Riverflow Measurement Technology

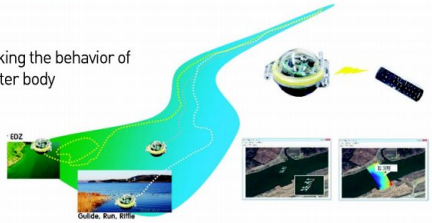
RMT

Overview

RMTs, which include multi-depth flowmeters, microwave surface velocity meter and gyro ball, are technologies to acquire reliable basic water resource data, and thereby perform relevant surveys in a timely manner

Configuration

Gyro ball for tracking the behavior of water body



Microwave surface velocity meter

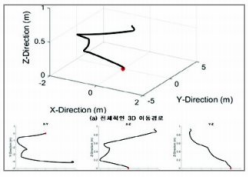
Multi-depth flowmeter

Features

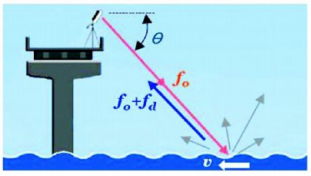
- Gyro ball
  Calculates 3-D flow velocity and travel distance, compare between gyroball flow velocity and measured flow velocity, and determine correlations among depth, temperature and flow velocity
- Microwave surface velocity meter
  Measures flow velocity on water surface from a difference between signals (Doppler frequency) sent and received from flow movement on water surface
- Multi-depth flowmeter
  Measures 3-point flow velocity at any given time through securing equal-ratio water depth based on the pulley principle

Functions

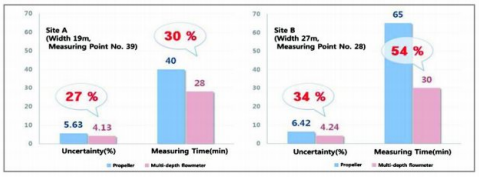
| Gyroball |



| Microwave surface velocity meter |



| Multi-depth flowmeters |



- Gyro ball : Functions to calculate 3D velocity and relative travel distance by calculating & integrating the accelerations of each axis, and post-process and visualize data with GUI
- Microwave surface velocity meter : Functions to resolve problems (that come from the risk of damages against rotational flowmeters, errors in measuring flow velocity with floats, a need to mobilize multiple personnel, etc.) through non-contact measurement methods, which, in turn, will make it possible to conveniently measure flow velocity even in case of flood
- Multi-depth flowmeter : Functions to save measuring time and reduce uncertainty by applying a simultaneous 3-point flow velocity measurement method

Effects

- Gyroball : Possible to track a river's 3D flow velocity, identify the point of flow stagnation, and thereby predict the point of water pollution
- Microwave surface velocity meter : Possible to regularly monitor flood discharge with an unmanned real-time flood measurement system
- Multi-depth flowmeter : Possible to save measuring time by 33~50%, and reduction uncertainty by up to 54%

Applications

- Applied to the measurement of flow velocity in a river (K-water, university labs, government organizations, etc.)

M-WAS

Mobile Water Analysis System

Overview

M-WASs are multi-purpose river Hydrological survey vehicles used to conveniently accommodate and transport such river survey equipment or instruments as flowmeters, suspended load samplers, S-boats, etc.

Configuration

Features

- Timely produces outputs by mobilizing mid-to-high speed flowmeters and suspended load samplers with a crane
- Possible to accurately moves & adjusts survey equipment with special devices (e.g., weight sensor, winch, etc.)
- Easy to accommodate relevant survey equipment thanks to a sliding platform
- Equipped with a portable refrigerator to prevent any pollution and alteration in specimen for water quality analysis

Functions

| Relevant equipment & tools |


[Medium-high speed flowmeter]


[Microwave surface velocity meter]


[ADCP]



[suspended load sampler]

| Storage of speciment for water quality analysis |


| Status view of surveys performed using a crane |



Effects

- Possible to improve the applicability & safety of survey equipments under various river conditions
- Possible to improve the storage & utilization of various survey equipment
- Possible to save traveling & measuring time
- Convenient to perform surveys at night time thanks to water depth and water surface detection sensors
- Possible to appropriately store samples as per a water pollution process test method.

Applications

- Applied for hydrological surveys required to operate K-water's dams and weir
- Applied to survey the status of salt damages, riverbed variation, etc.

K-HIT

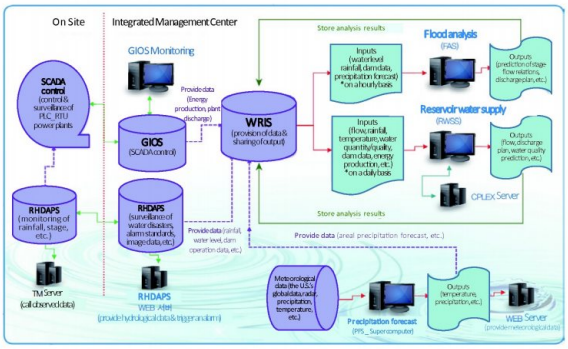
K-water Hydro Intelligent Toolkit

Overview

K-HIT is a decision support package converged with advanced ICTs and linked with individual water management technologies, which will ensure flood control & reliable water supply and monitoring of real-time data

- RHDAPS (Real-time Hydrological Data Acquisition and Processing System)
- PFS (Precipitation Forecasting System) : K-PPM (for short-term predictions), CAM (for long-term predictions)
- FAS (Flood Analysis System) : COSFIM (Coordinated dams analysis), K-DRUM (Distributed Rainfall Runoff Model)
- RWSS (Reservoir Water Supply System)
- GIOS (Generation Integrated Operational System)

Configuration



Features

- IWRM (Integrated water resource management) technology based on know-how accumulated by K-water through 40 years of water management development and application practices
- Allows scientific analyses and predictions with ICTs for rainfall prediction, hydrological data management, disaster alarm, flood analysis, water supply, electricity generation, etc.

Functions

- RHDAPS
  Remote call & control of hydrological data, development of DB with real-time hydrological data, web-based monitoring of real-time hydrological data
- PFS
  Long- and short-term weather forecasting for target dam & weir watersheds
- FAS
  Hydrological flood analysis, multi-dimensional rainfall-runoff analysis, integrated hydraulic & hydrological analysis
- RWSS
  Estimation of rainfall & runoff, linked operation of dams & weirs, river flow analysis, river water quality analysis
- GIOS
  Real-time remote surveillance & control

Effects

- Rainfall prediction → data acquisition & management → flood control & water supply → integrated management of hydraulic structures & facilities (e.g., dam, weir, flood control reservoir)
- Contributes to improve the reliability of water supply through minimizing flood and drought damages with scientific water management practices
- Allows the linked operation of dams & weirs
- Allows the production of quality, clean energy

Applications

- Applied to the operation of K-water's hydraulic facilities & structures, including 17 multi-purpose dams, 14 dams dedicated to water supply, 16 weirs, etc.
- Applied to integrated flood disaster management projects for municipal & provincial governments (Namweon, Muju, Gunsan etc.)
- Scheduled to develop & build integrated dam operation system in Algeria

K-PPM

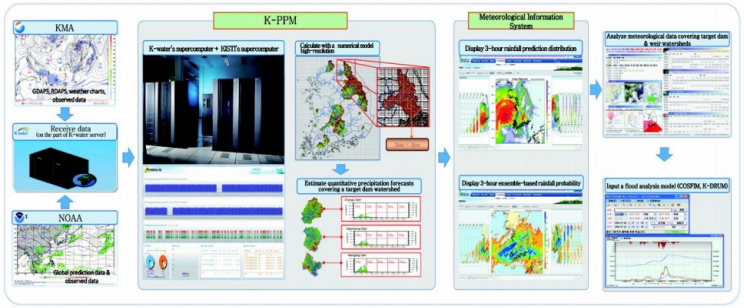
K-water Precipitation Prediction Model

Overview

K-PPM is a short-term precipitation prediction model to produce long- and short-term quantitative precipitation prediction data optimized for physical environment (e.g., detailed topography of the target dam watershed) by subdividing the nation into lots of grids with a size of 3㎞ × 3㎞, which compared with a long-term precipitation prediction model, CAM

- Produces 5-day (120-hour) prediction data 4 times per day with a 3km x 3km high-resolution model, which is composed of 10 ensembles
- Provides quantitative precipitation prediction data for 58 areas (including dams, weirs, etc.) nationwide
- Provides 10 kinds of real-time input data (including precipitation, temperature, humidity, etc.) required for water quality & hydraulic prediction models

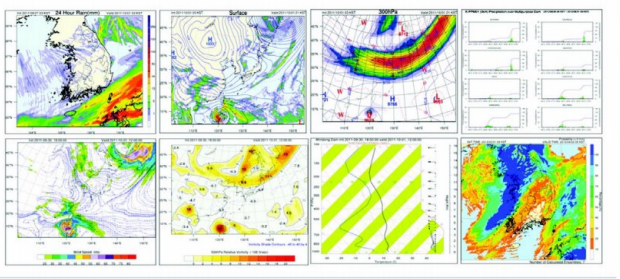
Configuration

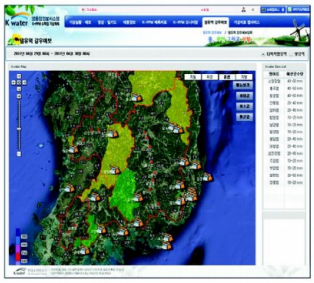


Features

- Improves accuracy considering the complex topography of specific dam watersheds (covering mountains, valleys, etc.) through developing a 3kmx3km high resolution model
- Timely produces data easy to use through building a supercom-based automation system
- Remedies uncertainty in weather prediction data through simultaneously operating 10 models as per an atmospheric physical equation

Functions





- Functions to query 5-day weather prediction data at different altitudes at intervals of 3 hours
- Functions to produce & analyze GIS-based 5-day precipitation prediction data
- Functions to predict some 60 meteorological variables, including precipitation, temperature, humidity, air pressure, insolation, etc.

Effects

- Contributes to the maximization of power generation revenues &, storage through helping make a decision about the proactive, flexible operation of target dams with 5-day precipitation prediction data
- Minimizes flood damages through helping making a decision about dam discharge in a timely, accurate way
- Improves the accuracy of 5-day precipitation prediction data through installing ultra-short-term & data assimilation modules

Applications

- Applied to the meteorological prediction of 58 basins nationwide, including 17 multi-purpose dams, 14 dams dedicated to water supply, 16 weirs, etc. managed by K-water
- Applied to the "Proposal of Thailand Weather Prediction System in the integrated water management module of Thailand IWRM Project"
- Applied to the real-time production and provision of input data for flood & water quality analysis models

K-DRUM

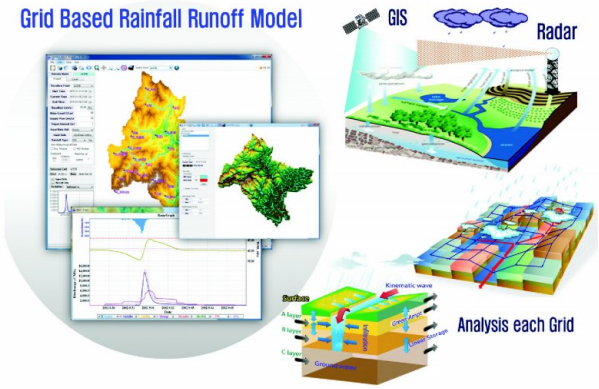
K-water Distributed Rainfall Runoff Model

Overview

K-DRUM is a distributed runoff model based on physically subdivided grids to survey and analyze basin runoff, suspended sediments and other water quality parameters

- Divides a specific basin into multiple grids, apply various physical characteristics (e.g., topography, soil. vegetation, etc.), and then calculate infiltration (from rainfall and other basin circumstances), surface flow, groundwater flow, evapotranspiration, snow-melt, sediments, water quality, etc. with a numerical analysis method
- Estimates normal runoff with an automated system to use meteorological prediction data

Configuration

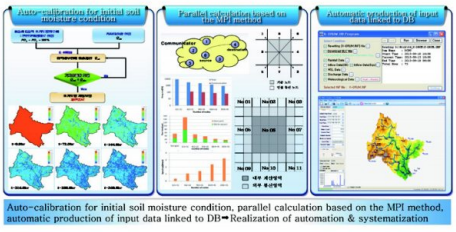


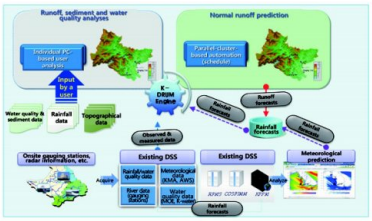
Features

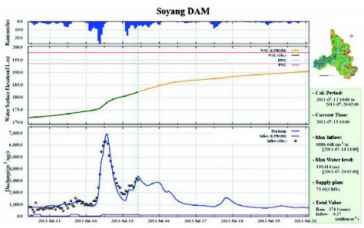
- Possible to build a completely automated system with the application of physical parameters and the initial soil moisture auto-calibration method
- Possible to perform a run-off analysis on an unmeasured basin with high accuracy
- Possible to perform a long-term runoff analysis on a large-scale basin with application of the MPI-based parallel computing method
- Possible to consider localized stormwater through inputting point rainfall data and high-resolution spatial distribution rainfall data
- Possible to analyze the behavior of sediments considering rainfall and flow energy

Functions

- Auto-calibration method (automation, systemization), PC-based analysis method (user-friendly GUI), server-specific system (normal runoff prediction system)







Effects

- Possible to perform short- and long-term rainfall-runoff & sediment analyses and save simulation time with a parallel computing technique
- Leads integrated basin analysis & prediction automation technologies
- Possible to acquire quality runoff data with high accuracy through improving a basinwide rainfall processing method
- User-friendly thanks to linkage to K-water's DB
- Equipped with evaluation technologies for unmeasured basins and newly developed basins

Applications

- Applied to the operation of a normal runoff prediction system linked to K-PPM (17 multi-purpose dams and 14 dams dedicated to water supply)
- Applied to the estimation of runoff and sediments required to survey dam sediments
- Applied to the development of one-stop water management system linked with KMA's LDAPS
- Introduced into the Pakistan Patrind HPP Project (long-term runoff pattern analysis); and applied to the estimation of evapotranspiration and soil moisture content (2014) in the target sub-basins of the Yongdam Dam watershed

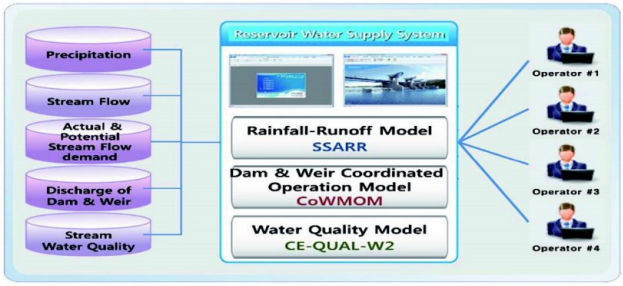
RWSS

Reservoir Water Supply System

Overview

RWSS is an integrated water resource management system to estimate optimal discharge for ensuring linkage among target rivers, dams and weirs considering expected flow into each of them and water demand within the same water system, and thereafter apply the optimal discharge estimates to a water budget analysis model and a water quality analysis model for estimating discharge availability at the event of water pollution and analyzing the effects of water quality improvement.

Configuration



Features

- Serves as an integrated solution in which various water supply analysis models are combined
  - Consists of rainfall-runoff model, irrigation reservoir-linked module, water budget analysis model, water quality analysis model, etc.
- Controls inputs and outputs through developing a user-friendly phased GUI by each model
- Allows real-time linkage among meteorological data, river discharge data, dam or weir operation data, water quality data, etc.

System Connection

| Procedure for the integrated, linked simulation of water supply system |

1 Rainfall-runoff module (SSARR)
- Daily rainfall/temperature data for each of indicative basins
- RDS-calibration of missing data
- Production of areal rainfall data with the Thiessen polygon

Natural areal runoff (of each indicative basin)

2 Dam-weir-linked operation module (CoWMOM)
- Setting targets (optimization/simulated operation)
- Natural runoff (runoff model)
- Water demand & abstraction considered

Optimal outflow from the simulation of dam/weir & discharge at indicative stations of a target river

3 Water quality simulation module (QUAL2E)
- Head water (dam/weir outflow)
- Discharge data (tributaries & main stream, etc.)
- Water quality data (tributaries & main stream, etc.)

Monthly water quality at indicative stations

4 Outputs
- Simulation-related data
- Dam & weir weir/reservoir storage/discharge, reservoir level (at the beginning/end of the simulation period), mean reservoir level
- Discharge, water quality, etc. at indicative stations of a target river

Outputs at indicative stations

Functions

| Integrated simulation environment |
- Provides user-friendly integrated simulation environment

| Rainfall-runoff model |
- Estimates runoff for each of typical basins with a long-term runoff analysis

| Dam-weir-linked operation mode |
- Performs a simulated dam-weir operation and an optimization analysis

| River water quality analysis |
- Simulates river water quality with the presence of dams or weirs

Applications

- Applied to the development of a dam-weir-linked operation plan for each water system considering expected flow into hydraulic structures and irrigation reservoirs in target river systems and water demand
- Applied to the estimation of available discharge capacity in case of water quality threats and algal bloom and the analysis of the effects of water quality improvement

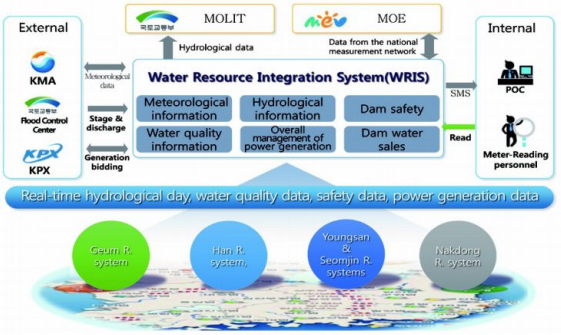
WRIS

Water Resource Integration System

Overview

WRIS is a system to support & ensure the integrated operation & maintenance of dams and weirs using 6 kinds of data, including meteorological data, hydrological data, water quality data, dam water management data, dam safety management data, and power generation data.

Configuration



Features

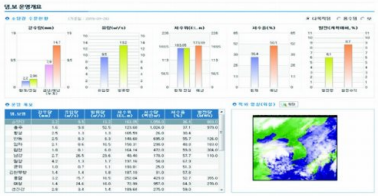
- Provides relevant services (e.g., rainfall prediction, weather chart covering specific dam watersheds, etc.) with K-water's own meteorological prediction models
- Supports the integrated management of water resource operation information about target dams & weirs
- Shares operational status data through linking among real-time measured data about target dams & weirs & supports decision-making
- Shares data among relevant organizations (e.g., MOLIT, MOE, KPX, etc.)

Functions

| Meteorological information |

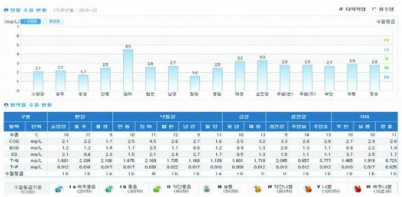
- Provides 『meteorological information』 (e.g., weather chart, rainfall prediction, etc.)

| Hydrological information |



- Supports overall decision-making through collecting 『hydrological information』 (e.g., inflow, discharge, energy production, storage, water level, rainfall, etc.)

| Water quality information |



- Manages pollutants and other environmental factors that affects 『water quality』

| Dam safety |

- Ensures the 『safety management』 of various hydraulic infrastructure assets

| Dam water sales |

- Manages 『dam water sales』 for water supply plan, contract management, monthly reading, billing,, etc.

| Overall management of power generation |

- Supports the overall management of 『power generation practices』 related to power generation plan, bidding process (KPX), power operation, etc.

Effects

- Improves data reliability through ensuring the integrated management of water resource information & supports timely decision-making
- Shares meteorological data among relevant organizations (e.g., KMA, GFS etc.) and ensure proactive risk response through K-water's own meteorological prediction system
- Ensures efficient water quality management through managing pollutants and ecological environment
- Monitors safety threat factors to hydraulic infrastructure
- Ensures the systematic management of dam water supply

Applications

- Applied to the provision and utilization of hydrological data covering 17 multipurpose dams, 14 dams dedicated to water supply, and 16 weirs
- Applied to the development & operation of real-time surveillance system through linking among embedded gauges in 31 dams and 16 weirs nationwide
- Applied to the testing of 41 kinds of water quality items for each of 109 water quality measurement points and the utilization of the outputs