Optimizing Data Sharing for Flood Forecasters & Responders

September 20, 2018 / Steve Elgie /
Who we are

- Software Developers specializing in Time Series and Environmental Data Management
- Headquartered in Aachen Germany, with NA offices in Sacramento, Colorado, Ohio, Toronto, & BC
- 30+ years of commercial off the shelf implementations in over 50 countries
KISTERS Water Solutions

- Tidal & Oceans
- Hydrology & Water Management
- Groundwater
- Water Quality & Ecology
- Hydro Power & Reservoirs
- Measuring & Telemetry
- Data-Centre
- Agriculture & Irrigation
- Urban Drainage & Waste Water Treatment
KISTERS Technology Stack

Water data management for experts

Specialists
Government, Authorities, Flood centers, Power plant operators

Desktop

Desktop

Browser

Calculations
Time series statistics
Polygons statistics
Raster to point calculations
Load calculations

Interfaces
Open standards, Industry standards

Products
Alerts & Notifications, Water reports, Year books, Extreme- value statistics, Retention periods, Base flow, Inundation maps, Alarm maps, Forecasts

Meta data

Time series data

Ensemble data

Raster data/“Gridded Data”

Samplings

Observations
ON WISKI Flood Forecasters
Levels of Sharing

How much is too much?

Internal Staff

vs

External Agencies

vs

the Public
Internal Staff

Sorry non-WISKI Users - this is an excellent 2 minutes to check your email.

How to facilitate data sharing & use in a single agency?

Favourites & Shortcuts

The Launchpad

Web Services
The Public

Never quite sure what they want, but they want it
External Agencies / Experts

The target audience

Individuals and groups that require critical, specific information for events

Specific information relates to:
- Watershed KPI’s
- Nearby / neighbouring gauges
- Real Time / NRT access immediately prior or during emergencies

Must have efficient & readily understood data to drive decision making
Traditional Methods

Call / SMS / Email
Website monitoring for latest information
Reports

What is the Common theme?

These are all active methods of acquiring data, requiring time & effort
WISKI IoT

Moving away from active approaches

KISTERS Technology allows users to **passively** acquire data from neighbours

Direct connection to pull external agencies data effortlessly into their system

This data can be used to generate custom alerts, compared to nearby stations as validators, etc.

All WISKI systems can be thought of as **ONE interconnected network**
One with WISKI

Why would I want to open up my environment to outsiders?

Free expansion and unfettered access to a whole new gauge network

Agencies can work together to determine which data is relevant and enforce restrictions on data flow

Track the effects of river levels & storm events across the Province

Further movement away from Reactive Response to Predictive/Prescriptive
Technology Showcase

KISTERS Developments For Flood Forecasters

Re-development / Assessment of modelling frameworks within a Climate Change environment

Better / Full Integration of predictive data with observed or NRT data

Focus on understanding of new meteorological paradigm
WISKI Raster

Full Integration of Gridded Datasets for Manipulation within WISKI

Fully integrates gridded data products into the WISKI environment

Allows for manipulation and analysis of radar rainfall, including:

- Delineation of basins and subbasins
- Areal calculations and statistics
- Calibration & Validation definition based on input
### Converting rasters to timeseries

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<th>Label</th>
<th>Name</th>
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<tr>
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</table>
HydroMaster: motivation

Understanding the precipitation related challenges are key to risk mitigation.

Water managers need to assess precipitation related risks and require an understanding of past and future events.

- Impact of heavy precipitation on water quality and retention
- Risk of sewer overflow in surface water causing pollution
- Optimize inundation prevention and run-off
- Impact of drought on water supply
- Optimize costs of extra staffing, stand-by or terrain action in heavy precipitation events
HydroMaster: key features

HydroMaster is a live web service that allows to

‣ view
‣ analyze
‣ archive
‣ report

historical and upcoming precipitation events

HydroMaster is THE meteorological tool for water managers and those active in protecting private and public assets.
HydroMaster: key features

HydroMaster provides for your defined hotspots, zones and catchments

- radar-based observation and forecast data
- refined deterministic and probabilistic forecasts up to 15 days

HydroMaster is THE meteorological tool for water managers and those active in protecting private and public assets.
HydroMaster: key features

Designed to manage water and to protect public or private assets.

- Powerful radar visualisation and analysis tools
- Integration of client specific rain gauges, catchments and points- and zones of interest
- Combination of measured, near-real-time and forecast precipitation data
- Hands on configuration of location- and client- specific alerts and warnings
- Easy archiving and post event analysis, reports
- Desktop and mobile versions of the application
- Return times of precipitation events

- Monitor precipitation and minimize the impact on your operations
- Manage effectively precipitation related risks
HydroMaster key features (1/7):
Radar visualisation and analysis tools

Visualise animated past and future precipitation events to perform quantitative analysis
HydroMaster key features (3/7): Tailored warnings and alerts

Easily set your alarm thresholds and immediately see the impact it has on your operations.
HydroMaster key features (6/7): Dashboard

Easily drag and drop the views of your interest into your personal dashboard.
But does it work?
Hurricane Harvey and the National Water Model

David R. Maidment
Center for Water and Environment
University of Texas at Austin

Presentation for Kisters User Conference, September 10, 2018, San Diego, California

Hurricane Harvey

- Hurricane Harvey
- Texas Flood Response System
- Improving flood data
Storm Track for Hurricane Harvey

First Landfall as Category 4 Hurricane at 10PM on Friday 25 August

Second Landfall as Tropical Storm at 4 AM on Weds 30 August

Strength

4
3
2
1

Hurricane Category

Tropical Storm

compiled from noaa.gov

5 days
Hurricane Harvey – Record Precipitation

Harvey 2-day precipitation was the \textbf{worst recorded storm} in US history.

Harvey 3-day Precipitation averaged \textbf{5 inches more} than previous worst storms.

Harvey 5-day Precipitation averaged \textbf{11 inches more} than previous worst storms.

National Water Model

Continuously forecasts flows over continental US
Hurricane Harvey and National Water Model

10-day Ahead Forecast

National Water Model Medium-Range Forecast

National Water Model Analysis

Actual

Hurricane Harvey

These maps present a comparison of the Medium-Range Forecast (left panel) and Analysis (right panel) from the National Water Model v1.1.

High Flow Potential

- Major Potential for High Flow (> 300% over historical flow)
- Moderate Potential for High Flow (100 - 300% over historical flow)
- Minor Potential for High Flow (0 - 100% over historical flow)
- Minor-Bad Flow (0 - 10% over historical flow)

- National Water Model Uniform

- Major U.S. Cities

Accumulated Precipitation (Inches)

Reference Time: 2017-08-22 12:00 UTC
Valid Time: 2017-08-22 12:00 UTC
Texas Flood Response System

- Take discharge forecast from the National Water Model
- Transform discharge to depth by rating curve or hydraulic model
- Create flood inundation map from water depth
- Assess impact on people and property

Flood emergency response depends on assessment of impact
Provides real-time access to National Water Model forecasts. Discharge converted to Depth using Rating Curves for all 100,000 reaches. Built using Kisters Big Data system (KiBiD) in Aachen, Germany.
Flood Impact from National Water Model forecast at 3PM Friday 25 August

Houston is going to get inundated

Using National Water Model Medium Range forecast

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Buildings Damaged
Data: Texas Division of Emergency Management

Total = 152,800

NWM Predicted Top 5 Counties
- Harris
- Fort Bend
- Brazoria
- Galveston
- Montgomery

Actual Top 5 counties
- Harris
- Orange
- Fort Bend
- Montgomery
- Jefferson