Mashreq Water Data Portal Ecosystem

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Environment, Natural Resources & Blue Economy Global Practice

Mashreq Water Knowledge Series
Disruptive Technologies for Improved Groundwater Management in the Mashreq Region
15-17 June 2021
“Top-Down” Data Acquisition System

Satellite & Aerial Earth Observation

Cloud Services

Big Data

Data Science

Platforms

APIs

Stakeholder Alerts

Operational Control Rooms

“Bottom-up” Data Acquisition System → IoT

Manual Monitoring

Crowdsourcing

Automated Monitoring

Machine Learning

& other AI

ChatBots

Crowdsourcing

Data Rescue

GIS and other datasets

Data Management

Analytics/Models

Dashboards/Portals/Apps/e-books/AR/VR

Country boundary

Major river

Capital city

Lake/Sea

0 - 0.5

2 - 1

2 - 3

4 - 5

6 - 10

11 - 25

26 - 50

51 - 100

101 - 150

151 - 1,194

GDP (million $/sq.km.)

Data source: NOAA, 2006

Machine Learning

& other AI

ChatBots

Crowdsourcing

Platforms

APIs

Dashboards/Portals/Apps/e-books/AR/VR

Stakeholder Alerts

Operational Control Rooms

Khartoum

Asyut

Luxor

Nasir Reservoir

Kassala

Wad Madani

Kusti

Malakal

Tana Lake

Egypt

Sudan

South Sudan

Eritrea

Ethiopia

Addis Ababa

Asmara

Cairo

Juba

Gonder

Bahir Dar

Jimma

Gdp (million $/sq.km.)

Data Source: NDoA, 2006
Recent Precipitation
Projected Change in Monthly Precipitation of Watershed #21 for 2080-2099 (Compared to 1986-2005)
Lake, Reservoir & River Levels

The image displays a webpage with a map and data related to lake, reservoir, and river levels. The map shows various locations across Europe, with numbers indicating levels or data points. Below the map, there is a table listing lake products, including names, drainage basins, countries, start and end dates, and types. The specific details of the data are not clearly visible in the image.
Streamflow Forecasts

GEOGloWS ECMWF Streamflow Hydroviewer

Map Controls
Map Animation
Fri Jun 18 2021 08:00:00 GMT-0400 (Eastern Daylight Time)
Find A Reach ID
Zoom to Lat/Lon Coordinates
Remove Map Marker
Switch to HydroShare Map

Stream Gauge Networks
Choose A Gauge Network

Leaflet | Powered by Esri | USGS, NOAA. Source: GEOGloWS ECMWF Streamflow System
Historic Streamflow Simulation
Reach ID: 606617

Return Periods for Stream 606617 (m^3/s)

<table>
<thead>
<tr>
<th></th>
<th>2 Year</th>
<th>5 Year</th>
<th>10 Year</th>
<th>25 Year</th>
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<td>4196.01</td>
<td>5046.18</td>
<td>6120.38</td>
<td>6917.28</td>
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Groundwater Assessment Platform

GAP Maps allows you to view and print maps related to geogenic groundwater contamination. By creating a free login, you can also upload your own data to view, share or model. By default, your data are private, however you can choose to share them with individual users, with a community of users or publicly. You can also grid your point data or model them using logistic regression to produce a prediction map.

Use the buttons on the left and right sides of the screen to access and navigate GAP’s maps and functionality:

- **Layer list** - active and available layers
- **My Layers** - upload and manage layers
- **Statistical Analysis** - grid or model your data
- **Community** - interact with groups of users
- **Print** - print a PDF map

Go to the Help to learn how to use a particular section by clicking the question mark or by using the Help link in the top bar.

* Available only when logged in
Watersheds, Topography
The selected region has an area of 50.89 km².

Total Population in 2018: 1,744,000
Population Density in 2018: 34,274 per km²
Population Trends

The selected region has an area of 50.89k km².

Total Population in 2000: 3.723m people
Population Density in 2000: 71.158 per km²
Rainfall

The selected region has an area of 2.93 km².

Rainfall Daily

Daily Rainfall mean value: 1.829 mm/day
Vegetation (NDVI)

Your custom shape

The selected region has an area of 2.93 km².

NDVI

Vegetation Health mean value: 0.173
Soil Moisture

Soil Moisture (0 - 10 cm underground)

Performing Analysis...
Sub-surface Soil Moisture
Evapo-Transpiration
Evapo-Transpiration

Actual Evapotranspiration (SSEBop)
Available Data from 2019-11-02 to 2020-11-01

Processing Request
This computation requires a large amount of daily data and may take a couple of minutes.

Cancel Request
Digital Infrastructure (World Bank Infrastructure Toolkit)
Data from Water Point Data Exchange in Spatial Agent Mobile App

https://data.waterpointdata.org/
Public Data e.g. MASDAP: [http://www.masdap.mw/](http://www.masdap.mw/)
OGC WaterML 2: Part 4 – GroundWaterML 2 (GWML2)

1) Overview
This standard describes a conceptual and logical model for the exchange of groundwater data, as well as a GML/XML encoding with examples.

2) Downloads

<table>
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<tr>
<th>Version</th>
<th>Document Title (click to download)</th>
<th>Document #</th>
<th>Type</th>
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<td>2.2.1</td>
<td>OGC WaterML 2: Part 4 – GroundWaterML 2 (GWML2)</td>
<td>16-032r3</td>
<td>IS</td>
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OGC: [https://www.ogc.org/](https://www.ogc.org/)
Illustrative Interactive Dashboards
Example for Water Infrastructure Operations

Decisions to be Supported: When to release? How much to release?

**Climate**
- Rainfall in upstream watershed (GPM, in-situ gauges/radar, CHIRPS, ...) – current & historical
- Weather forecasts (short-term, seasonal); Storm tracks
- Snowmelt estimates (if relevant)...

**Flows**
- Current and historical flows (from in-situ observations, satellite estimates where possible)
- Dam inflow forecasts (e.g. from GEOGLOWS Global Streamflow Forecasting, local forecasts)...

**System Levels**
- Current and historical levels of this dam’s reservoir as well as other storages in system (e.g. from satellite, in-situ gauges)...

**Downstream**
- Irrigation status (crops, crop stage from earth observation and in-situ)
- Soil and sub-surface soil moisture, groundwater (from earth observation and in-situ)...

**Other Data & Analytics**
- Inundation forecasts
- Systems water infrastructure needs
- Systems model to explore implications of alternative dam operations
- Hi-resolution Satellite data
- Crowdsourced data

Need to draw upon global and other accessible data and analytic services to make interactive maps, graphs, and analytics for such decision support dashboards that are accessible on portals, apps, e-books, touchscreens, etc.
E-Packaging of Knowledge (e.g. Interactive E-books/Storymaps)

Outreach (e.g. virtual/online learning, hackathons, Expos)
Reimagine Groundwater Management Challenges in a Disruptive Tech Context

**Information**

Understanding and monitoring groundwater systems (e.g. aquifers, extraction, recharge, quality)

Analytic insights into specific groundwater links to water cycle and inform longer-term planning and shorter-term operational decision support

**Institutions**

Institutional arrangements to work across spatial and sectoral scales

Capacity, policies, and instruments to effectively manage groundwater effectively and sustainably

**Investments**

Planning and operation of extraction and recharge investments in a systems context

Development and climate scenario-based investment planning considering technical, environmental, social, economic, financial, institutional, and other sustainability aspects

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**Map**

- Khartoum
- Asyut
- Luxor
- Nasir Reservoir
- Kassala
- Wad Madani
- Kusti
- Malakal
- Tana Lake

**Country Boundary**

**Major River**

**Capital City**

**Lake/Sea**

- 0 - 0.5
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**GDP (million $/sq.km.)**

Data source: NOAA, 2006

**Monthly Blue Nile Flows at Khartoum**

**Annual Blue Nile Flows at Khartoum**

**Blue Nile Sub-Basin**
Water Investments (e.g. Storage, MAR, Water Conservation, Treatment, Green Infrastructure/NBS, …)

Integrated Basin Plans (information, institutional, and investments)

Resource Management Issues/ Options/ Goals

Investment (New/ Rehab) & System Operation Issues/ Options/ Objectives

Models (Water balance, Systems Simulation/Optimization, Multi-Criteria, climate resilience)

Existing Knowledge Base (e.g. “top down” and “bottom up” monitoring, GIS, models)

Surveys (e.g. groundwater, topography, soils, socio-economic, environmental, geophysical, water infrastructure)

Brainstorming Options (investments, system operations, cropping choices, incentives, financing)

Decision Support

Planning Process (Analytical and Stakeholder Inputs to assess impacts, trade-offs)

Implementation (Investment Preparation, Financing, Notification, …)

The Data Value Chain
Planning Water Infrastructure

Knowledge

Information

Data
The Data Value Chain

**Example: Deciding on Coping with Floods**

**Flood Coping Actions**
(stakeholder actions to minimize loss of life / livelihood)

**Dissemination/Preparedness**
(Stakeholder Channels – DSS, Bulletins, SMS, Radio, TV, Social Media, Portals, Apps, Podcasts, phone, emails,

**Flood Early Warning & Recommendations**

**Products & Services**
(Formats, Frequency, Messaging, Customization, Media)

**Weather Forecasts**

**Hydrologic Forecasts**

**Flood Inundation Forecasts**

**Models**
(Seasonal to nowcasting; statistical/ hydrologic systems/ hydrodynamic, …)

**Surveys & Studies**
(detailed Digital Elevation Model, Soils, Geomorphology, Water Infrastructure Status, Flood impacts)

**“Top-Down” Data**
(from remote sensing/ earth observation products)

**“Bottom-up” Data**
(from field gauges, manual reporting, crowdsourcing)

**Historical Climate, Flow, and Flooded area Data**

**Decision Support**

**Knowledge**

**Information**

**Data**
In Summary

• Please explore this growing Mashreq Water Data Portal Ecosystem:
  • [Mashreq Water Data Portal](#)
  • [Mashreq Water Knowledge Explorer](#)
  • [Disruptive Tech in Groundwater E-book](#)

• Please do showcase your data and analytics work!

• **Please** do contribute links to your *public-domain* data, models/scripts, analytics, case studies, knowledge products, videos that are in the public domain!
Disrupt or Be Disrupted!

Thanks!

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http://spatialagent.org/Mashreq/

Download the Spatial Agent App at: http://apps.worldbank.org

http://spatialagent.org/KIDS/