

Deployment of New Services Using DioVISTA/Flood Real-time Flood Simulator

#Disaster Prevention and Resilience #IoT/Data Utilization #Digital Solutions

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Highlight

Measures for dealing with major rain events have become more pressing in recent years due to climate change. Accordingly, results obtained by conducting simulations are becoming increasingly important when investigating flood control measures. In response, Hitachi Power Solutions, Co., Ltd. is offering an API service that provides a simple means of performing flood risk analysis and a flood risk analysis service that supports customers' flood control measures and can be customized to meet their needs.

This article describes these two new services together with a case study that trialed the implementation of a flood prediction system using the API. By adopting an approach that involves providing simulation results to a wide range of customers, the services allow customers to determine the risk of flood damage with greater accuracy and enact rapid and effective countermeasures.

1. Introduction

Along with the need for measures to deal with the major rainfall events that come with climate change, wider use of hazard maps is making people more aware of how serious flood damage can be. Hazard maps are important tools that enable residents to understand the specific flooding risks in the places where they live. By providing a more personal sense of what this flood risk means to them, this prompts residents to pay greater attention to appropriate disaster prevention measures. In one example, action by the Ministry of Land, Infrastructure, Transport and Tourism to promote resident engagement¹⁾ aims to get residents and companies to take flood risk seriously and to encourage proactive involvement in catchment flood control. Through these measures, disaster prevention awareness is being raised throughout catchments and specific actions are being considered.

What is needed when considering what action to take on flood control measures is more detailed information about what the consequences are likely to be when floods occur. If residents are to be made aware of what the risks actually are, and so take appropriate action, they need access to information about potential flood damage based on the latest meteorological information, presented in a form they can act on. In addition to hazard maps and other relevant information, this will also include detailed time-series information about flood risks as well as when and where they are likely to occur.

2. Overview of New Service

To meet these needs, Hitachi Power Solutions, Co., Ltd. is deploying two new services. The first is an application programming interface (API) service that enables large numbers of users to utilize and share simulation results by making simulation simple to use. The other is a flood risk analysis service that presents the results of flood damage simulation in ways that suit customer needs. This article presents an overview of the services and their features.

2.1 API Service

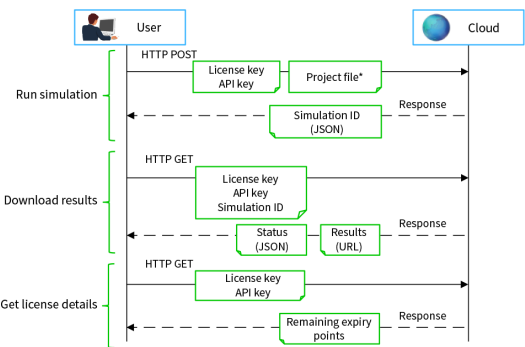
The DioVISTA/Flood Web API Service assists with the operational aspects of running simulations using the DioVISTA/Flood real-time simulator developed and marketed by Hitachi Power Solutions. APIs are important tools for enabling interoperability between software and systems and provide an efficient means of making their functions available. The API makes it simple for users to use DioVISTA/Flood to undertake simulations and to output the results of those simulations more quickly.

The service works by using the API to perform analyses and calculations based on simulation conditions specified by the user in the cloud and to present the results. Having users run simulations on their own device is detrimental to productivity because of the heavy device workload during the several minutes to several hours it takes to perform the analysis. In contrast, analyses done using the API service in the cloud eliminates the need for a high-performance device and allows users to make better use of their time while analysis is in progress. It also makes the work more efficient by allowing multiple simulations to run concurrently and by shortening the computation time.

Figure 1 shows an overview of the API functions for running computations. The three functions provided by the API are simulation execution, downloading of simulation results, and access to license details. The service works by issuing a simulation ID in response to the user providing a simulation conditions file, a license key, and an API key. The simulation ID, license key, and API key can also be resubmitted to obtain uniform resource locators (URLs) to the simulation conditions and results data. The user can then use these URLs to download the results of the simulation for their own use. This information is available both in DioVISTA/Flood's own results format and in network common data form (NetCDF).

Hitachi recognizes that the process of running simulations needs to be made simpler if the results of simulating flood control measures are to be made more widely available. A simulation is made up of three processes, these are: specifying the conditions, executing the calculation, and analyzing the results. Customizing the API to suit the different stimulation conditions and analysis needs of different customers allows them to run more scenarios at the same time and to obtain analysis results more quickly. Analysis results can also be provided to a larger number of users by automating analysis and sending the results to the customer's own systems.

Figure 1—Overview of API



HTTP: Hypertext Transfer Protocol, API: application programming interface, URL: uniform resource locator
* Project files are used internally by DioVISTA/Flood.
Simulations are executed in the cloud based on a project file that was created by the user using DioVISTA/Flood. The results are then available for downloading.

2.2 Flood Risk Analysis Service

Hitachi Power Solutions supplies its flood risk analysis service to help customers with flood control measures. The service covers the steps from creating the simulation conditions to analyzing the results. The results are provided as a report.

A feature of the service is that it can simulate flooding risks based on customer requirements. It does this using the DioVISTA/Flood real-time flood simulator developed and marketed by Hitachi Power Solutions.

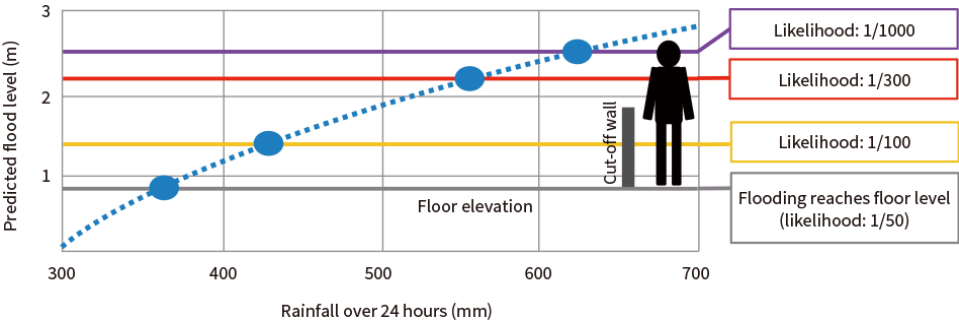
The service is intended for use by flood protection engineers who are entrusted with protecting customer property and social infrastructure. Examples include support for the analyses undertaken by construction consultants to obtain information on flooding risks, the provision of analysis results that loss insurers use to assess and mitigate customer flooding risks, and support for companies undertaking disaster prevention work that involves assessing flooding risks and investigating what can be done to mitigate them.

Customer requirements have become more onerous in recent years due to growing public awareness of the rising level of flood damage. What this means in practice is that, whereas the spread of hazard maps has reduced demand for flood risk assessment, more customers are wanting to investigate practical countermeasures.

While the consent of affected parties is needed when investigating flooding countermeasures, raising awareness of the issues among the stakeholders also brings out a wide range of opinions. Balancing these competing interests is getting more difficult. Overcoming this problem calls both for further study and for sources of information that can inform these investigations. Effective ways of doing this include the use of simulation to quantify how the provision of new facilities or changes to the operation of stormwater infrastructure alter or improve flood risk, and to determine the flooding risks associated with rainfall scenarios not considered in hazard maps (see Figure 2).

By doing so, customers can assess the risks and facilitate the building of consensus with stakeholders once they get to the phase of formulating and designing countermeasures.

Figure 2—Example Use of Simulation to Quantify Floodwater Depth



The DioVISTA/Flood simulator from Hitachi Power Solutions can be used to assess the flood risk at a site. Results are presented in visual form so that the assessment can be utilized when reviewing potential countermeasures such as cut-off walls for keeping out water.

3. Case Study of API Service Evaluation

The DioVISTA/Flood Enterprise Edition service from Hitachi Power Solutions is intended for use by local governments. It combines weather forecasts with actual water level measurements to supply predictions on things like river levels and where inundation will occur. This makes it an important tool for local governments to keep track of flood risk and ensure the safety of their residents. By combining real-time weather information and observations to provide highly precise predictions, it allows users to respond quickly to what is happening. Of particular importance is how well the system performs at predicting inundation and identifying the affected areas. The system was implemented using the API service to provide flexibility and expandability. This allows it to integrate information from different data sources and make more accurate predictions. It can also present simulation results as graphs or on a map. This visual presentation enables stakeholders to quickly see what is happening and take appropriate action.

The system can be configured to run simulations automatically in response to rainfall predictions. On receiving rainfall data, it incorporates the rainfall prediction into the preset conditions and then uses the API to run a simulation. The results API can then be used to output the results of the simulation and display them on a browser in the format of a map or graph (see Figure 3).

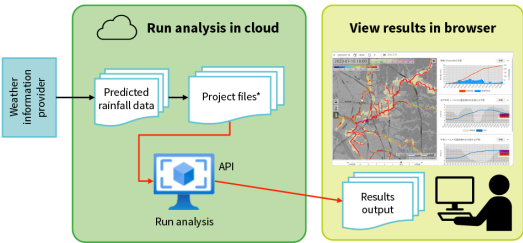
Cost is an issue with systems such as this due to the need to maintain a high-performance computing environment. In response, Hitachi has kept simulation costs down through efficient operation of the runtime environment, including by invoking it only when needed and releasing it afterwards. Doing it this way eliminates unnecessary costs as customers only use resources when needed. Moreover, to provide flexibility in system operation, a function is also provided whereby customers can explicitly specify when to start and stop prediction. This allows customers to perform prediction for specific time periods and to take action promptly based on the results.

Note that, the API was not used in this evaluation trial to specify rainfall data settings or to analyze results such as water level data. However, Hitachi intends to continue expanding the range of API functions to make it easier for customers to integrate the service into their own systems.

4. Conclusions

This article has described two services from Hitachi Power Solutions that support the provision of information and implementation of countermeasures to flooding events that are becoming increasingly severe due to climate change. To help society become more resilient to flooding, Hitachi also intends to continue making communities more robust by providing the infrastructure for a sustainable and safe future.

Figure 3—Case Study of API Service Evaluation



* Files used internally by DioVISTA/Flood.

If water levels and other such information is available in addition to rainfall predictions, this data can be included in the project file.

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