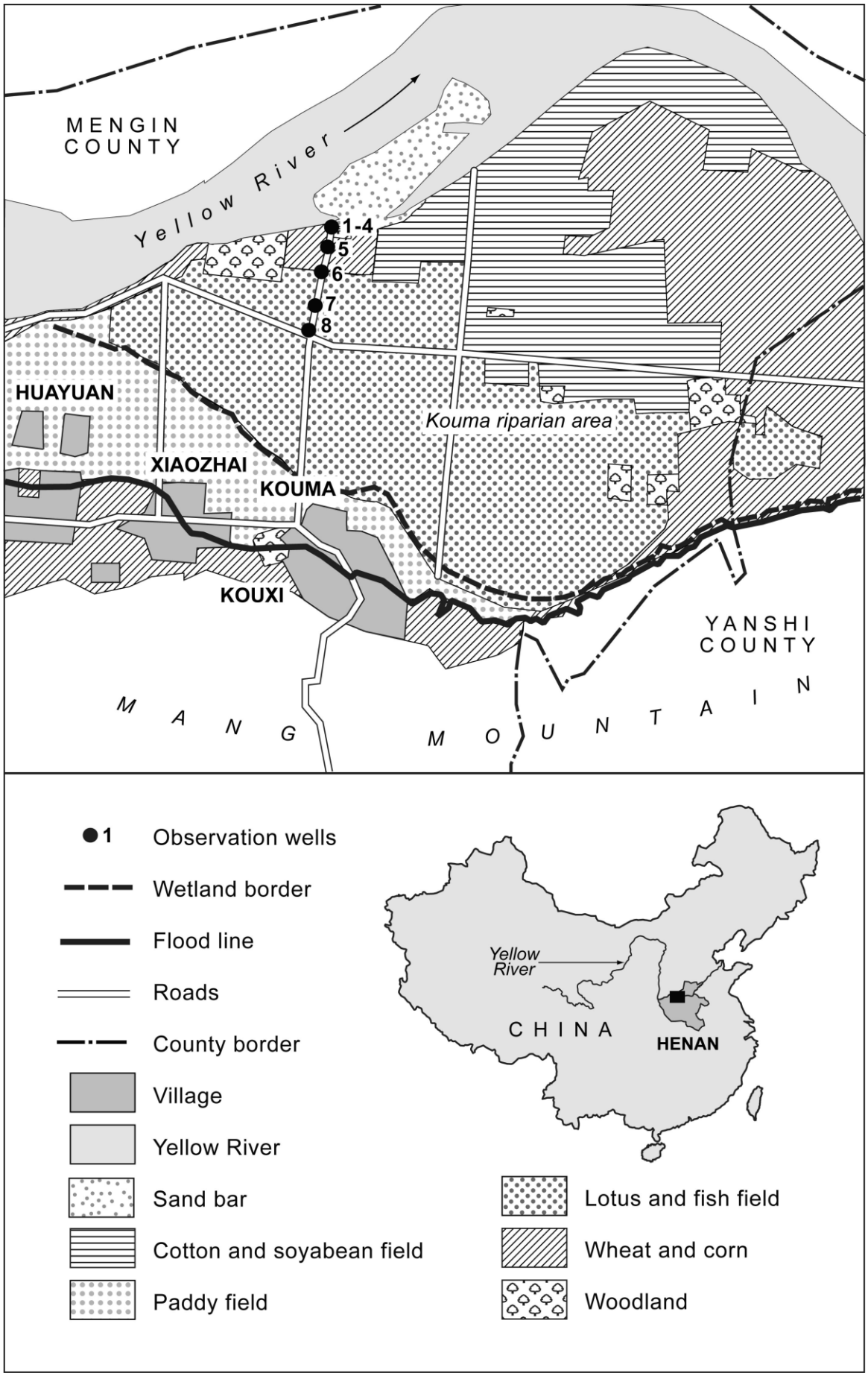


Figure 1 – The location of the Kouma riparian area on the Yellow River floodplain

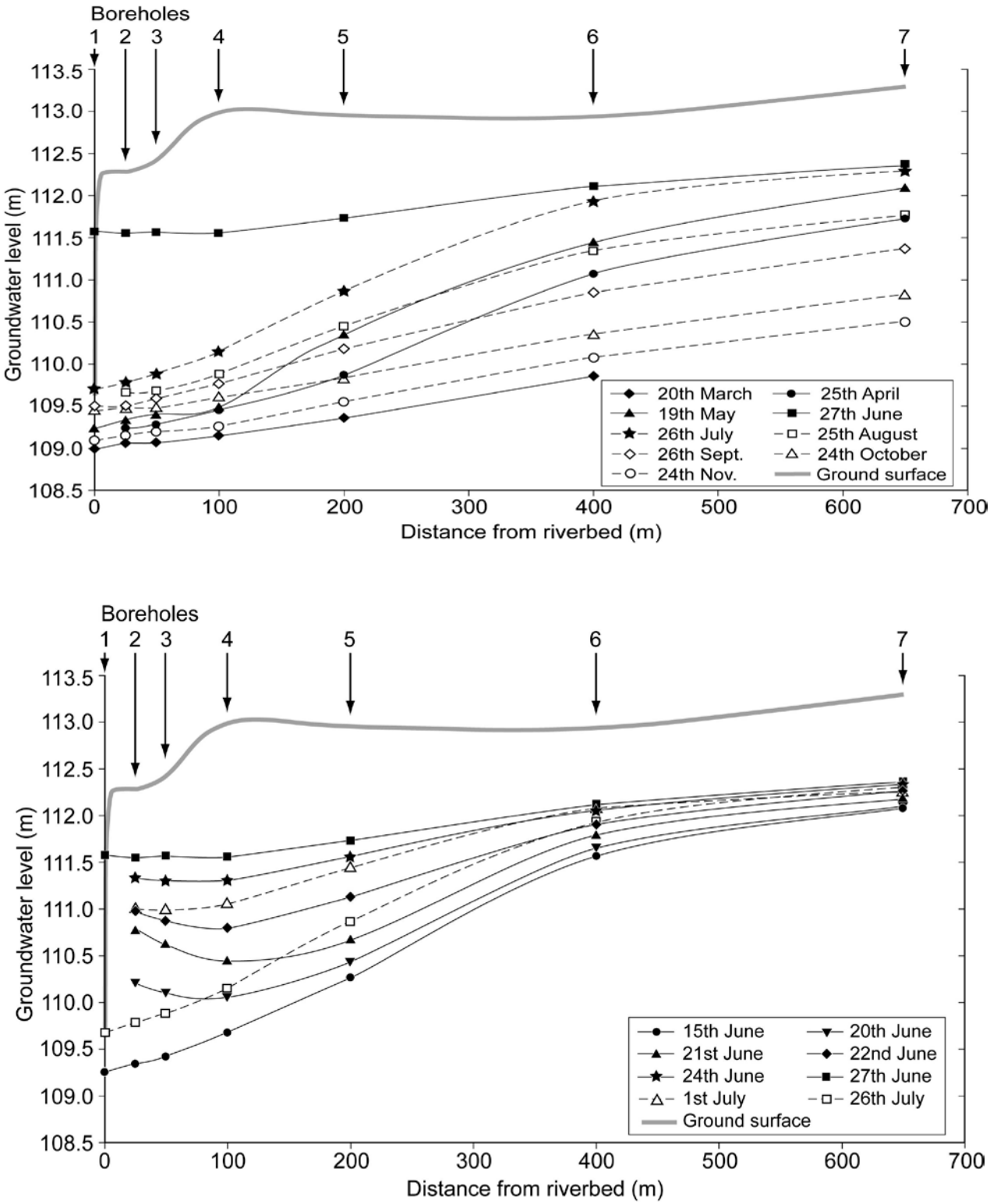


Figure 2 - Groundwater variations in the Kouma riparian zone, seasonally (top) and during the flushing period of the Xiaolangdi Dam (bottom)

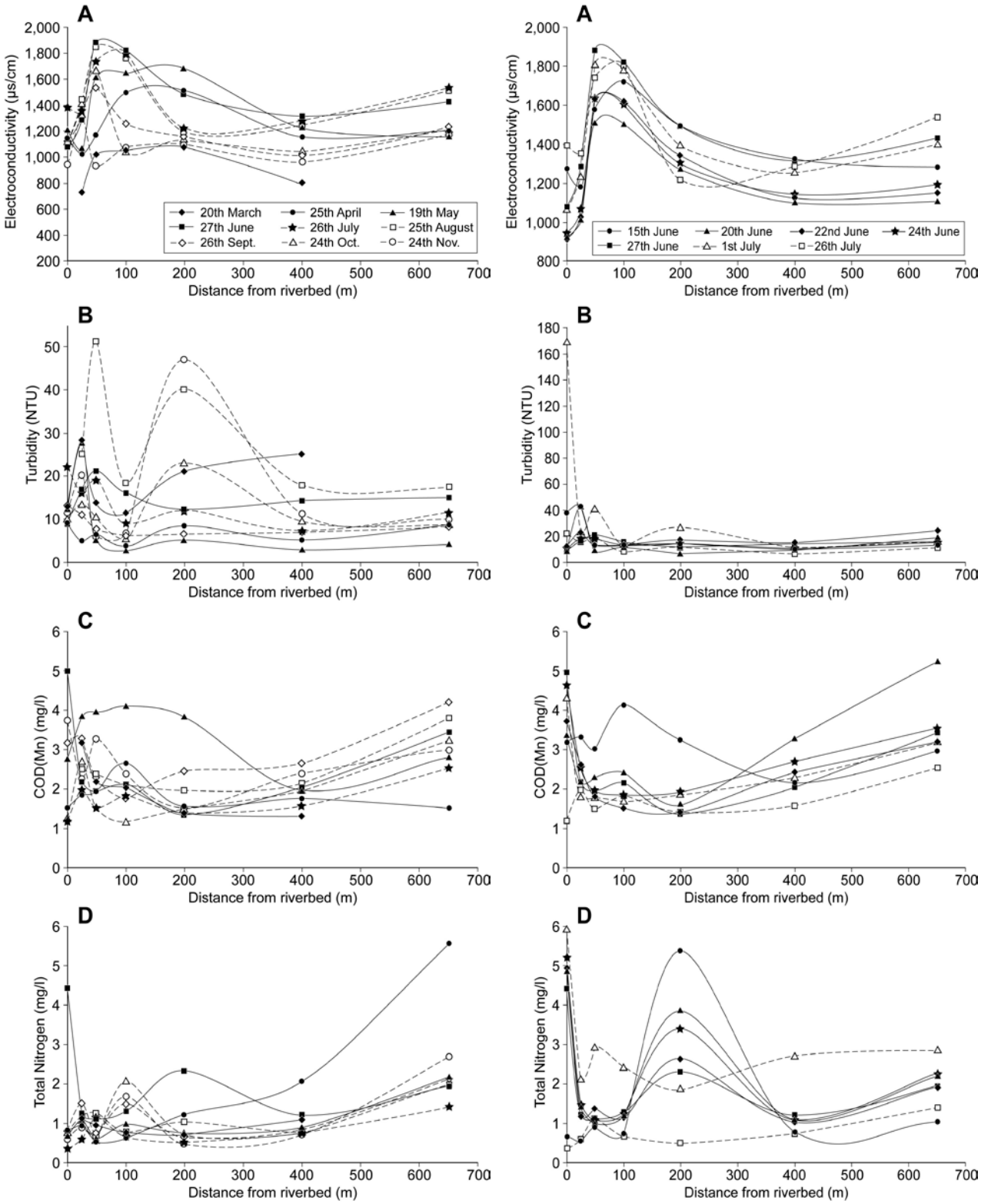
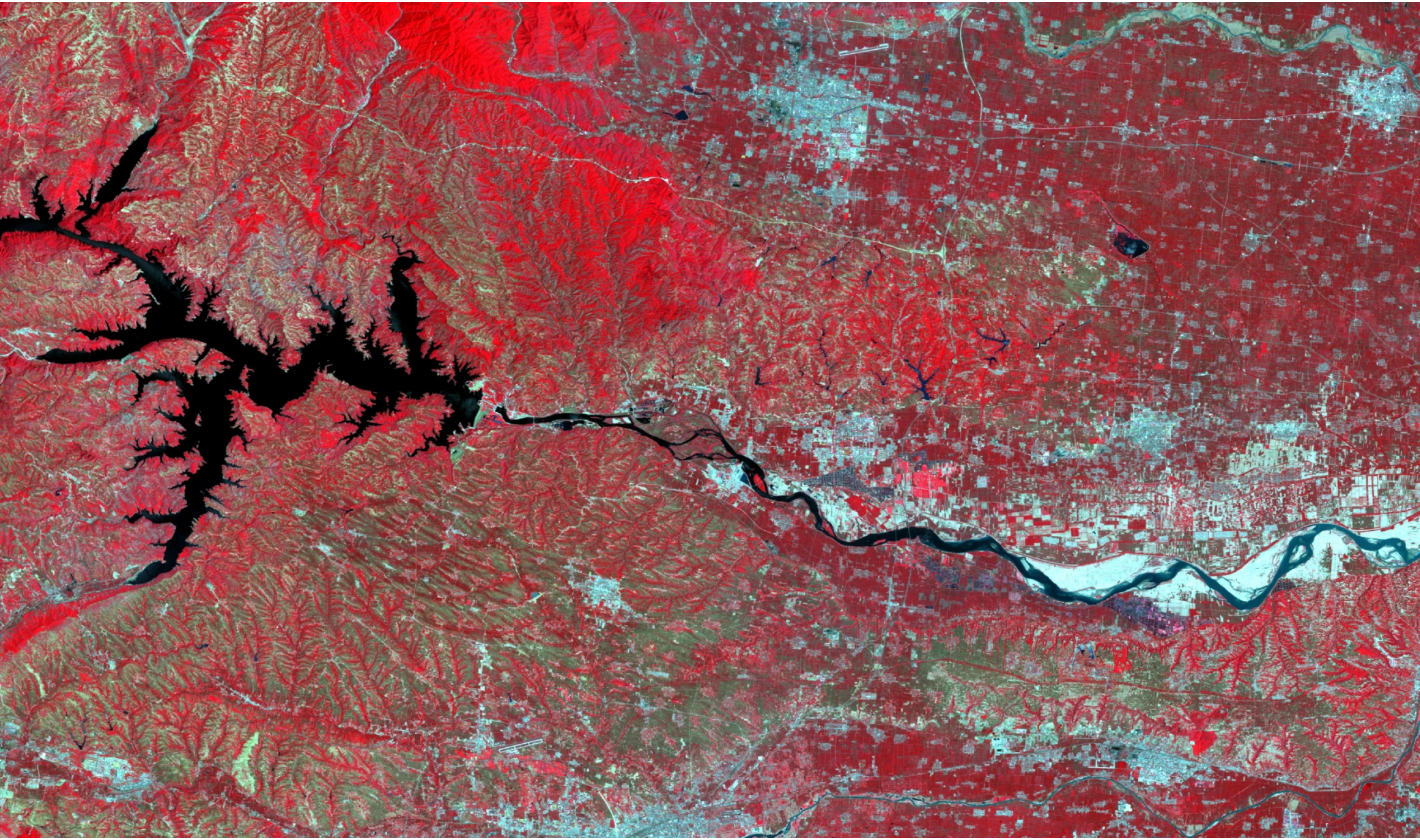


Figure 3 – Water quality variations in groundwater in the Kouma riparian zone, seasonally (left) and during the flushing period of the Xiaolangdi Dam(right)



The Yellow River (2006-05-23); Xiaolangdi Dam and reservoir, and the downstream reach to Kouma