– Short Technical Note –

Water loss from reservoir development in the Lower Mekong Basin

This short technical note describes the effect of reservoir development in the Lower Mekong Basin on water loss derived from evaporation and seepage. Findings translate that the water loss in Cambodia and Lao PDR increases in proportion to the number of proposed reservoirs in 2020 and 2040. Additionally, seepage is a dominant factor of the water loss as evaporation could be compensated by rainfall. Finally, the water loss is considered insignificant when comparing to inflow to the reservoirs.

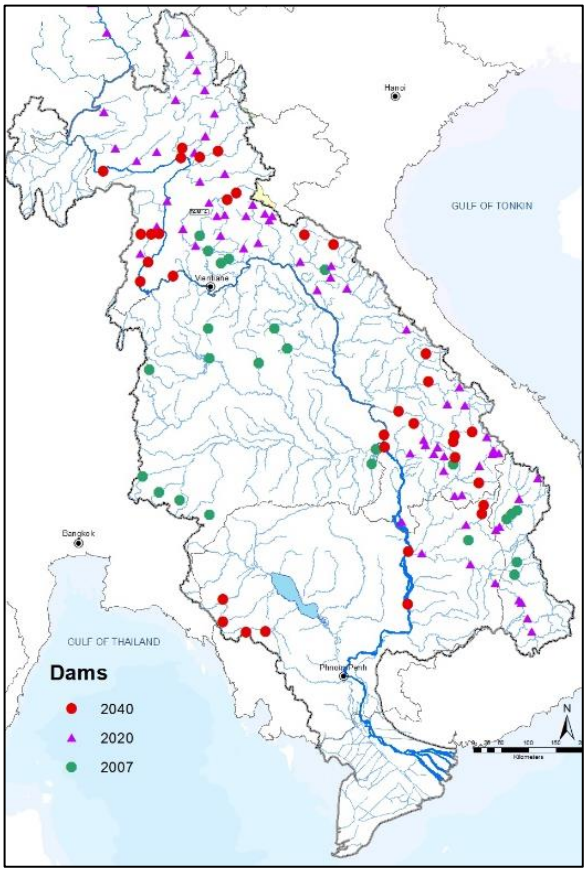

Figure 1. Reservoir development in 2007, 2020 and 2040.

Evaporation and seepage are two main components of the water cycle known as the hydrological cycle. In this short technical note, these two terms are considered as water loss from the system. A mass balance is used as a governing equation of Integrated Water Quantity and Quality Simulation Model (IQQM). Mass balance of a given reservoir can be estimated from inflow (flow from upstream to the reservoir and rainfall), outflow (flow from the reservoir, evaporation and seepage) and storage in the reservoir.

Table 1. Proposed reservoir development in the four countries (* including mainstream reservoirs).

Country	2007	2020	2040
Cambodia	1	9	*13
Lao PDR	6	*60	*85
Thailand	12	12	12
Viet Nam	5	13	13

In this note, we tend to use net evaporation (sum of evaporation and rainfall as the model could not simply separate the two). The net evaporation can have a positive value when the rainfall is higher than the evaporation. This usually happens over the Lower Mekong Basin in the wet season (May to October).

The information on this note was retrieved from the model built for the Study on the Sustainable Development and Management of the Mekong River, including impacts by mainstream hydropower projects – known as the 'MRC Council Study'.

A scenario-based approach is being employed in the study by considering various future development conditions in 2020 and 2040 and compared to baseline condition of 2007 as seen in Figure 1, Table 1 and Table 2. Hydrological period of this study is 1985-2008, from which results are derived.

Table 2. Considered development conditions of 2007, 2020 and 2040.

Scenario	Description	Detail Information
M1-2007	Baseline 2007	Infrastructures of six related sectors in 2007
M2-2020	Development 2020	Infrastructures of six related sectors in 2007, currently under construction and planned for 2020
M3-2040	Development 2040	Infrastructures of six related sectors in 2007, currently under construction and planned for 2040
M3cc-2040	Development 2040 with climate change	Infrastructures of six related sectors in 2007, currently under construction and planned for2040 with climate change

Figure 2 illustrates annual net evaporation and seepage from the reservoirs. Comparing to baseline of 2007, the annual net evaporation and seepage in Cambodia and Lao PDR increase in proportion to the number of proposed reservoirs in 2020 and 2040. Additionally, positive value of the net evaporation indicates that rainfall is higher than evaporation. Hence, this suggests that seepage is a dominant factor contribution to the annual water loss from reservoir development in the Lower Mekong Basin.

As indicated in Figure 3, the annual water loss from the reservoirs (sum of net evaporation and seepage) is approximately 30 million m^3 (MCM) for 2007; increases to 130 MCM and 830 MCM for 2020 and 2040, respectively. The climate change exacerbates the condition in 2040, bringing the annual water loss to 873 MCM. However, comparing to annual inflow to the reservoirs, this annual water loss is considered insignificant.

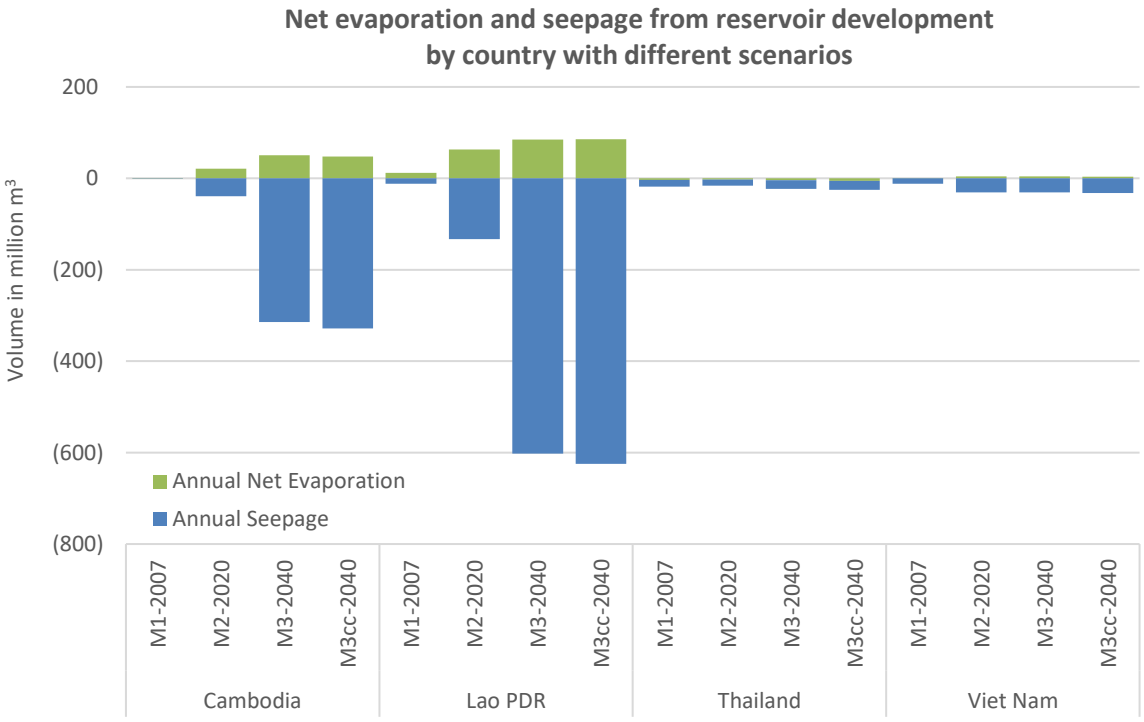

Figure 2. Annual net evaporation (sum of evaporation and rainfall) and seepage from reservoir by country with different scenarios.

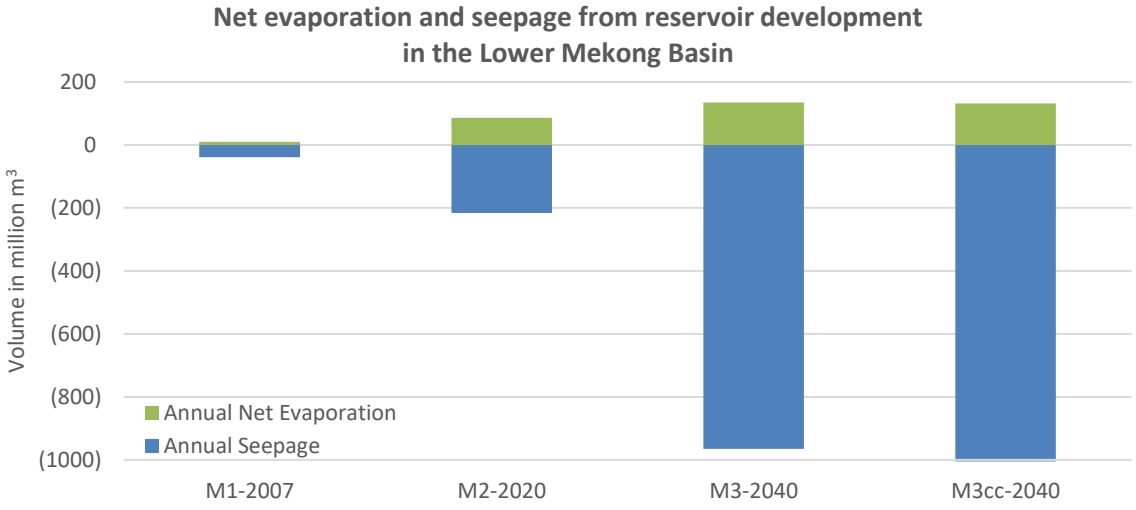

Figure 3. Annual net evaporation (sum of evaporation and rainfall) and seepage from reservoir development in the Lower Mekong Basin.