

News Release

FOR IMMEDIATE RELEASE

Development of new technology to automatically draw up reservoir discharge plan to minimize damage caused by river flooding

Drawing up a discharge plan within 10 minutes that serves to avoid emergency discharge even in heavy rainfall that occurs once in 100 years, reduce downstream peak flow by up to about 80%, and prevent inundation

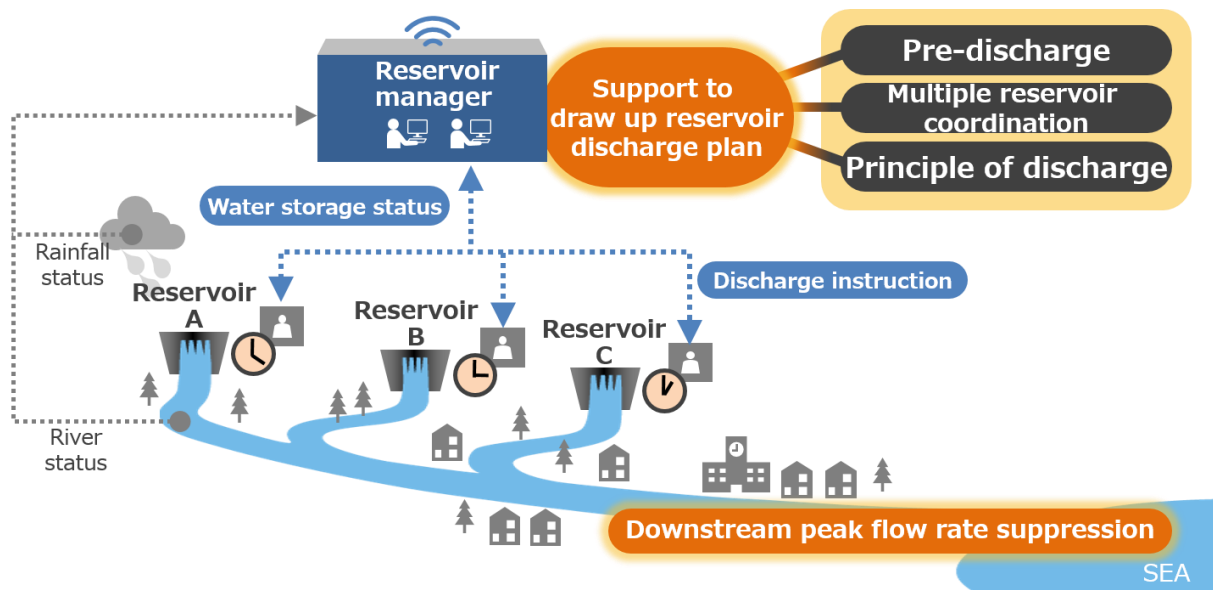


Illustration of expected solutions that support drawing up reservoir discharge plan

Tokyo, December 15, 2020 --- Hitachi, Ltd. (TSE: 6501, “Hitachi”) and Hitachi Power Solutions Co., Ltd. (“Hitachi Power Solutions”) today announced the development of a new technology to automatically draw up a reservoir discharge plan that serves to establish measures for effectively minimizing river flooding damage caused by heavy rainfall. The technology, which uses a new numerical optimization method, automatically draws up a reservoir discharge plan that suppresses downstream river flow as much as possible. The plan is a combination of “pre-discharge” which lowers the water level of the reservoir prior to heavy rain and “multiple reservoir coordination” which shifts the timing of discharging and storing of water at multiple reservoirs. It also satisfies on-site rules such as the “principle of discharge”⁽¹⁾ which restricts sudden changes of discharge volume.

A simulation of three reservoirs located upstream of a river was conducted by using open data. In the case of commonly used discharge plans which implement neither “pre-discharge” nor “multiple reservoir coordination,” all the three reservoirs became

full in the early phase, leading to an emergency discharge⁽²⁾. In contrast, in the case of using the developed technology, the downstream peak flow⁽³⁾ was reduced by up to about 80% and inundation was prevented while the reservoirs avoided emergency discharge even with heavy rainfall that occurs once in 100 years. The plan was created within 10 minutes. It has also been found that the inundation area can be reduced by 95% even if inundation occurs due to heavy rainfall that occurs once in 1,000 years.

In fiscal year 2021, Hitachi Power Solutions plans to provide solutions that support management of reservoirs including drawing up discharge plans by using this technology.

In recent years, severe flood damage has frequently occurred due to climate change, and countermeasures are urgently needed. It has been the common practice for reservoir operation that engineers observe the flow of rain into the reservoir periodically and determine the discharge volume of the reservoir as needed⁽⁴⁾. However, in order to minimize river flooding amid frequent heavy rainfall, complicated and advanced operations such as “pre-discharge” and “multiple reservoir coordination” are required. Even for an experienced engineer, it is difficult to create the optimal discharge plan in a short time during a tense situation, and various factors such as the water storage status at upstream and downstream reservoirs and the time delay downstream need to be taken into consideration while obeying various on-site restrictions and rules such as the “principle of discharge.”

Therefore, Hitachi and Hitachi Power Solutions have developed this technology with the aim of minimizing river flooding, using the know-how in formulating operational plans for social infrastructure acquired in various fields such as water supply, sewerage, electric power, transportation, and logistics. By using a newly developed numerical optimization method called Progressive Dynamic Programming, a discharge plan that can effectively suppress downstream river flow and changes to the extent possible when discharge is implemented at reservoirs can be automatically created in a short time. Specifically, through this method, the volume and the timing of discharge at multiple reservoirs, which are coordinating each other, are calculated very roughly at first, and then more detailed calculations are gradually repeated. As a result, river discharge is effectively reduced in the early phase and the plan satisfies on-site rules such as the “principle of discharge” in the latter phase. All these calculation iterations can be finished in a short time.

Hitachi Power Solutions has been supporting BCP measures of various companies and local governments with its the real-time flood simulator “DioVISTA/Flood.” The software was launched in 2006. Hitachi Power Solutions plans to provide solutions that support reservoir operations by utilizing this technology in fiscal year 2021.

Hitachi and Hitachi Power Solutions will contribute to the realization of a safe and secure society by advancing measures to prevent flood damage caused by heavy rainfall that has occurred more frequently in recent years.

- (1) The rate of increase in discharge should be below a certain value in order to prevent sudden fluctuations in the water level downstream due to discharge from the reservoir. In many reservoirs, specific values are set according to the actual conditions of reservoirs and rivers.
- (2) When the reservoir is nearly full due to heavy rainfall, the same amount of inflow is discharged. This is done to prevent damage or collapse of the reservoir.
- (3) Maximum discharge observed in the river downstream of the reservoir.
- (4) discharged downstream from the reservoir.

Real Time Flood Simulator “DioVISTA/Flood”

<https://www.hitachi-power-solutions.com/en/service/digital/diovista-flood/>

About Hitachi, Ltd.

Hitachi, Ltd. (TSE: 6501), headquartered in Tokyo, Japan, is focused on its Social Innovation Business that combines information technology (IT), operational technology (OT) and products. The company's consolidated revenues for fiscal year 2019 (ended March 31, 2020) totaled 8,767.2 billion yen (\$80.4 billion), and it employed approximately 301,000 people worldwide. Hitachi drives digital innovation across five sectors - Mobility, Smart Life, Industry, Energy and IT - through Lumada, Hitachi's advanced digital solutions, services, and technologies for turning data into insights to drive digital innovation. Its purpose is to deliver solutions that increase social, environmental and economic value for its customers. For more information on Hitachi, please visit the company's website at <https://www.hitachi.com>.

About Hitachi Power Solutions Co., Ltd.

Hitachi Power Solutions contributes to the development of customers' business and the safety and security of society by providing high value-added services fusing its accumulated multiple control and operational technology and various on-site experiences with state-of-the-art digital technologies in energy and infrastructure related field. For more information on Hitachi Power Solutions, please visit the company's website at <https://www.hitachi-power-solutions.com/en/>

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