Introducing

The Three Gorges Dam (TGD) is among the most prominent human-induced examples for large-scale environmental impacts. Due to the flooding alongside the Yangtze River and its main tributaries, the region is largely characterized by an enormous boost of typical georisks such as soil erosion, mass movements, and diffuse matter inputs. Within the immediate reservoir area, the uphill-movement of farmers to the steep sloping uphill sites can result in a high conflict potential between the available and suitable land. Combined with a very steep topography, subtropical monsoon climate, and fragile soils, the population pressure and rapid ecosystem changes still foster the ecological and geological consequences and environmental risks of the TGD.

YANGTZE GEO 2012 - 2015

Sino-German BMBF collaborative research project

Within the framework of the BMBF-funded project YANGTZE GEO (2012 - 2015), German and Chinese scientists jointly focus on the ecological and geological risks in the reservoir of the Three Gorges Dam after the impoundment of the Yangtze River and its tributaries. Together with their Chinese partners from the China University of Geosciences in Wuhan and the Chinese Academy of Sciences, five German research groups conduct collaborating studies on soil erosion, mass movements, diffuse matter inputs, and sediment pathways. An integrative approach was set up in order to combine multi-scale investigation methods and state-of-the-art techniques from soil science, geology, hydrology, geophysics, geodesy, remote sensing, and data survey and monitoring.

Together with its partner network YANGTZE HYDRO, YANGTZE GEO will contribute to a better understanding of the dimensions and dynamics of the ecological consequences of such large dam projects at the Yangtze River and worldwide.

We thank the Juelich Research Center and the Project Management Juelich for close collaboration, and the German Federal Ministry for Education and Research (grant No. 03G0827A) for funding.

www.yangtze-project.de

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Subproject 'Soil Erosion'

Mechanisms and control factors of soil erosion by water in the Three Gorges Dam ecosystem

The subproject 'Soil Erosion', situated at the University of Tübingen, aims at a deeper understanding of the mechanisms and control factors of soil erosion by water in highly dynamic mountainous ecosystems. A specific modeling approach will be developed that allows to predict soil loss on forested and the subsequent sediment pathways under changing climate and land use. Worldwide in mountainous regions, terracing serves as key technology for sustainable land use. Terrace maintenance and conditions control their functioning with respect to soil loss and flood production. Therefore, new methods to incorporate terracing in erosion modeling serve as important tool for environmental and resource planning aiming at sustainable land management. Data on long-term average soil loss for different land use and climate change scenarios and the identification of areas at risk for soil erosion will be used to create a monitoring and measuring network and early warning system for soil erosion.

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Subproject 'Monitoring'

Quantification of georeference structures and processes by geophysical and geodetic monitoring (Ground Truth)

The subproject 'Monitoring' deals with the identification of geohazards and the development of geomonitoring systems. It will obtain data for model parameterization and process studies in context of YANGTZE GEO. Methodologically, the subproject Monitoring applies techniques referring to seismoelectroacoustics and terrestrial radarsatellite interferometry. Furthermore, a feasibility study on the application of hydroacoustic methods will be conducted. Seismoelectroacoustics and terrestrial radarsatellite interferometry observe and analyze changes of the earth surface as well as of the subsurface by state-of-the-art, high precision, and sensitive tools. The hydroacoustic feasibility study aims at the potential in order to analyze the structure, composition and changes of the sediment structure by hydroacoustic signals. The challenges of the goal are: (i) the identification of weak seismic signals from mass movements in the subsurface by seismoelectroacoustics, (ii) the assignment of slope movement within a range of millimeters by radarsatellite interferometry, (iii) the modeling of upheaval-and drawdown-processes by stochastic and dynamic 3D model approaches, (iv) a feasibility study to improve data quality of the sediment structure by hydroacoustics. Within the joint research of YANGTZE GEO, the industrial partners DMT and AIT will be involved developing algorithms and source codes will be available for the joint research project and for further remote sensing-based analyses. All developed algorithms and source codes will be available for the joint research project and for the scientific community.

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Subproject 'Subproject 'Remote Sensing''

Remote sensing based assessment and evaluation of the land use change and biophysical characteristics of the vegetation at the Yangtze River

The subproject 'Remote Sensing' resides at the University of Tübingen pursues the assessment and analyses of dynamic processes taking place before and after the start of operation of the TGD. Further focus lies on the derivation of the spatial and temporal surface characteristics that will be also used for process studies, for instance for soil erosion modeling. The methodological framework covers the (i) preparation and supply of spatially quantitative and qualitative georeferenced data and data processing, (ii) multitemporal land-use classification from optical and high temporal remote sensing data, (iii) construction of reference data and derivation of the land use change of the TGD reservoir, and (iv) spectral reference measure- ments of the dominant soil types and classification of the lithology in the area of Baoding, and creation of a high-resolution digital elevation model using terrestrial laser scanning, and (v) assessment of the land use changes and the TGD reservoir. The results of the subproject Remote Sensing will serve as important input for the process studies in other subprojects and for further remote sensing-based analyses. All developed algorithms and source codes will be available for the joint research project and for the scientific community.

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The stream of the Yangtze River at a length of 6,300 kilometers in China (Baka line) from the Qinghai-Tibetan Plateau into the East China Sea. The black dashed line marks the upper Yangtze catchment from the Three Gorges Dam upstream. The red line marks the borders of the provinces. The yellow line shows the location of the 3G, the Chongqing, Yichang, Wuhan, Nanjing, and Shanghai from West to East. The Three Gorges Reservoir reaches 1,939 m (Three Gorges Dam) to Chongqing at a length of 660 km.