

EFFECTIVENESS OF EARLY WARNING SYSTEMS AND MONITORING TOOLS IN THE MEKONG BASIN¹

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The Mekong River ranks among the 10th longest river in the world (about 5,000 km). From the above-5000 m Tibetan plateau to the delta in Viet Nam, the Mekong Basin (795,000 km²) includes 6 countries (People's Republic of China, Myanmar, Lao People's Democratic Republic (Lao PDR), Viet Nam, Thailand and Viet Nam). The climate is mostly controlled by the monsoon regime. From May to October, during the wet season, wet winds from the Southwest bring heavy rain totalizing about 90% of annual rainfall. The dry season, extending from November to April, is characterized by dry winds coming from the Northeast. In August and September, tropical cyclones originating from the North Pacific Ocean and the South China Sea induce long-lasting heavy rainfall interacting with the monsoon. Annual mean rainfall ranges from about 1,000 mm/year in Northeast Thailand to 3,000 mm/year along the mountainous border between Lao PDR and Viet Nam. The flow regime of the Mekong River and of its tributaries is characterized by a flood pulse that starts a few weeks after the beginning of the wet season (June) and ends in November. This 6-month period accumulates more than 90% of annual flows. For many centuries, populations have adapted to this natural annual cycle of floods and droughts, characterized by highly contrasted flow patterns between the wet and the dry season. Each year, between 2.6 and 4.5 million hectares of rice are inundated in the Cambodian lowlands and the Vietnam Delta. These floods are essential for the rice production and traditional villages were usually built in upland areas which are never flooded, in order to avoid possible damages related to flooding. With the recent acceleration of human development in the lower Mekong Basin, flood-prone areas are now partly inhabited and extreme floods tend to become harmful to lowland populations. In addition to these flooding localized along the Mekong mainstream, flash-floods in mountainous areas are sporadic and generally occur in response to typhoons and tropical storms. Their deleterious effects are generally worsened by landslides. Each year, hundreds of people are injured or killed by such disasters. Droughts can be as devastating as floods. From 2003 to 2005, 10,000 ha of rice in the Vietnamese part of the Mekong Delta were affected by salt water, as a consequence of sea water intrusion in the Delta where the Mekong River flow was particularly low. The cost of this salt water intrusion was estimated at about 60 million USD. During the same period, 500,000 ha of paddy in Cambodia were affected by drought and induced food shortage for 2 million people. 650,000 ha of rice were lost in Thailand. A recent statistical analysis of trends in rainfall recorded over the last half century (Lacombe et al., 2010, submitted to International Journal of Climatology) indicates that the frequency and magnitude of extreme events remained stable at the regional scale during this period. It was concluded that the year-to-year variability in rainfall pattern over the region reflects a natural phenomenon rather than any human-induced climate change signal.

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The negative effects of droughts and floods on populations are magnified by limited socio-economic capacities. Affected communities are generally poor and vulnerable to flood and drought and to some extent are kept that way by recurring cycles of flood and drought. Reducing the vulnerability of these people to the negative environmental impacts of floods and droughts should improve their standard of living and assist them to climb out of poverty. In that perspective, the first early warning system in the Mekong was set up in the early 1970s, after the large flood event of 1966. The forecasting system, including the major tributaries was progressively improved after the 1978 and 1981 extreme floods. After the 2000 and 2001 extreme floods which caused 400 million USD damage and 800 fatalities, the council of the Mekong River Commission (MRC) established a basin-wide "Flood Management and Mitigation" program. Its objectives are grouped in 5 components: i/ establishment of the FMM center (FMMC) in Phnom Penh, and maintenance of its operation; ii/ study of infrastructure (reservoir, embankment, waterways) effects on floods; iii/ mediation and coordination of trans-boundary flood related issues (land-use planning, infrastructure development, cross-border emergency management; iv/ capacity building, knowledge sharing and public awareness to improve existing emergency management systems; v/ achievement of sustainable natural resource management, flood probabilities assessment, land-use management. The early warning system consists in: i/ the collection of hydro-meteorological data from the riparian countries and forecasted rainfall by the National Oceanic and Atmospheric Administration (NOAA); ii/ the forecast operation with hydrological models and iii/ the forecast disseminations. This process successively involves the hydro-meteorological station operators, the national meteorological centers, the Mekong River Commission Secretariat and the FMMC. In parallel, data from the rain gauge station network of the riparian countries are transmitted through the Global Telecommunication System of the World Meteorological Office to the FMMC. Flow and water level forecast are disseminated daily (or 4 times daily in August and September) to national organizations. The MRC website forecast pages are updated every day.

The recent 2008 flood of the Mekong River has revealed some flaws in the early warning system. The poor-data coverage associated to inaccurate hydrological models for flash-flood simulations introduced large errors in the conversion of rainfall into simulated flows, estimated water level and flooded areas. In addition, the global scale USGS/NOAA satellite images were found to be too coarse for the Mekong Basin. Finally, the information transfer to local flood-prone communities appeared to be too weak. The 7th Annual Mekong Flood Forum held in Vientiane in 2009 concluded that new accurate and effective models should be coupled with geographical information systems, digital elevation models in order to provide flood maps and risk/vulnerability maps. Non-structural improvements are also required. They involve the capacity analysis in the national meteorological centers, the institutional memory, the implementation of quality control of the early warning systems, the flood preparedness and the emergency management of local authorities and communities.