Hydro-STIV

Measurement software

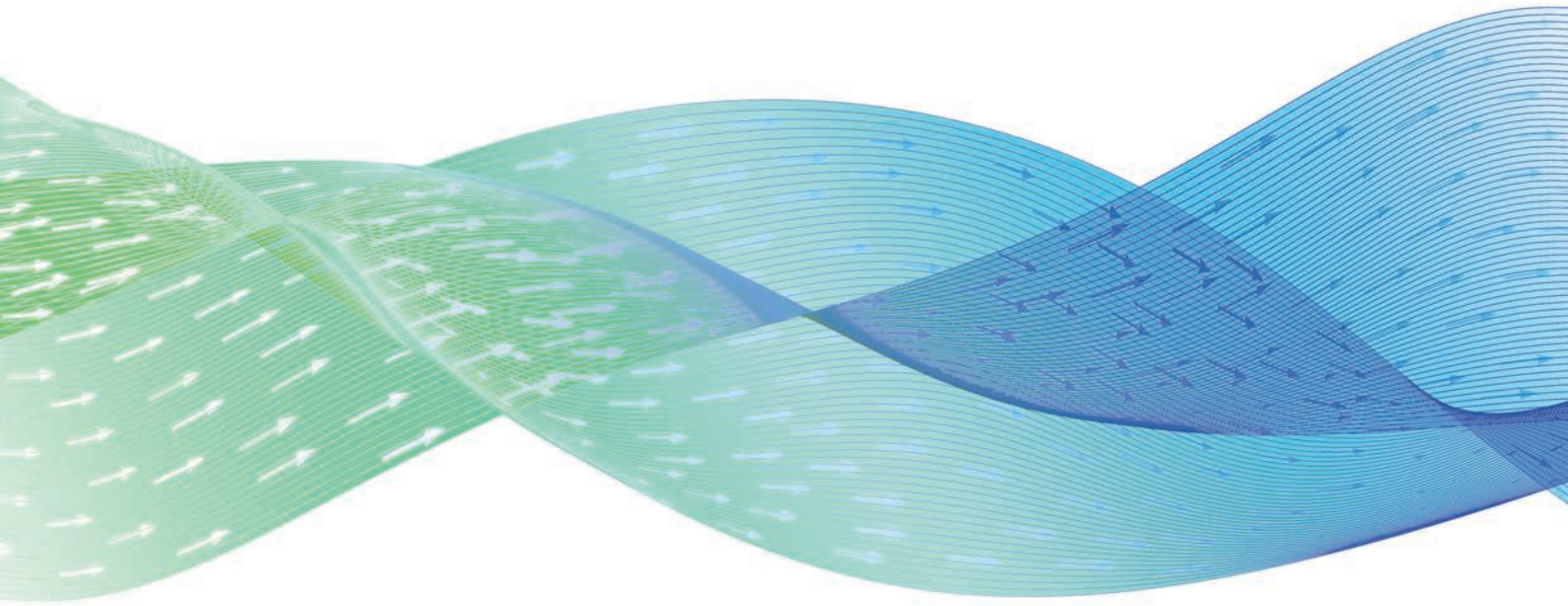
Flow Velocity and Rate Using Video Images

Safe, Accurate, New Flow Measurement

Based on the latest STIV Technology by Professor Emeritus Ichiro Fujita, Kobe University[*1]
The only commercial system equipped with STIV[*2]

AI Analysis

DX Support

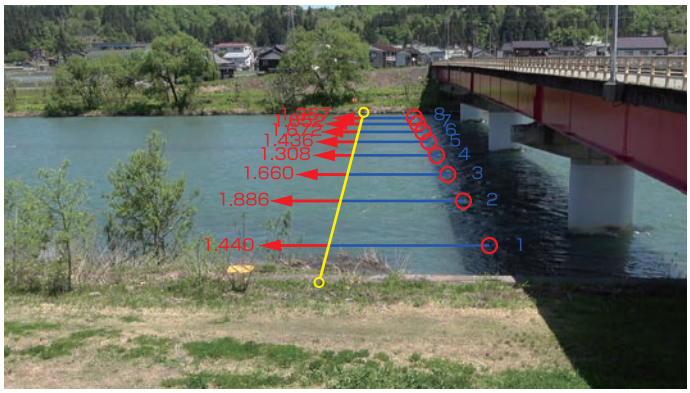


Hydro Technology Institute Co., Ltd.

*1 Fujita I. Discharge Measurements of Snowmelt Flood by Space-Time Image Velocimetry during the Night Using Far-Infrared Camera. Water. 2017; 9(4):269.

*2 As of March 2025

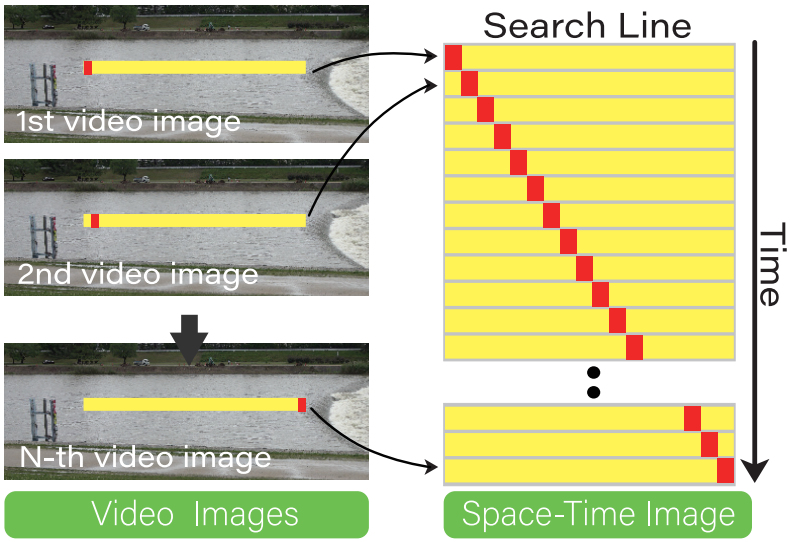
Flow Velocity Measurement Using Image



Hydro-STIV is a software which measures flow velocity and rate using video images and a water level.
High measurement accuracy is achieved by the combination of the latest STIV technology and AI technology. Safe and easy measurement can be done even for flood without dangerous on-site work.

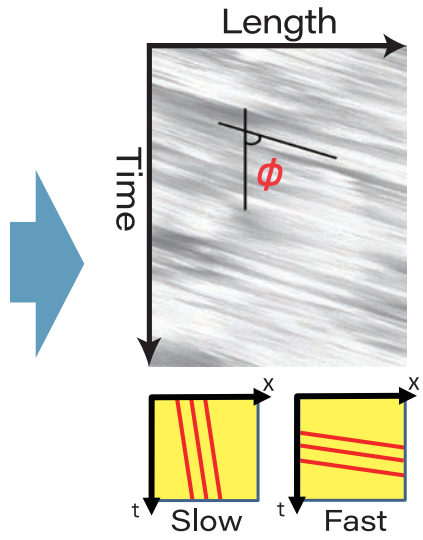
STIV overview

STIV creates STI(Space-Time Image:STI) from the video image and calculates flow velocity(V) from the STI. By taking the measured points of flow velocity from the river image frame by frame and arranging them vertically, an image(STI images) is generated where a stripe pattern based on the flow velocity appears. Flow velocity can be measured by using that the slope of the stripe pattern which represents the speed of the flow.



Generation of Space-Time Image(STI) from video images

The yellow lines shows search lines, and the red squares show features of brightness value(surface ripples etc.). STI is generated by arranging the brightness values on the search line in the time direction, and the stripe pattern indicates velocity.



Calculation of Velocity(V) from STI

Velocity is calculated using slope of the stripe pattern(ϕ), length, and time of STI. When ϕ is small, velocity is slow(left-bottom), and vice versa(right-bottom).

Field survey

Placing GCPs on both banks

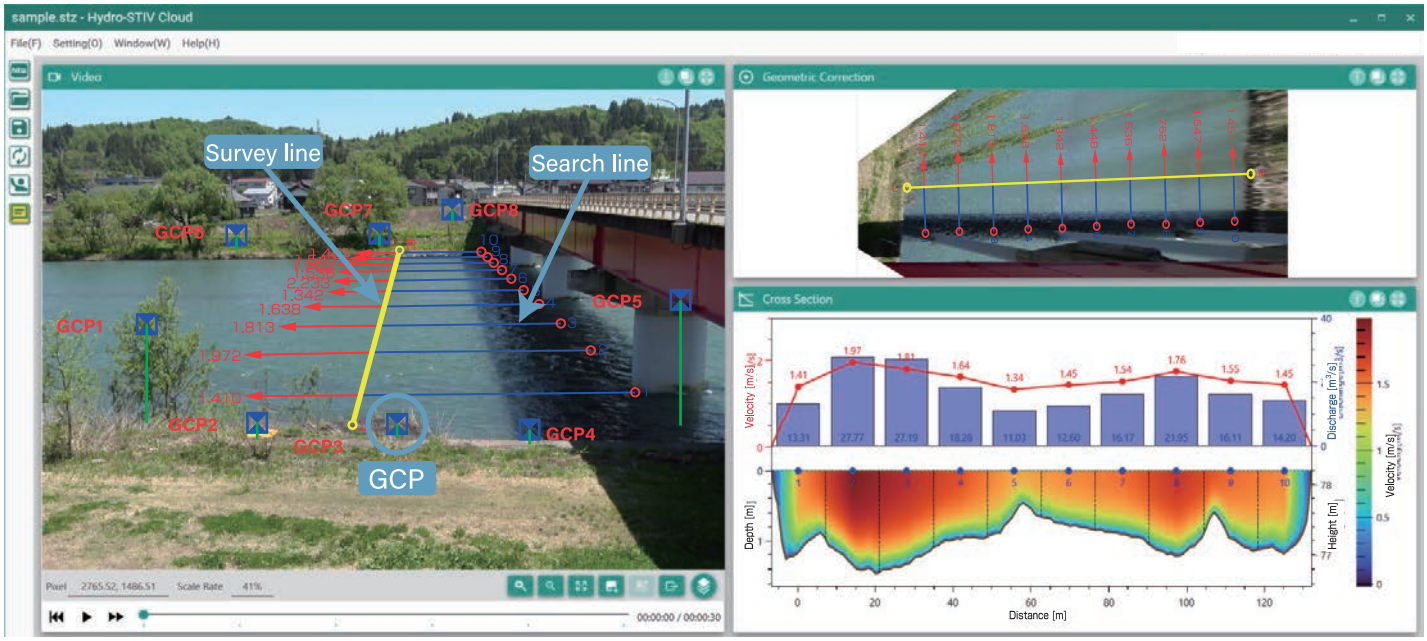
Surveying the coordinates of GCPs

Getting water level information

Shooting video

That is all for on-site work!

Measurement using STIV

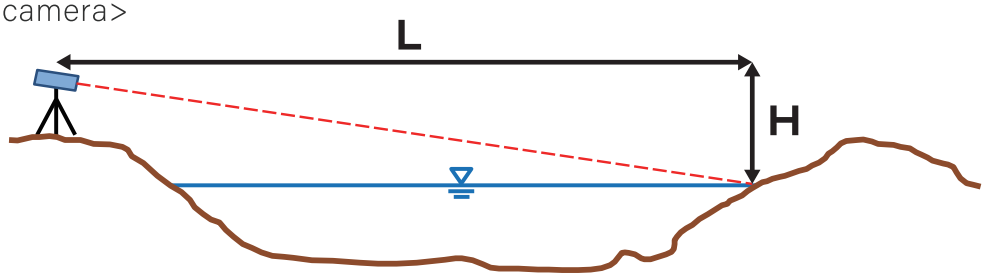


Wizard format enables easier measurement with an intuitive operation.
The measurement result can be output as HTML, and it can be used as a project report.

Example of observation camera positioning

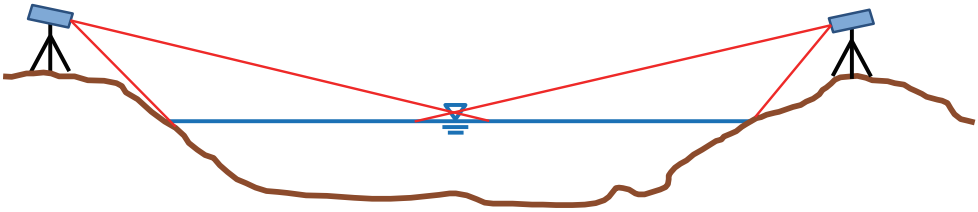
The figure shows examples of a camera positioning for observing flow velocity and discharge with Hydro-STIV. Please place the camera with reference to the following.

<Shooting with 1 camera>



Distance to the opposite bank : L	Height from water surface : H	Camera resolution
~100m	3m or higher	HD(1280×720)
~200m	7m or higher	FHD(1920×1080)

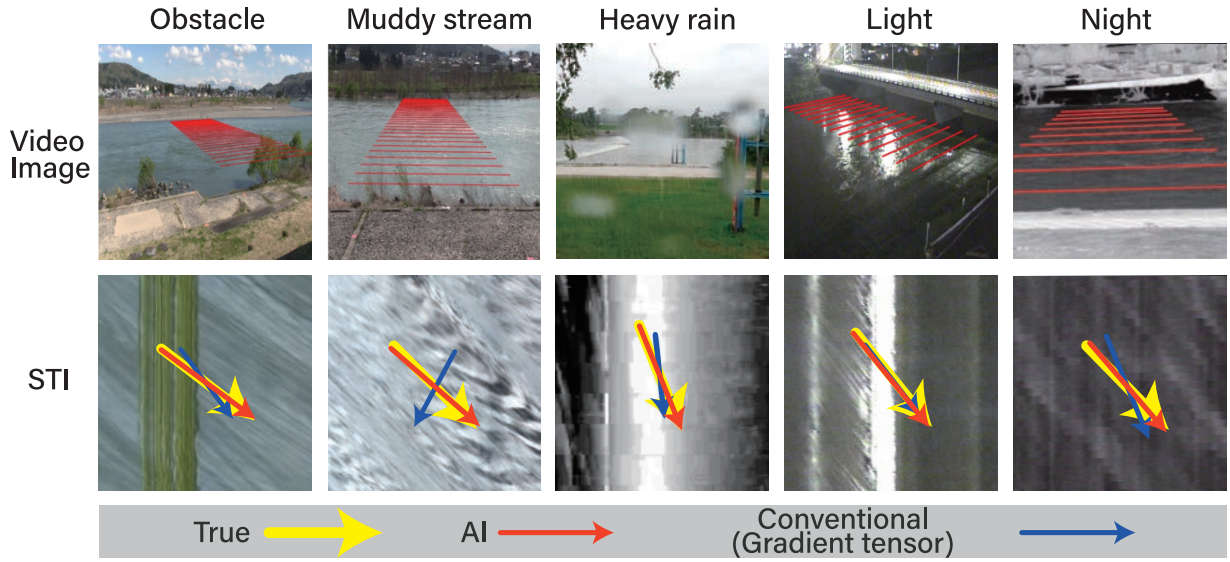
<Shooting with 2 cameras on both side of bank>



Distance to the opposite bank : L	Height from water surface : H	Camera resolution
~200m	3m	HD(1280×720)
~400m	7m	FHD(1920×1080)

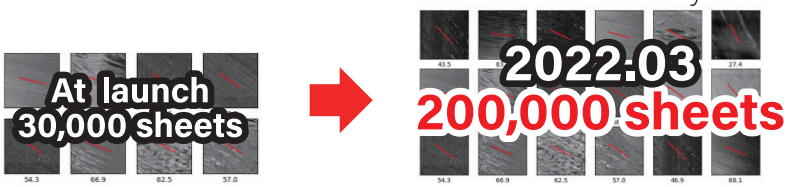
AI enables high-speed and high accuracy measurement

AI(Deep learning) enables more stable measurement than conventional methods. Highly accurate measurement can be performed with complete automatic analysis even when obstacles are in the image, when there is muddy water and heavy rain with high water, when there is a reflecting light at night, and when an infrared camera is used.

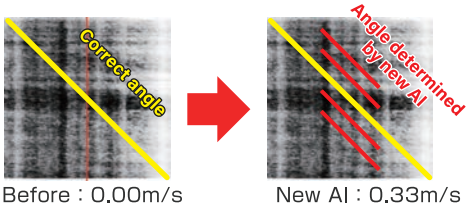


※Ichiro FUJITA, Tastushi SHIBANO, Kojiro TANI: Improvement of STIV for video images captured under deteriorated measurement conditions, JSCE, Ser. B1(Hydraulic Engineering),Vol. 74, No.5,I_619-I_624,2018.

AI has been trained by collecting actual river data continuously and improving learning data. As a result, even deteriorated STIs can be measured accurately.

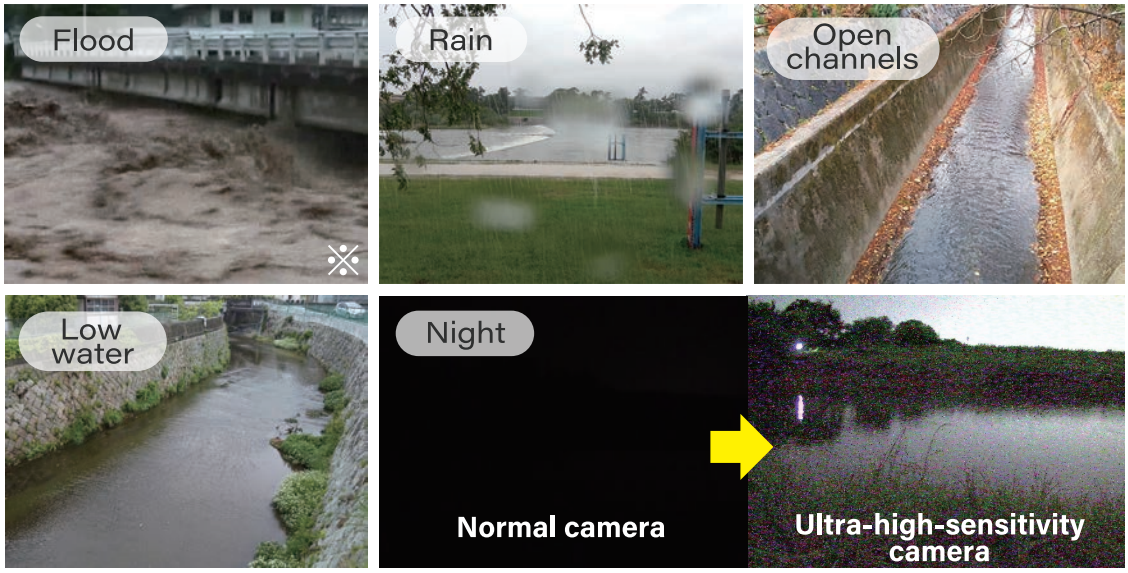


Deteriorated STIs that cannot be visually determined can be measured



The main features of STIV and applied examples

Unlike PTV, no tracer is needed because STIV measures flow velocity from a subtle difference of the brightness. Measurement is available in various environment such as floods, low water.

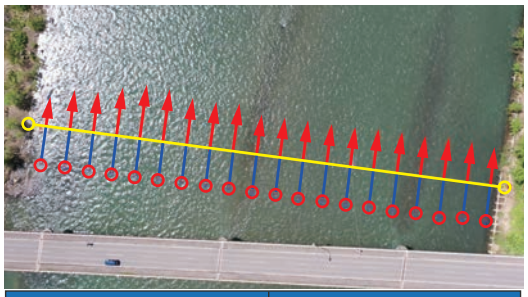


※Created by processing data from GSI Japan(https://www.gsi.go.jp/BOUSAI/H29hukuoka_ooita-heavyrain.html)

Evaluation of STIV Measurement Accuracy

Comparison of measurement results using STIV and ADCP

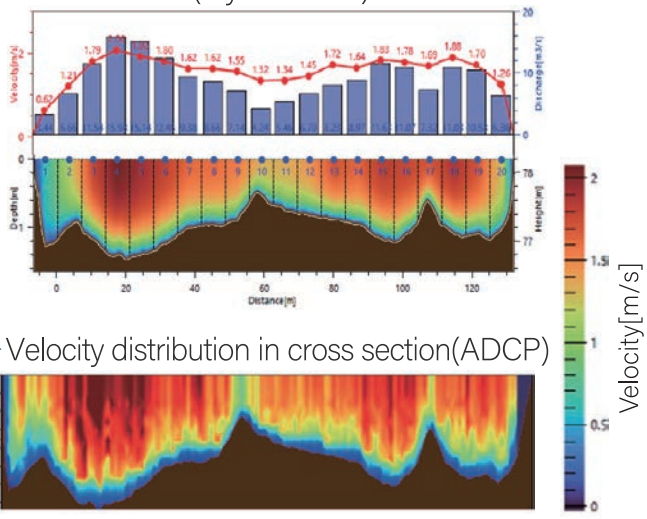
A comparison of flow velocity and discharge measurements by ADCP (Acoustic Doppler Current Profiler) and Hydro-STIV has confirmed that the measured discharge of the two differ within 5%.



Hydro-STIV	ADCP
181.98m³/s ⟷	182.35m³/s

difference 0.2%

▶Velocity on the surface and distribution in cross section (Hydro-STIV)

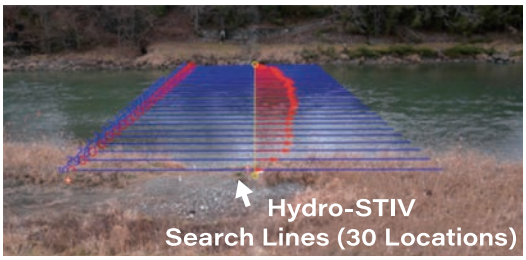


▶Velocity distribution in cross section(ADCP)

Measurement accuracy equivalent to ADCP

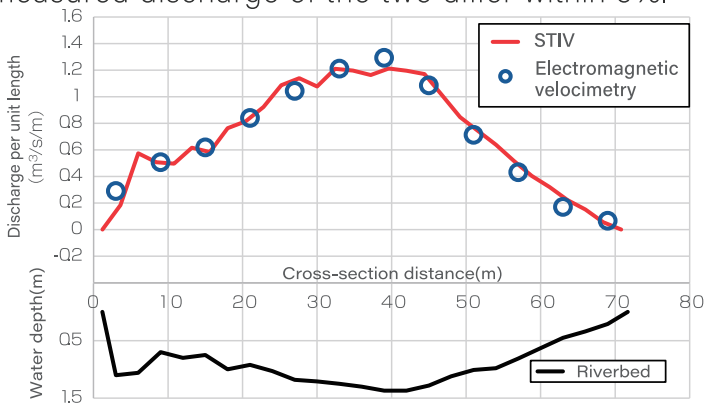
Comparison of measurement results using STIV and Electromagnetic velocimetry

A comparison of flow velocity and discharge measurements by a Electromagnetic velocimetry and Hydro-STIV has confirmed that the measured discharge of the two differ within 5%.



Hydro-STIV	Electromagnetic velocimetry
49.96m³/s ⟷	49.25m³/s

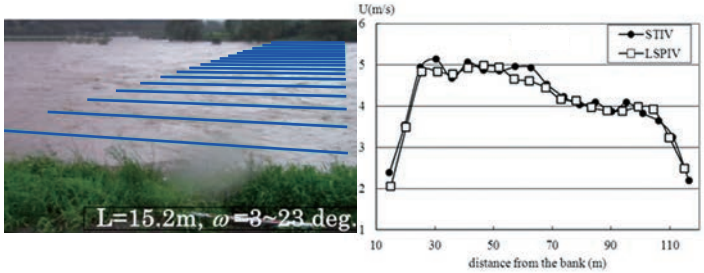
difference 1.4%

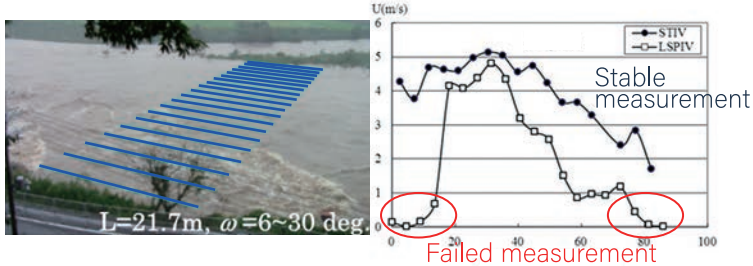


Measurement accuracy equivalent to Electromagnetic velocimetry

Comparison of measurement results using STIV and LSPIV(other image velocimetry)

In STIV, the flow velocity can be measured stably even if there are obstacles such as vegetation that are difficult to apply LSPIV or even if the clear ripple does not appear on the image.





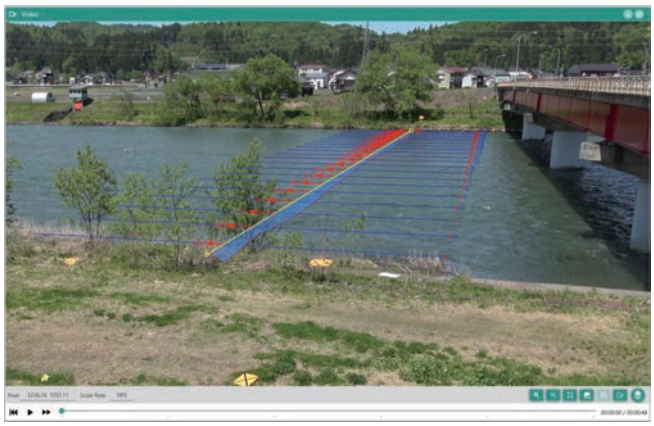
※Aberle, Jochen, et al., eds. Experimental Hydraulics: Methods, Instrumentation, Data Processing and Management: Volume II: Instrumentation and Measurement Techniques. CRC Press, 2017.

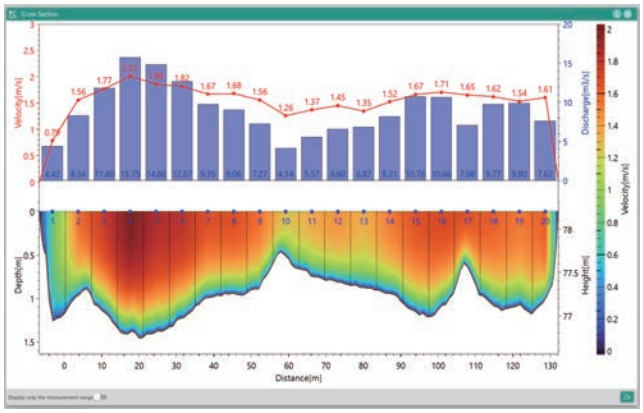
Stable measurement accuracy compared to other image velocimetry

Main Features of Hydro-STIV

Calculation of cross section velocity distribution by MEM(Maximum entropy Method)

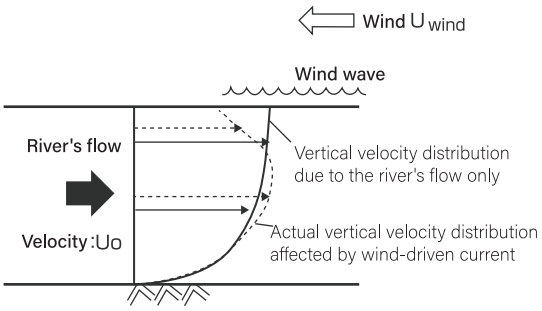
This feature estimates the cross section velocity distribution from the velocity distribution on the surface and the cross section profile. By using this feature, velocity can be calculated without the calibration factor. The estimated cross section velocity distribution is displayed in contour on the cross section image.





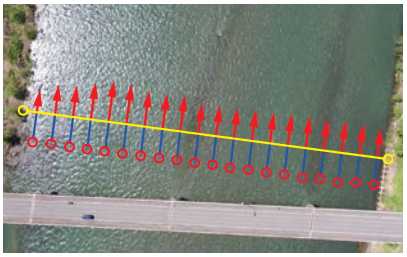
Wind effect correction

By using this feature to take into account the effects of wind direction and velocity, surface velocities can be calculated with correction for wind effects.
※The correction formula presented in the "Manual for Advances Flow Observations during High Water" of PUBLIC WORKS RESEARCH INSTITUTE, Japan.



Drone footages for measurement

Images taken from the sky by a drone or other devices can be used to measure the flow velocity and discharge. Rivers so wide that the opposite bank cannot be seen, mountainous areas that are difficult to access, or rivers during flood can be easily measured by drone footage. Another advantage of vertical shooting is that no geometric correction is required since the actual scale can be detected by the distance between only two points in the image.



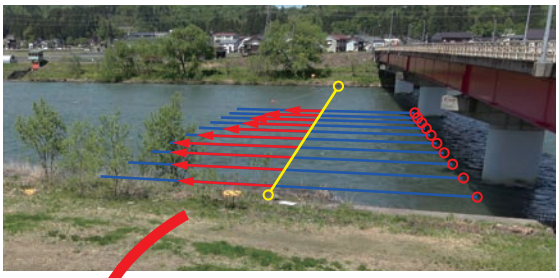
※1 Created by processing data from GSI Japan(https://www.gsi.go.jp/BOUSAI/H29hukuoka_ooita-heavyrain.html)

※2 Fujita I., Notoya Y. and Furuta T.:Measurement of inundating flow from a broken embankment by using video images shoot from a media helicopter,River Flow 2018.

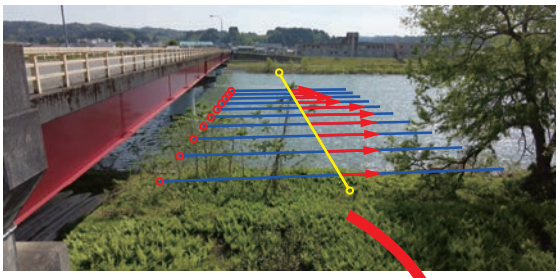
Measurement in large rivers using multiple cameras

Large rivers can be measured by dividing the shooting range with multiple cameras.

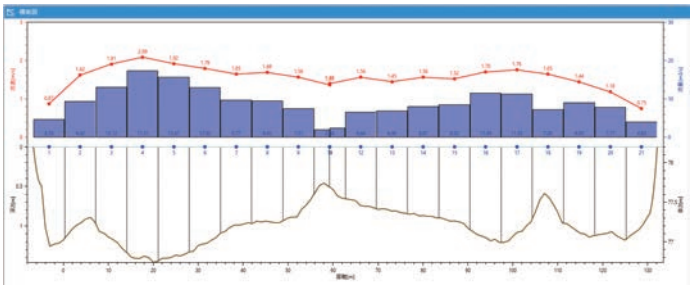
<Taken from the left bank>



<Taken from the right bank>



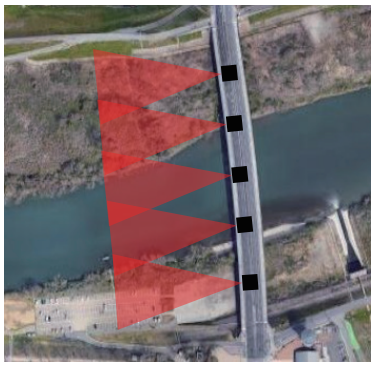
Merged



It is possible to customize a system that automatically performs measurement with multiple cameras.

▶Cameras on both banks

▶Multiple cameras on the bridge

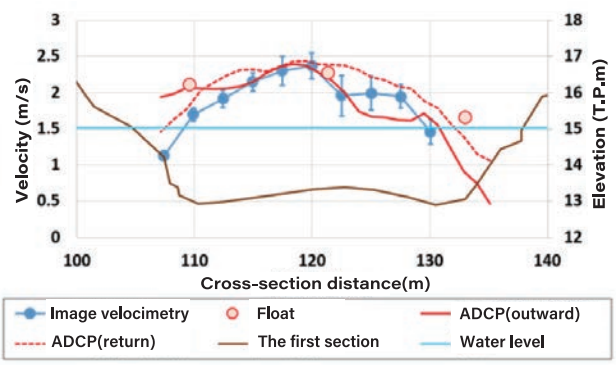


▶Example of application when the entire width of the river is not visible due to vegetation, etc.

Uncertainty evaluation

Based on the uncertainty evaluation method specified by International Organization for Standardization(ISO), we have developed an uncertainty evaluation function for STIV measurement results.※

The uncertainty evaluation range of measurement results can be used to evaluate the validity of measurement conditions and to make rejection decisions on measurement results.



※ISO：ISO 25377 (Hydrometric uncertainty guidance (HUG)), 2020.

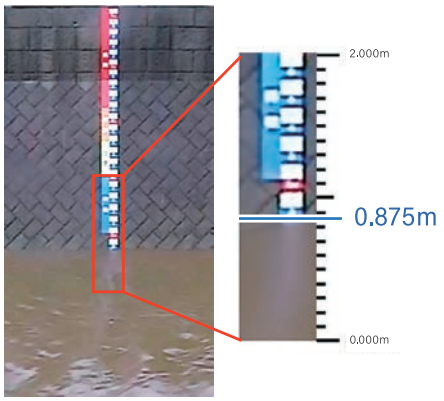
Paper from Hydrosoken, Watanabe et al., Uncertainty evaluation of STIV river flow measurement, Advances in River Engineering, Vol. 27, pp7-12, 2021.

Main Features of Hydro-STIV

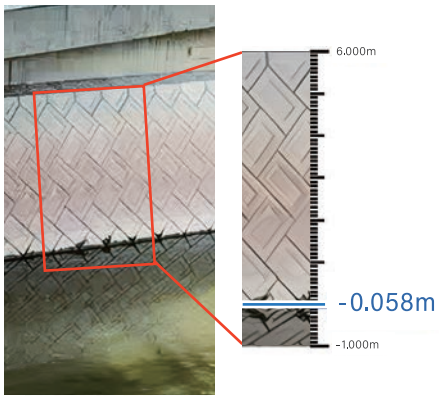
Automatic water level measurement using image

Hydro-STIV also has a function of measuring water level. By detecting the water edge from vertical structures such as gauges, piers, and concrete walls in the images, water levels can be measured without using other systems.

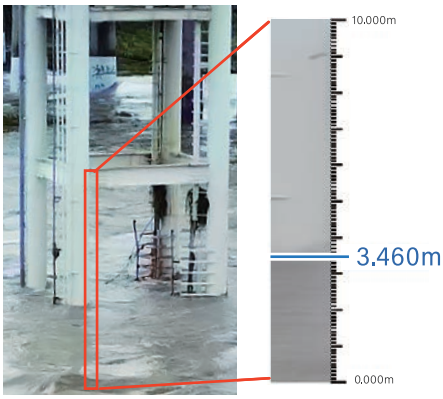
Using a gauge



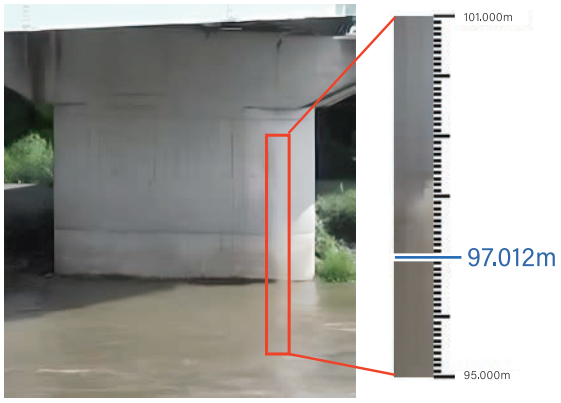
Using the slope of an embankment

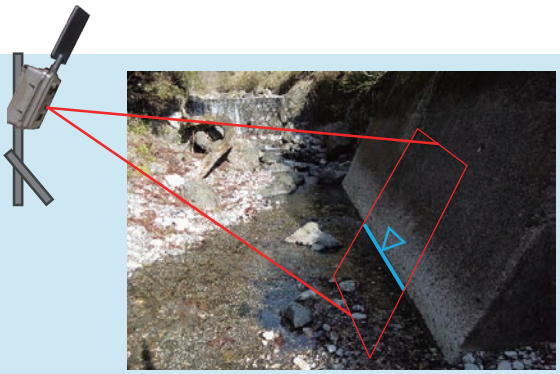


Using a column structure



Using a bridge pier

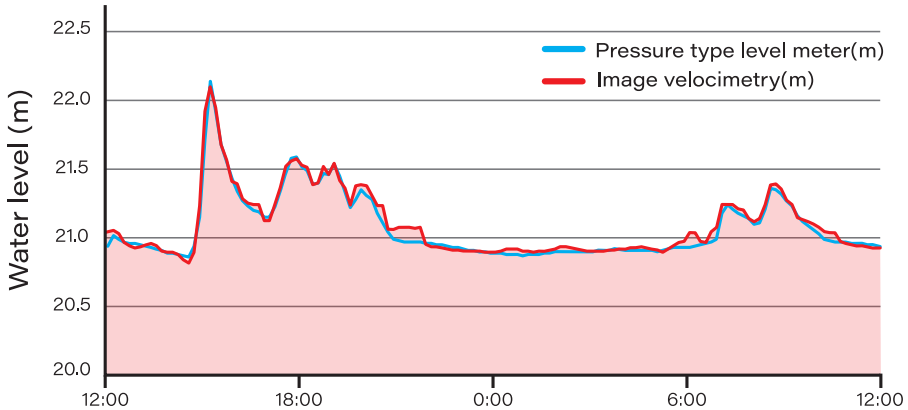




Even for small rivers in mountainous areas, water level and flow velocity can be measured and flow observation can be performed by installing a trail camera only.
A camera which has communication function enables real-time flow observation using only itself.

Validation of water level measurements

The water level measured by Hydro-STIV was compared with the water level measured by the pressure type level meter, and it has been confirmed that the results by the Hydro-STIV follows that of pressure type level meter.



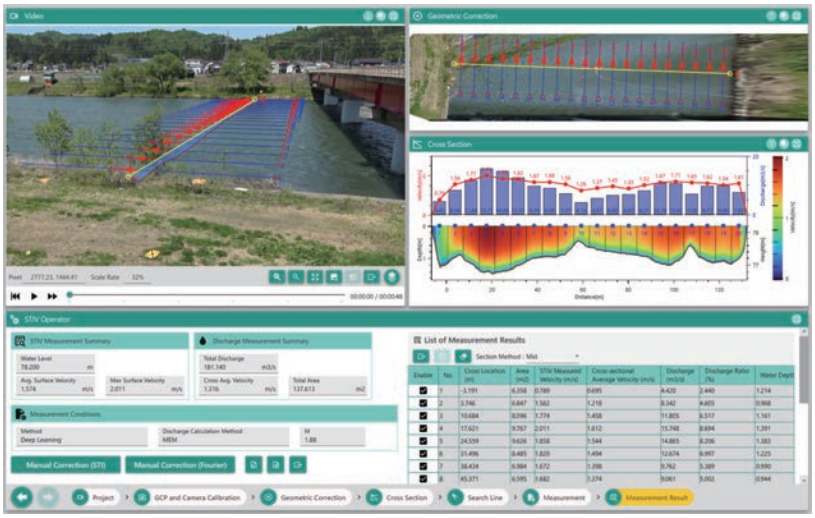
Hydro-STIV Products

Hydro-STIV Cloud

Flow velocity and discharge measurement software using video footage

Hydro-STIV Cloud uses network authentication via a cloud system, allowing it to be used not only on office PCs, but also at telework, observation sites, and any other location.
Information such as video data or measurement results are not used or stored on the network, the system can be used with confidence in terms of security.
In addition, Hydro-STIV Cloud customers will be provided with a portal site for software downloads and the latest information on Hydro-STIV.

Main screen



Portal site

Main functions

Measurement	Flow velocity and discharge measurement by STIV
	AI automation with high accuracy in velocity
	Flow velocity measurement by PTV
	Automatic water level measurement using image
	Geometric correction of a fixed point shooting image
	Discharge calculation by mensuration of division
	Filtering of abnormal values in measurement
	Wind effect correction
	Discharge calculation by MEM
Utility	Visualizing results across river cross section
	Consecutive measurement at same angle of view
	Manual correction of measurement results
	Video stabilization
	Video editing(cut out the target time section)
	Result summary report output
	KMZ coordinates output (Google Earth, etc.)
	Batch output of related files

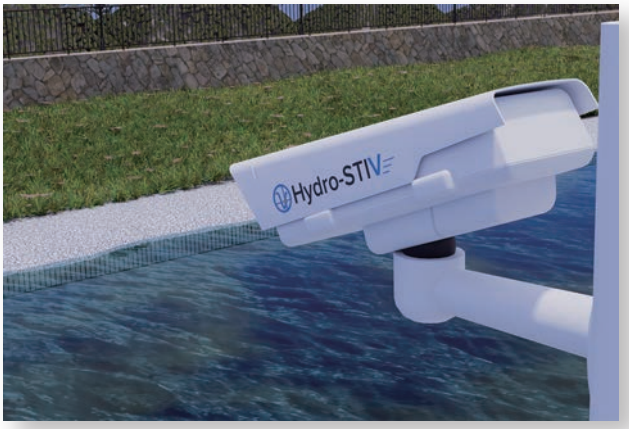
System requirement

<System requirement>	
O S	: Windows 10 (64-bit), Windows 11
C P U	: Intel Core i5 third generation or higher
Memory	: 4GB or more
Resolution	:1920×1080 (Display)
<Video requirement>	
Format	: avi, mp4, mov, wmv, m2ts
Scanning	: Progressive
Length	: 15~30 Seconds (Recommended)
Frame rate	: 24fps or more (Recommended)
Resolution	: 720p, 1080p or more (Recommended)
*Camera lens without distortion is recommended	

Hydro-STIV Real Time

Automatic discharge observation system using video footage

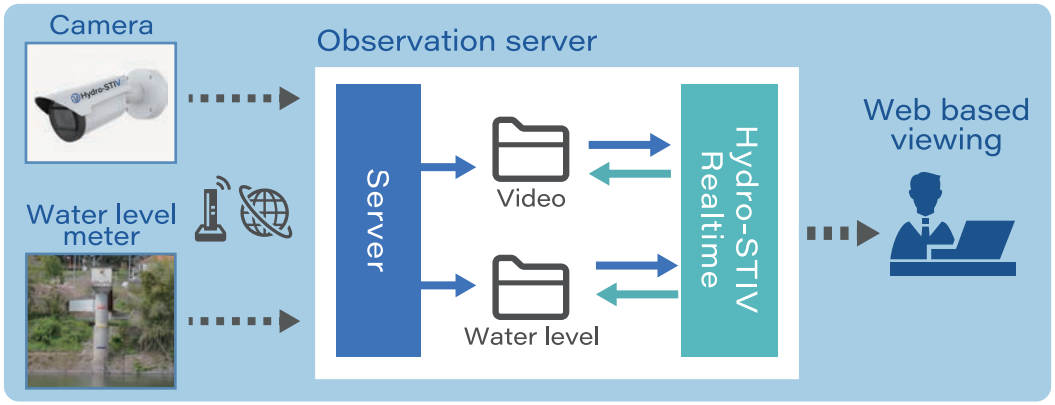
Hydro-STIV Real Time is a system that automatically observes, discharge using videos recorded by a camera and water level. By installing the system on a server connected to a camera installed at the observation point, real-time discharge can be observed at all times. This system includes processing of image and other data, and user interface.



Main screen

Camera image

System building



Features

- Flow velocity and discharge measurement by STIV
- Water level measurement using videos
- Image stabilization
- Observation information browsing screen
- Simultaneous multi-point management
- Alert function
- Video and Water level data management
- CSV output of measurement results

System requirement

<System requirement>	
O S	: Windows Server 2019 or higher
C P U	: Intel Xeon E-2314 2.8GHz, 8M cache, 4C/4T Turbo(65W), 3200 MT/s or higher
Memory	: 4GB or more
Resolution	: 1920x1080 (Display)
HDD	: 2TB or more(select according to required storage period)
<Video requirement>	
Format	: avi, mp4, mov, wmv, m2ts
Scanning	: Progressive
Length	: 15~30 Seconds (Recommended)
Frame rate	: 24fps or more (Recommended)
Resolution	: 720p, 1080p or more (Recommended)
*Camera lens without distortion is recommended	

Hydro-STIV Portable

Flow velocity and discharge measurement device using video footage

Hydro-STIV Portable is a measurement device that can record videos with a built-in camera in smartphone or tablet and perform velocity and discharge measurements on-site. The velocity and discharge can be measured using only angle information from the smartphone or tablet's accelerometer and distance to the water surface. It does not require surveying of GCPs and can easily measure flow velocity and discharge using distance between the two points.

※1 Commercial use tablet with excellent shock resistance, waterproof and dustproof performance compliant with MIL-STD-810H procurement standard of the U.S. Department of Defense

※2 If using a smartphone

Camera suitable for shooting videos for use with Hydro-STIV

▶CCTV camera, handy camera, smartphone camera

Any type of camera can measure flow velocity and discharge as long as it can capture even the slightest ripple on the surface. It is available with a standard visible light camera during the day, and it can be done at night if the light is properly positioned.

▶Ultra-high-sensitivity camera

A high sensitivity camera that can observe at night is effective at hydrological observation points of rivers and other locations where accurate discharge observation is required at all times.
It is ideal for full-time observation using Hydro-STIV Realtime.

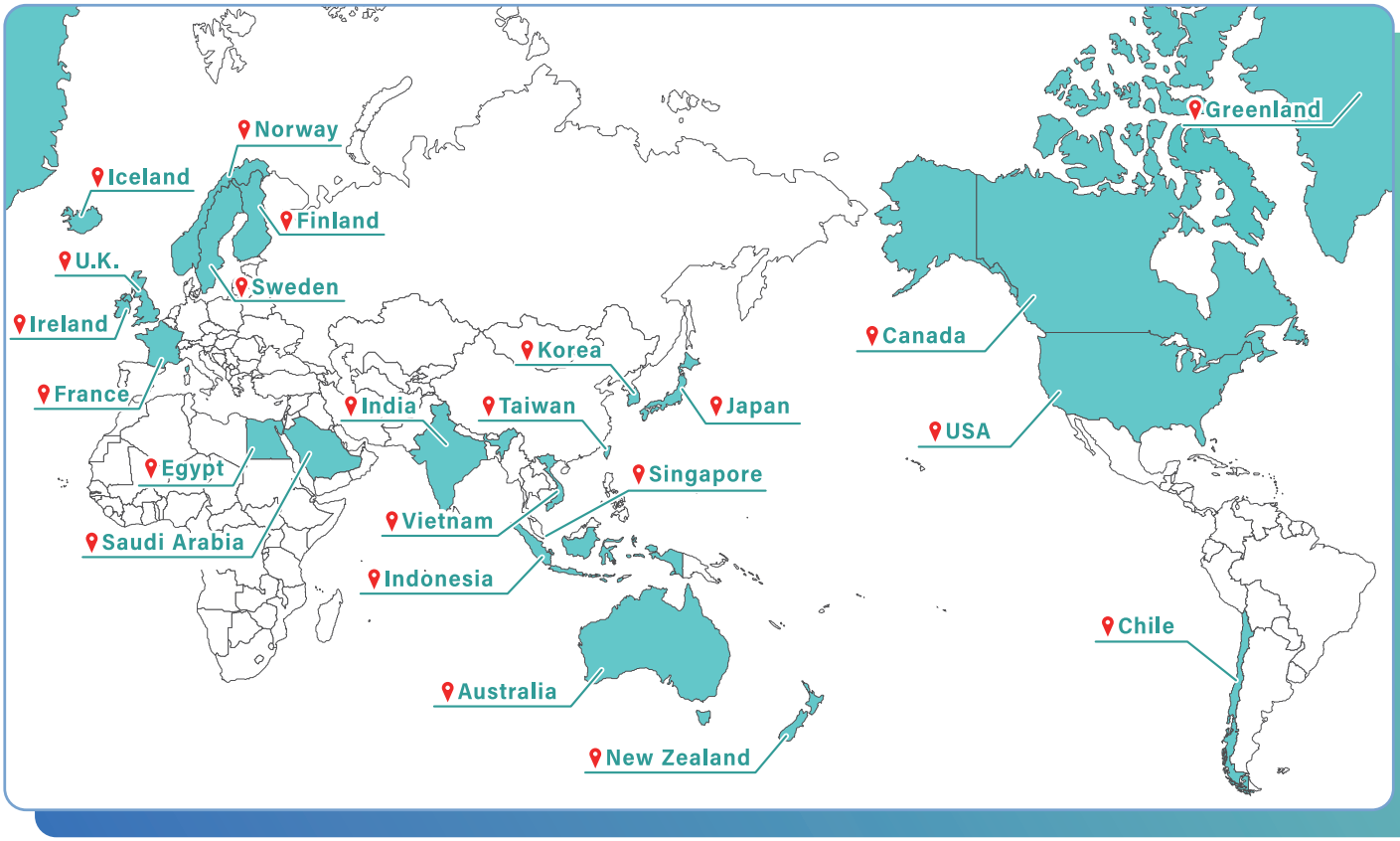
▶Trail camera

A trail camera costs low, and its communication function is useful in mountainous areas where regular camera installation is difficult due to power and communication problems.

Key Feature Comparison of the 3 Services

Key Features		Cloud	Portable	Real Time
Measurement Functions	Flow velocity and discharge measurement using STIV	●	●	●
	Precise automatic velocity measurement by AI	●	●	●
	Discharge calculation using the area method	●	●	●
	Automatic water level measurement via image analysis	●		●
	Wind effect correction	●		●
	Discharge calculation using MEM	●		
	Geometric correction by built-in accelerometer		●	
Utility Functions	Export of measurement result reports	●	●	●
	Video stabilization	●	●	●
	Display of velocity on image	●	●	●
	Manual correction of measurement results	●		
	High water level and discharge alert notifications			●

Worldwide Customers



Contact Us

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https://www.hydrosoken.co.jp/en/

Issued in June 2025