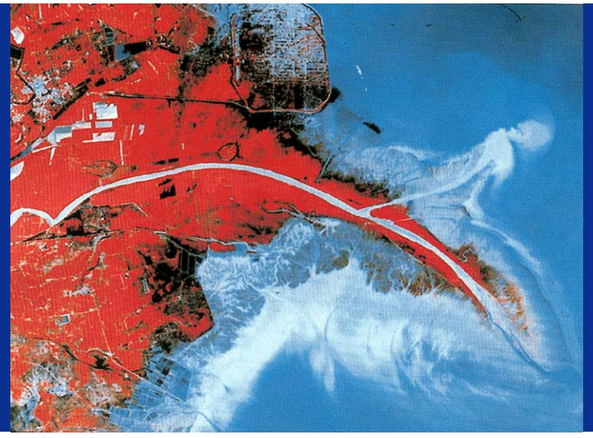


技术类成果

黄河水沙过程变异及河道的复杂响应

【创新性】

建立了萎缩性河道演变理论，揭示了黄河水沙过程变异规律，建立了自然要素和人类活动等因子对水沙变异影响的定量关系；提出了黄河上中游不同区域内产流产沙与下游河道泥沙输移和沉积、高含沙水流的形成和发生频率及河口入海通量的定量关系；提出了河道萎缩的定义和“滩槽并淤”与“集中淤槽”两种河道萎缩模式；建立了萎缩性河道断面形态与水沙因子之间的响应关系，从理论上阐述了水沙变异条件下萎缩性河道的“小水大灾”致灾机理；提出并论证了萎缩河道是可逆的，为萎缩性河道治理提供了理论基础。提出了萎缩性河道治理的调控措施，提出了萎缩性河道冲淤平衡的临界含沙量及其相应的临界水沙组合、临界平滩流量、临界来沙系数及临界河相关系等阈值，建立了萎缩性河道冲淤动力平衡临界阈值体系；建立了基于临界阈值体系的大型水利枢纽联合运用与河道整治工程等相结合的萎缩河道治理调控措施，成功塑造和维持了黄河下游平滩流量接近 4000m^3/s 的中水河槽，实现下游河道减淤 11.95 亿 t。研究开发了黄河中下游多系统互动泥沙数学模型和流域植被－侵蚀动力学模型，前者解决了高低含沙水流挟沙能力模拟、恢复饱和系数的定量确定、长河段泥沙输移及考虑支流入汇和区间引取水的水沙动力方程改进等关键技术；后者建立了流域植被－侵蚀动力学理论方程，并得到了其理论解，提出了划分不同区域植被－侵蚀状态的状态图。

【影响力】

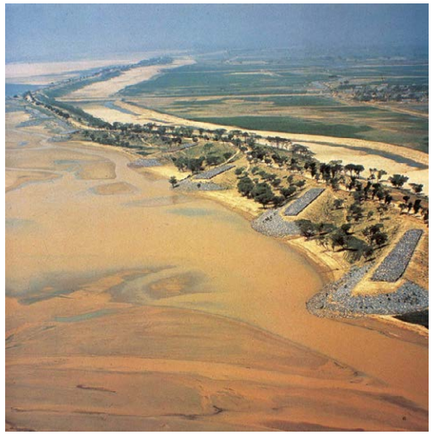
发展了三个模型、探讨了四项理论、支撑了多项应用，其中黄河下游中水河槽塑造与维持、潼关高程控制等成果已被实践所证实。“该项成果整体达到国际领先水平，获得 2007 年度国家科技进步成果二等奖。发表论文 110 篇，出版专著 2 部，研究成果丰富了河流动力学及河床演变的理论，推动了学科发展。

主要完成人：胡春宏、郭庆超、许炯心、姚文艺、吉祖稳、陈　浩、王兆印、曹文洪、李文学、陈建国

受奖单位：泥沙所

【Influence】

The research group has developed three models, discussed four theories and support various applications, and relevant achievements such as the building and maintenance of medium-sized channels in the lower Yellow River and the control of Tongguan elevation have been verified. The research has reached the international advanced level as a whole, and obtained the second prize of the National Science and Technology Progress Award in achievements in 2007. The research group has published 110 papers and two monographs. The research achievements have enriched the theory of river dynamics and riverbed evolution, and promoted disciplinary development.



【Innovation】

The research has created the theory of atrophic river channel evolution, revealed the variation law of the flow-sediment process of the Yellow River, and established the quantitative relationships of the influence of factors such as natural elements and human activities on flow-sediment variation; put forward the quantitative relationships between the runoff and sediment yield in different areas of the upper and middle reaches of the Yellow River and the sediment transport and deposition in the lower reaches, and between the formation and frequency of hyper-concentrated flow, and between sediment flux into the sea; proposed the definition of channel shrinkage and two channel shrinkage modes; established the response relationship between section morphology of atrophic river channels and water and sediment factors, and in theory expounded the disaster-causing mechanism that “a small flood causes a big disaster” for atrophic river channels under water and sediment variation conditions; put forward and demonstrated that atrophic river channels are reversible, providing a theoretical basis for the management of atrophic river channels. It has also put forward regulatory measures for the management of atrophic river channels, proposed the critical sediment concentration for the scouring and silting equilibrium of atrophic river channels and corresponding threshold values, such as critical combination of water and sediment, critical bankfull discharge and critical incoming sediment coefficient, and established a critical threshold value system for the dynamic equilibrium of scouring and silting; established atrophic river channel management and regulation measures in combination with joint operation of large hydro-projects and river channel renovation projects based on the critical threshold value system, and successfully built and maintained the bankfull discharge of nearly 4000m^3/s in the lower reaches of Yellow River and reduced deposition of 1.195 billion tons for river channels in the lower reaches. The research has developed the sediment mathematical model and the vegetation-erosion dynamics model with multi-system interactions in the middle and lower reaches of Yellow River, with the former solving key technologies, such as the sediment carrying capacity simulation for sediment laden flow with high and low concentration, the quantitative determination of recovery saturation coefficient, sediment transport of rivers with long reaches, and the improvement of the water and sediment dynamic equation with consideration of the influence of tributaries and water diversion, while the latter building the vegetation-erosion dynamics theory equation and putting forward the vegetation-erosion status diagram in accordance with different regional divisions.

Main Contributor : Hu Chunhong, Guo Qingchao, Xu Jiongxin, Yao Wenyi, Ji Zuwen, Chen Hao, Wang Zhaoyin, Cao Wenhong, Li Wenxue, Chen Jianguo

Award-winning Unit : Department of Sediment Research

FLOW AND SEDIMENT PROCESS VARIATION OF YELLOW RIVER AND COMPLEX RESPONSE OF RIVER COURSES