

Critical Discussion of the Three Gorges Project's Consequences*

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Abstract the realization of the Three Gorges Project (TGP) is discussed all over the world. These discussions are often not objective. In this paper the main positive and negative aspects of the TGP are described. There is a focus on its flood control function and the economy of the region surrounding the reservoir. All in all, it can be pointed out that power generation, as an argument in favour of the realization of the TGP is more convincing than the argument of flood protection. Although flood waves from the upper reaches of the Yangtze River can be cut, there will still be a high risk of floods in the catchment of the middle reaches. Generally, these floods are the result of strong precipitation in this region and they cannot be prevented by the TGP and the storage capacity management which is planned. The generation of power will have a positive influence on the economic development of Central China and besides will secure the energy supply of the prosperous cities along the East Coast, especially of Shanghai.

Keywords: Three Gorges Project, Yangtze River, floods

The realization of the Three Gorges Project (TGP) leads to a worldwide controversy on this subject. The realization of the project is also discussed a lot in China. After years of research and discussions in 1992, the then Prime Minister Li Peng finally managed to gain political support for the project, but “only” by a two-third majority of the people’s congress. Fig. 1 shows the geographic location of the Three Gorges Dam and the affected region in the catchment of the Yangtze River.

In this article the main arguments for the realization of the TGP are pointed out and even some critical aspects are discussed. There is a focus on the flood control function of the TGP and on the economy of the region surrounding the reservoir. The article concludes with an overall contemplation.

1 Arguments in favour of the realization of the TGP

The realization of the TGP is based on the following arguments^[1]: (1) Flood Control: The flood control storage capacity of the reservoir will be 22.15 km³. This will raise the flood control

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capability of the middle reaches of the Yangtze River from the present 10-year flood frequency to the 100-year flood frequency. Safety along the middle reaches will be guaranteed with the additional use of the existing flood diversion areas even if there occur a flood of 1×10^3 a return period. (2) Power Generation: Most of the power in China is generated by burning raw coal. With an average annual electricity output of about 85 GWh and an installed capacity of 18.2×10^3 MW the TGP will therefore make an important contribution to the reduction of emissions. As a comparison: the currently largest hydroelectric power plant Itaipu storing the Parana, has an installed capacity of 12.6×10^3 MW. (3) Improvement of Navigation: After the completion of the Three Gorges Reservoir the waterway from Yichang to Chongqing will be improved and it will be possible for ships up to 1×10^4 t to navigate from the coast directly to Chongqing. So far the way from Yichang to Chongqing was only open for ships up to 3×10^3 t. In the dry season the regulation of the Three Gorges Reservoir will let the minimum discharge downstream of Yichang increase from 3×10^3 m³s at present to over 5×10^3 m³s. This will obviously improve the navigation conditions during this time of the year in the middle reaches of the Yangtze River. Due to the increased minimum discharge in the middle reaches, there will be more water available for irrigation. The increased discharge is a condition for the planned South-to-North -Water-Diversion-Project.

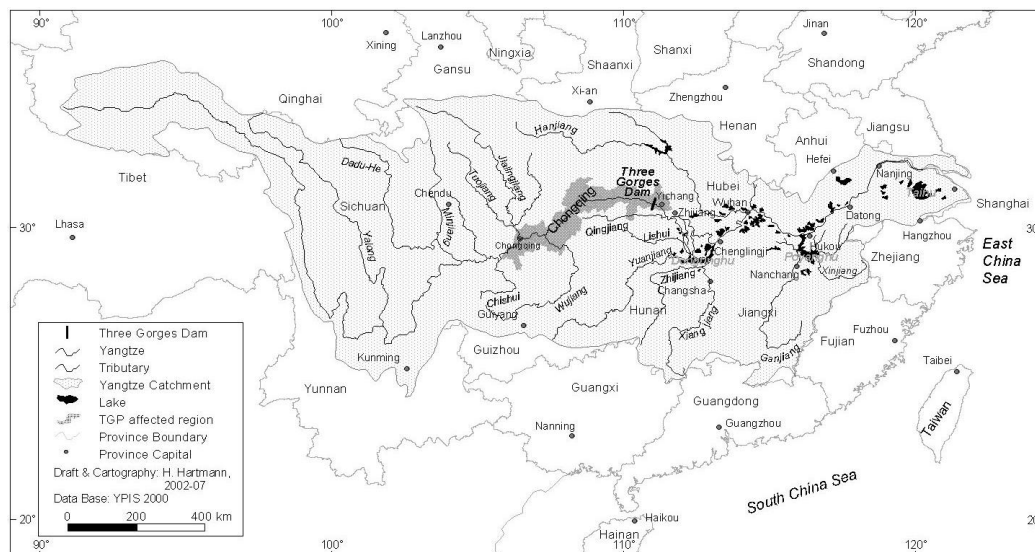


Fig. 1 The geographic location of the Three Gorges Dam

2 Arguments against the realization of the TGP

After some intern debates public discussion on the project started and is still going on in the media. The main arguments by which the TGP is criticized are mentioned in the following; the cited literature is exemplary: There are doubts whether the TGP is able to protect the middle and lower reaches of the Yangtze River against floods^[2]. The resettlements that are necessary for the realization of the project are criticized^[3-4]. Concern is raised about the loss of storage capacity

due to sedimentation^[5]. The sedimentation could lead to difficulties in the navigation^[6]. The annual inflow of over 1 billion tons wastewater will cause pollution of the water of the reservoir within a short period of time. After the damming up of the Yangtze River the velocity will be slower which leads to the reduction of the natural self-purification^[7]. The inundation of several cultural / historical sites is criticized because only a few of them could be preserved^[2]. As shown above there are various points under discussion. Only the first point will be analysed in detail in this article.

3 The capability of flood control

The following facts will show that the doubts concerning flood protection for the middle reaches of the Yangtze River are justified:

The rain season usually starts between the beginning and the middle of June in the southern catchment of the Yangtze River. In this region there is a high risk of floods before precipitation starts one month later in the catchment of the upper reaches of the Yangtze River, which can cause flood waves.

To make a faster outflow of the Dongtinghu and the Poyanghu possible it would be better to start the regulation of the Yangtze River discharge in June. As a result the reservoir would fill up slowly, which in fact would hamper the cutting of flood waves later on. This would be the only possibility to make the catchment of the middle reaches of the Yangtze River safer. This region recorded lots of losses, for example during the 1998 flood. The construction of the Three Gorges Dam will not make it any safer as there is no plan to regulate the discharge by the TGP as long as it does not exceed $56.7 \times 10^3 \text{ m}^3/\text{s}$ ^[8]. This is generally not the case in June. So the possibility of dam breaks and inundations in the Dongtinghu and Poyanghu area will still be the same.

Due to the capture of sediment in the Three Gorges Reservoir the Yangtze River will have a lower sediment load downstream of the dam. Up to now there are accumulation processes in the section between Yichang and Wuhan. Erosion processes will happen instead in this section, when the TGP is finished. The subsidence of the riverbed will lead to a drop of the water level during equal discharges. This leads to a minimal reduction of the waterlogging risk. All in all, the safety of this section against floods will not be improved by the lowering of the riverbed because the changed sediment load will increase the risk of eroding flood control embankments.

Generally, the flood protection for the middle reaches of the Yangtze River is mentioned as the most important argument in favour of the realization of the TGP. This argument is not very convincing as it is shown above. Flood waves from the upper reaches of the Yangtze River can be cut, however, a lot of floods are the results of strong precipitation in the catchment of the middle reaches. These cannot be controlled by the TGP and its planned management of the storage capacity. It should be tested whether a further lowering of the water level in the Three Gorges Reservoir could be a chance for a better flood protection in the catchment of the middle reaches of the Yangtze River - even with the consequence of reduced power generation and worse navigation conditions. It is very important that the flood risk will not be underestimated after the reali-

zation of the TGP. An underestimation could have catastrophic consequences.

4 A chance for central China?

Power generation is mentioned as the second key reason for the realization of the TGP. Finally, this argument seems to be more important than the argument of flood protection because of the probably limited effectiveness of the later. Power generation will have a positive influence on the economic development of Central China. There are obvious disparities between the economic prosperous East Coast and the provinces in Central and Western China. This fact is documented by the Gross Domestic Products of the provinces which can be taken from Fig. 2.

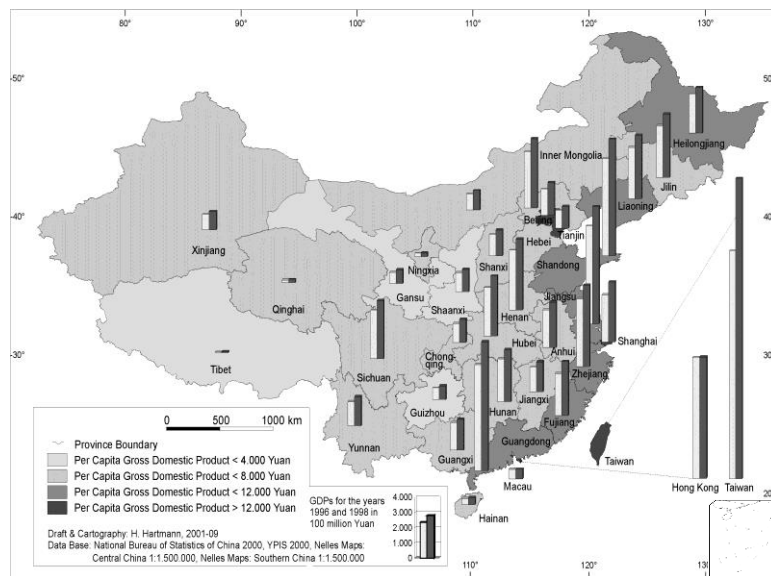


Fig. 2 1996 and 1998 gross Domestic Product by province

Using the hydroenergetic potential and improved navigation conditions will give a positive impulse to the economic development of Chongqing City. The waterway will connect Chongqing City with the prosperous East Coast and the harbour of Chongqing City will be open for ships up to 10000 t. Chongqing City already had a high Per Capita Gross Domestic Product in 1998 (Fig. 3). Chongqing is known as a centre of the heavy industry. Nowadays it even plays an important role, for instance, for the automobile and the pharmaceutical industry. The TGP will definitely have a positive effect on the economic development of Chongqing City in the long-term.

Currently there is economic growth especially in the surroundings of the Three Gorges Dam construction site. The Per Capita Gross Domestic Product for Yichang County is as high as for Tianjin Municipality or even higher than for Jiangsu Province at the Chinese East Coast (Fig. 2, Fig. 3). A long-term positive economic development of the dam region can be secured if numerous factories will settle down - as it is planned - in this area.

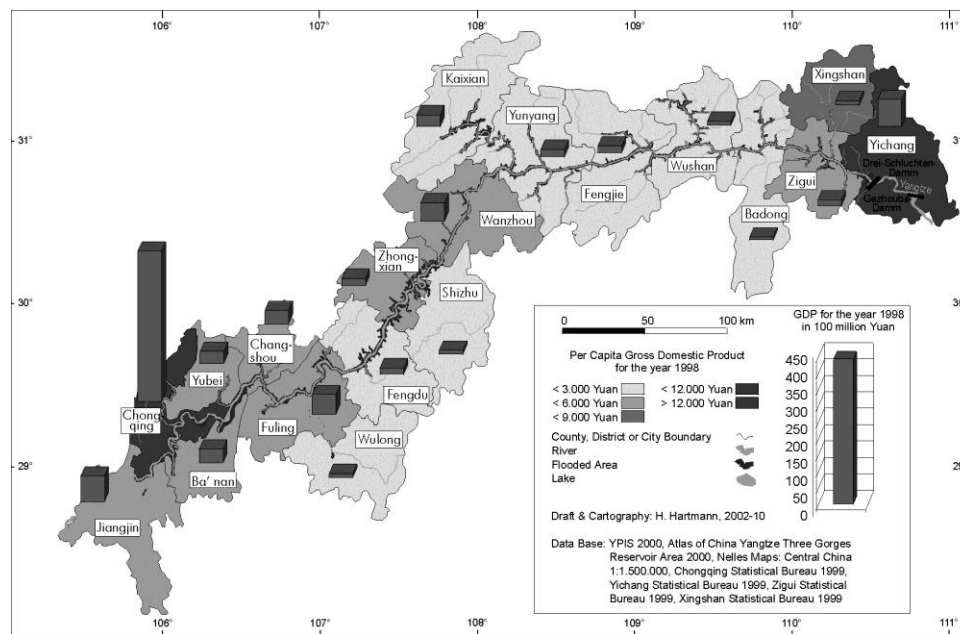


Fig. 3 1998 Gross Domestic Product for the affected counties, districts and cities

5 An overall contemplation

All in all, it can be pointed out that flood protection as an argument in favour of the realization of the TGP is less convincing than the argument of power generation. The power generation will have a positive influence on the economic development of Central China and will secure the energy supply of the prosperous cities along the East Coast, especially of Shanghai.

In some papers it is emphasized that most positive consequences of the TGP would effect the region downstream of the dam (for example by flood protection) and negative consequences would only effect the region surrounding the reservoir (for example by resettlements). This thought should be reconsidered. Resettlement which is going along with the realization of the TGP is only necessary in the region surrounding the reservoir. However, there will also be positive consequences for this region. The power generation and the improved navigation conditions will cause economic growth especially in Chongqing City but also in the other greater cities along the reservoir like Wanzhou City.

It is rather nonserious to take on an undifferentiated position either in favour of or against the TGP. This is due to the multitude of the involved factors and the complex nature of the expected consequences. The disputable effects of the TGP on flood prevention and the disputable consequences of the resettlements as well as the ambivalent ecological impacts are opposed to the positive economic effects. It is a question of personal preferences which importance will be attributed to the listed arguments.

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三峡工程影响的初步评价

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摘 要

全世界都在评论三峡工程的修建, 这些评论经常是不太客观的. 本文从正负两方面对三峡工程进行了讨论, 重点在防洪工程和区域经济方面. 作者认为修建三峡工程作为发电的功能远大于防洪的功能. 尽管上游来的洪峰经过三峡水库调蓄后能够被削弱. 但中游的洪水风险仍然很大. 一般而言, 中游地区的洪水是大降水事件的产物. 三峡工程不可能完全控制中游的洪水. 三峡水库发电对中国中部及周边地区经济的可持续发展将产生积极作用, 也将能确保东部沿海地区尤其是上海市电能的供给.

关键词 三峡工程 长江 洪水 区域经济

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