Evaluation of dam safety after the Kerala flood 2019

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Hydroelectric projects are projects that have revolutionized the energy sector in Kerala. We can consider Idukki as the headquarters district of hydroelectric projects. The economic and social change in Idukki began with the advent of numerous hydroelectric projects. While hydroelectric projects are making revolutionary contributions to more of us, they are also causing environmental problems. Here we study how the management of hydroelectric operations in Kerala during 2018-2019 period was affected by flood.

Introduction

Energy has become as urgent a factor as any other basic need among the nations of the world. Planning without energy is now impossible. One of the most important goals facing the 21st century is how to make energy efficient. There are different options before us, solar, wind, nuclear, and hydropower projects, all of which differ and differ in technology, depending on the policy formulation and availability of each country. The production, consumption and death of hydropower projects are considered to be relatively low cost. At the same time, their income and profits are high, some interim developments point to the fact that in the process of converting kinetic energy into electricity by adapting the flowing river, losses to both human and ecosystems as well as to consumers are a concern.

The catastrophic floods shook Kerala in August 2018. It is estimated to have caused a loss of Rs 400 crore (approximately US $ 5.6 billion),483 people have died and about 140 people are still unaccounted for. Historical records show that a previous catastrophic flood engulfed Kerala in 1924. After the great flood in 2018, the flood was repeated in Kerala in 2019 as well. There are some differences between the floods of 2018 and 2019. The floods of 2018 mainly affected the southern districts of Kerala such as Kottayam, Pathanamthitta, Idukki, Alappuzha and Chalakudy in the central Thrissur district of Alappuzha. But the devastation of the 2019 floods was in North Kerala, Mainly in Kannur and Wayanad districts. The floods of 2018 and 2019 caused more damage geographically in two directions and therefore the results were different.

Month	Actual Rainfall (mm)	Normal Rainfall (mm)	% Departure from normal
June, 2018 749.	749.6	649.8	15
July, 2018	857.4	726.1	18
1-19, August, 2018	758.6	287.6	164
1 June to 19August,2018	2346.6	1649.5	42%

Table No 1 Showing Rainfall in 2018 Jun to July

(Source: IMD)

Rainfall done Kerala throughout southwest monsoon season 2018 (1 June to 19 August, 2018) has been exceptionally high. Kerala so far usual 2346.6 mm contrary to normal of 1649.5 mm (beyond normal by 42%).Above table indicates that highest surplus rainfall is noted over Idukki District (92% overhead normal)charted by Palakkad (72% above normal).

Experts point to the floods of 2018 and mention them in the report of the Center Water Commission Hydrology Studies Organization (Study Report KeralafIood august 2018). One is heavy rain in Kottayam, Idukki, Pathanamthitta, Ernakulam and other districts. Secondly, as part of the heavy rains, dams in Idukki, Pathanamthitta and Ernakulam districts released more water in storage capacity, causing rivers to overflow and flooding towns and farms. Landslides and mudslides accompanied by heavy rains made the situation worse.The rainfall all over Kerala during June, July and August (1-19 August) has been 15%, 18% and 164% above normal correspondingly as shown in the above Table**.(Government of India Earth System Science Organization Ministry of Earth Sciences India Meteorological Department)**

Table No 2 Showing Monsoon Rainfall from 1st to 30th August 2018

District	**Actual Rainfall (mm)**	**Normal Rainfall (mm)**	**Percentage Departure (%)**	
Thiruvananthapuram	373.8	142	163	Large Excess
Kollam	644.1	258.7	149	Large Excess
Pathanamthitta	764.9	352.7	117	Large Excess
Alappuzha	608.2	343.1	77	Large Excess
Kottayam	619.2	386	60	Large Excess
Idukki	1478.9	527.3	180	Large Excess
Ernakulam	648.3	401.3	62	Large Excess
Thrissur	734.7	440.1	67	Large Excess
Palakkad	848.8	333.8	154	Large Excess
Malappuram	913.7	395.3	131	Large Excess
Kozhikode	836	500.9	67	Large Excess
Wayanad	1053.5	592.9	78	Large Excess
Kannur	665.3	540.9	23	Excess
Kasaragode	636.9	636.3	0	Normal

TOTAL	821	419.3	96	Large Excess

(Source: IMD)

The State received an additional of 96% throughout the period from 1st to 30th August 2018, and 33% throughout the total monsoon period till the end of August. Above Table illustrations the rainfall surplus that the state has received throughout this period. Note that in the second stage prediction issued on 30th May 2018, the calculation was only of 95% of LPA (5% below average) throughout the month of August, while the state received 96% extra rainfall. This surprising surplus intense rainfall spell have caused important loss to life and property.

Hence most of the main reservoirs in Kerala had extra 90% of its volume on 8th August 2018. Meanwhile heavy rain in the catchments upstream of main reservoirs was extraordinary, the reservoirs had to release the significant amount of water in a little span of time. For like, Idukki, Kakki, and Periyar reservoirs, which were already nearly full, observed dangerous rainfall of more than 500 years return period. Idukki, Kakki, and Periyar reservoirs received 279, 700, and 420% extra rainfall, correspondingly from their long-term mean between May 1 and August 21 in 2018 **(Hydrol. Earth Syst. Sci. Discuss., https://doi.org/10.5194/hess-2018-480)**

Table 3Seasonal sub divisional rainfall distribution over the SP region during the SWM season, 2019 (01st June-30 Sep 2019)

SUB-DIVISION	Actualr ainfall(mm)	Normal rainfall (mm)	Percentage departurefromnormal (%)
COASTAL AP&YANAM(CAP)	641.5	586.9	9%
TELENGANA(TEL)	805.6	759.6	6%
RAYALASEEMA (RYS)	460.0	411.6	12%
TAMILNADU,PDCandKKL(TN)	396.7	342.0	16%
COASTALKARNATAKA(CK)	3787.7	3098.9	22%
NORTHINTERIORKARNATAKA (NIK)	611.6	497.1	23%
SOUTHINTERIORKARNATAKA (SIK)	839.1	681.8	23%
KERALA&MAHE(KER)	2309.9	2049.2	13%
LAKSHADWEEP(LAK)	1227.0	1013.1	21%

Source Government of IndiaEarth System Science Organization Ministry of Earth Sciences

India Meteorological Department

Compared to the floods of 2018 and 2019, the total rainfall received in Kerala as compared to 2018 was 2310 mm. But most of the damage was done in north Kerala. As mentioned earlier, people in Kannur and Wayanad districts were affected by landslides and landslides. Experts

point out that the high rainfall and the gravel mining in the area are one of the reasons. The MadhavGadgil report included these areas in Zone 1, and ten of the 11 landslide-prone areas were included in Zone One of the report. Vibration caused by granite eruptions in these areas is likely to cause landslides and landslides during the monsoon season in that area. Of the 11 landslides that occurred in 2019, 10 out of 11 were in areas where MadhavGadgil report advised never to erupt. There are 27 quarries in Kavalappara, one quarry in Puthumalai within 10 km, two in Kurubalakottu, 9 in 5 km in Perumcherimala, 13 in 5 km in Mangalassery hill, one in Vilangadu in 5 km radius and one in Anala hill in 5 km radius.

What is Rule Curve?

Rule Curve is the policy of controlling the inflow and outflow of water in a dam and generating electricity.

Did Kerala Dam Management violate Rule Curve during Flood?

All dam is supposed to have a dam exact rule curve that tells, among other things, how the dam is supposed to be full during the monsoon, to optimize flood moderation for the downstream area, while safeguarding that the dam is filled up only closer to the end of the monsoon. Nearly all the dams in Kerala were nearly full by the end of July. This was in whole breaching of the rule curve, as end of July is just half through the South West Monsoon and large parts of Kerala also gets advantage from the North East Monsoon that come after South West Monsoon. So to fill up the reservoirs by end of July was sure call to disaster.

The Central Water commission report is evidently designed to save the dam operators from any liability so it does not say that Kerala dam operators followed or breaching the rule curve. However, the very first suggestions of the report is: “It is essential to review the rule curves of all the reservoirs in Kerala. The rule curves need to be formulated for both conservation as well operations during the flood, particularly for the reservoirs having the live storage capacity of more than 200 MCM in order to create some dynamic flood cushion for moderating the floods of lower return periods particularly in the early period of monsoon.”**(Central Water commission report)**

Conclusion

The monsoon season is the biggest highlight of Kerala's topography. Agriculture and other things are planned here in anticipation of this monsoon.This monsoon is a blessing not only for Kerala but also for South India.All the 44 rivers in Kerala depend on this monsoon.Therefore, this monsoon also makes an immense contribution to the survival of hydroelectric projects.Extreme levels of flood danger were announced in 2018 and 2019 due to some inadequate management of the dam .We can address this with a conscious approach.

Reference

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Central Water commission report