TIDAL REGIME CHANGE DUE TO SIWHA TIDAL POWER PLANT OPERATION IN THE KYUNGGI BAY OF THE YELLOW SEA

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Abstract

The west coast of Korean peninsula is famous for its high tidal range and a series of tidal feasibility studies for the tidal power generation have ever been carried out since late 1970s. Now Siwha tidal power plant (TPP) with installed capacity 254MW is being constructed since 2004 in the Siwha barrage region in the Kyunggi Bay of the Yellow Sea, expected to be completed in 5 years (2009).

In relation to this power plant operation, the tidal regime change has been carefully examined, based upon the two-dimensional numerical model. Several additional control factors were considered for TPP operation in the numerical model, as well as open sea boundary condition.

From tidal regime change point of view, since the Siwha tidal barrage had been already completed, tidal amplitude variation is expected to be small by the TPP operation itself. However, the tidal regime change by the tidal power plant operation was predicted to take place in the whole Yellow and East China Seas. The tidal amplitude in the Kyunggi Bay is predicted to be decreased by the order of 0.5~1.0 cm. The positive and negative variation of the tidal amplitude occurs over the whole Yellow and East China Seas, with amplitude variation being less than 0.5cm. This pattern implies that the newly inflowing volume flux

into the Siwha TPP may distort the volume budget over the YECS. The new volume balance occurs over the whole YECS. If we examine the tidal regime change more carefully, the negative response in the near field of the Siwha TPP may be due to the water volume movement into the tidal basin through which no volume flows into the tidal basin before the Siwha TPP construction. When this happens, neighboring sea region again responds to this. Through this kind of process, the new redistribution of the volume or the sea level takes place.

Other hydrodynamic characteristics such as various sea levels in the Siwha TPP basin (lake) and in the outer sea are also examined, as well as the investigation of the discharges from the turbine and sluice gate, with the Siwha TPP being operated. For three day operation of the Siwha tidal power plant, the peak maximum discharge through the turbine is 4000~5000 m^3/s (CMS), while the peak discharge through the sluice gate is about 7000~8000 CMS. And the discharge during the ebb is about 12,000 CMS, which is the amount which is roughly equal to the discharge in the Yangtze River during the winter season.