

Overview of Mashreq Groundwater Disruptive Tech Interactive E-book

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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

Groundwater Management Challenges



Information

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

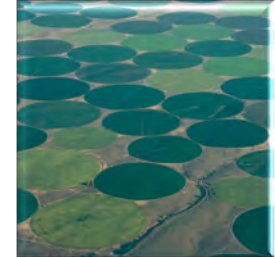
Analytic insights into specific groundwater links to water cycle and inform longer-term planning and shorter-term operational decision support



Institutions

Institutional arrangements to work across spatial and sectoral scales

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

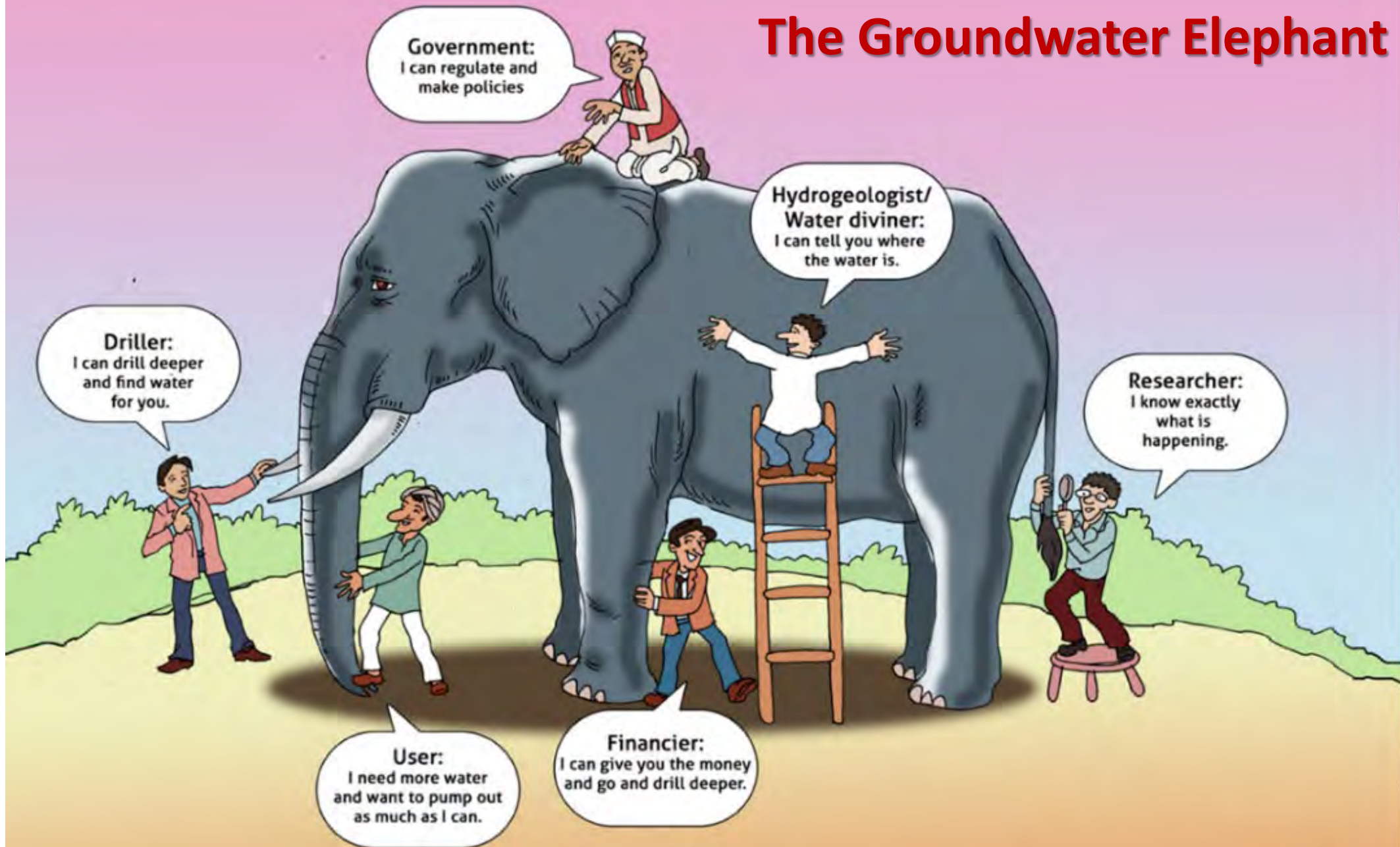


Investments

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

The Groundwater Elephant



A new world of “Disruptive Technology”



“Disrupt” data value chains

- **Data Collection:** Monitoring/Surveys (in-situ sensors/IoT/Biometrics, earth observation (satellite, aerial, UAVs), crowdsourcing, digitization...
- **Data Management:** Telemetry, 5G, cloud services, open data, Blockchain, ...
- **Data Analysis:** Big data, Geospatial/ AI/Machine Learning, modeling/ scenario analysis, script repositories, Cloud/Edge/Quantum computing...
- **Data Access:** Open data APIs, data visualization, gamification, mixed reality-AR/VR, ...
- **Outreach:** Platforms/Social Media/Portals/ Apps/e-books/Competitions...



“Disrupt” production value chains

- 3D/4D printing/additive manufacturing...
- “Digital Twins”
- Automation/SCADA...
- Robotics/ Autonomous transport...
- Advanced materials/nanotech/ biotech/genomics/energy tech/ green tech, ag tech...



<http://www.appsolutelydigital.com/dt/>



“Disrupt” stakeholder value chains

- Virtual social networks/ Digital Platforms...
- Sharing economy...
- Crowdsourcing, gamification, competitions (e.g. *hackathons*, *apathons*...)
- Mobile money, fintech, cryptocurrency...
- Blockchain enabled value chains
- Maker movement/DIY/Tech Incubators...
- Virtual learning/re-skilling...



Disruptive Technology

WORLD BANK GROUP

Disruptive **KIDS** (Knowledge, Information & Data Services) Helpdesk

<http://spatialagent.org/KIDS/>



MC4 - 840



Disruptive Development
An Interactive Primer on Disruptive Technology in Development

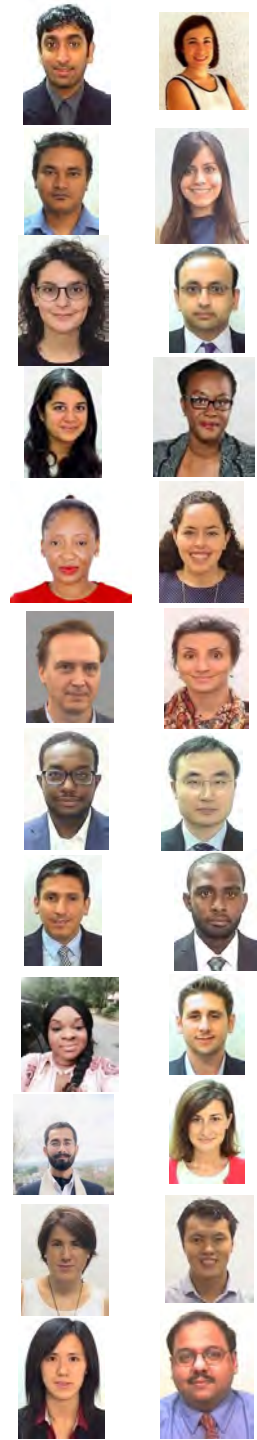
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- Introduction
- Key Development Challenges
 - Economic
 - Social
- Emerging Disruptive Technologies
 - Types of Disruptive Technology
- Disruptive Tech in Development
 - Market Development
 - Overcoming Key Challenges
 - Enabling Environments at your fingertips
 - Interactive Tech Application Explorer
 - Classroom
 - Current Issues
 - Regulatory Environment
 - Mobile Money

ANALYSIS OF INTERNATIONAL FINANCING VISIBLE SPATIAL ANALYSIS TOOL

INTERACTIVE TECHNOLOGY APPLICATION EXPLORER

Use the following dropdown menu to explore a wealth of all data on technology access, access to mobile, information or a combination of the three. Data is sourced from various sources, by the World Bank's Disruptive Development team, or by other sources available in the public domain.




MASHREQ WATER RESOURCES PORTAL

- All
- Environmental
- Social
- Economic
- Climate
- Water
- Disasters



Water Transition



RICCAR



JRC Urban Explorer



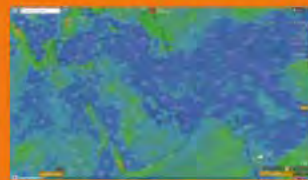
Water Inventory




Fishing Watch



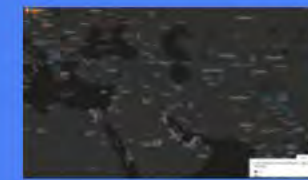
Aqueduct Food



Windy



GEOGloWS Streamflow Explorer



Power Plants




GRDC




Watershed Delineation



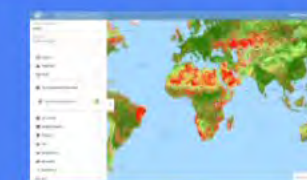
NASA Disasters Portal



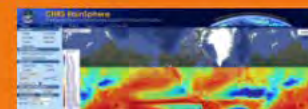
Climate Stations



Earth Engine Water Watch



EarthMap (FAO)



Mashreq Water Knowledge Portal

<https://spatialagent.org/Mashreq/filter.html>

MASHREQ KNOWLEDGE RESOURCES TOOL

Filter by Theme

- Show All
- Agriculture**
- Climate Change
- Data and Analytics
- Disasters
- Economic
- General
- Groundwater
- Institutions
- Monitoring
- Other Environmental
- Policy
- Social
- Technology
- Transboundary
- Water Infrastructure
- Water Quality
- Water Resources

Filter by Type

- Show All
- Article
- Report
- Video
- Website

Filter by Location

- Show All
- Global
- Iran
- Iraq
- Jordan
- Lebanon
- MENA
- Mashreq
- Syria
- Turkey

Working Together to Achieve Water Security

Agriculture and economic transformation

Agriculture land (% of Land Area)

Middle East food security amid the COVID-19

Drought monitoring and early

Supporting drought action through

RESEARCH ARTICLE



Anthropogenic depletion of Iran's aquifers

Roohollah Noori, Mohsen Maghrebi, Ali Mirchi, Qihong Tang, Rabin Bhattara...

+ See all authors and affiliations

PNAS June 22, 2021 118 (25) e2024221118; <https://doi.org/10.1073/pnas.2024221118>

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ARTICLE CLASSIFICATIONS

Physical Sciences » Sustainability Science

Article

Figures & SI

Info & Metrics

PDF

Significance

Iran is facing a state of water bankruptcy that threatens its socioeconomic development and natural environments. Using an exceptionally rich measured groundwater dataset, we illustrate the extent and severity of Iran's groundwater depletion and salinization problems during the 2002 to 2015 period, when the number



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Submit

Mashreq Water Initiative

Disruptive Tech in Groundwater

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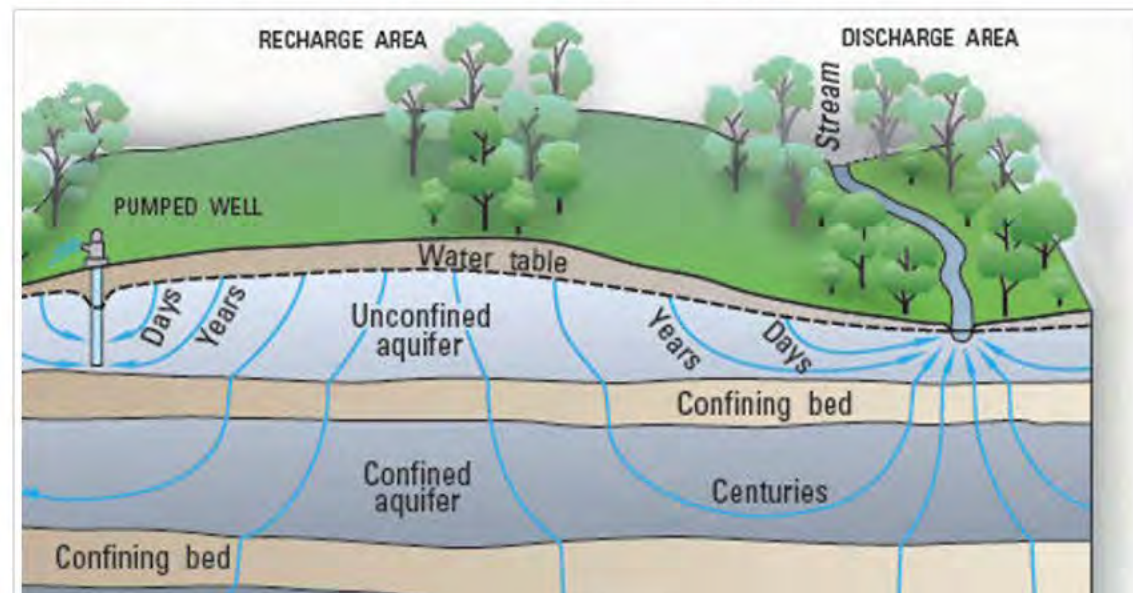
- [About this Interactive eBook](#)
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 - [Groundwater Use](#)
 - [Mashreq Region](#)
 - [Disruptive Tech](#)
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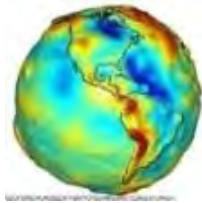
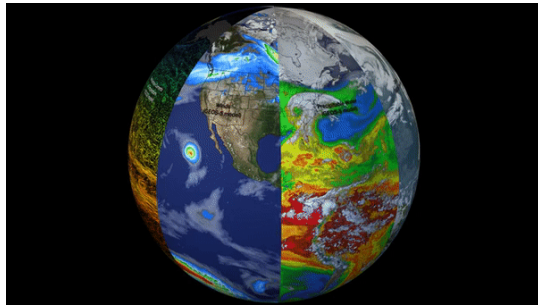


MASHREQ WATER INITIATIVE - DISRUPTIVE TECH IN GROUNDWATER

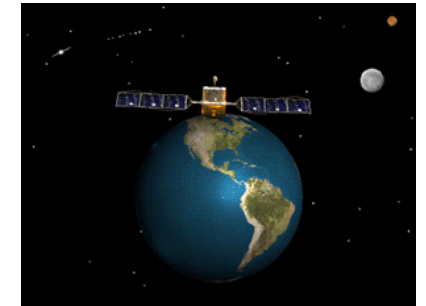
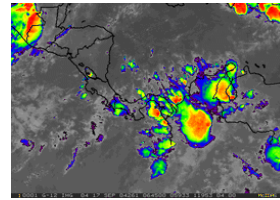
Groundwater is classified into renewable groundwater and non-renewable or fossil groundwater stores. Renewable groundwater. According to the **FAO**, renewable water resources "...represent the long-term average annual flow of rivers (surface water) and groundwater" while non-renewable water resources are "...groundwater bodies (deep aquifers) that have a negligible rate of recharge on the human time-scale and thus can be considered non-renewable." The volume of groundwater that includes renewable and fossil groundwater has been estimated at **8-10 million cubic kilometers, or 98-99 percent** of the total volume of liquid freshwater. In contrast, lake volume is less than one percent. However, the total groundwater volume is about one percent of the total volume of water available on Earth, which includes oceans. While this is the case, it is critical to note that most groundwater volume is fossil groundwater - only **10,000 billion cubic meters (10,000 cubic KM)** are renewable.

The image below from the **USGS** visualizes what is meant by renewable and non-renewable groundwater sources. Renewable groundwater existing in "unconfined" aquifers and are recharged in days or years. Confined aquifers, however, are less easy to both recharge and access as they are located beneath confining beds and water represents centuries or millennia of recharge.





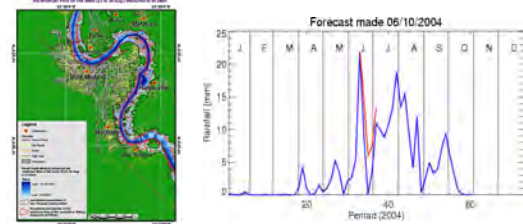
"Top-Down" Data Acquisition System



Satellite & Aerial Earth Observation

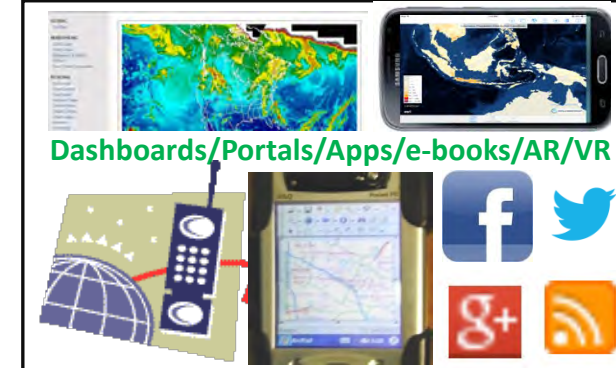
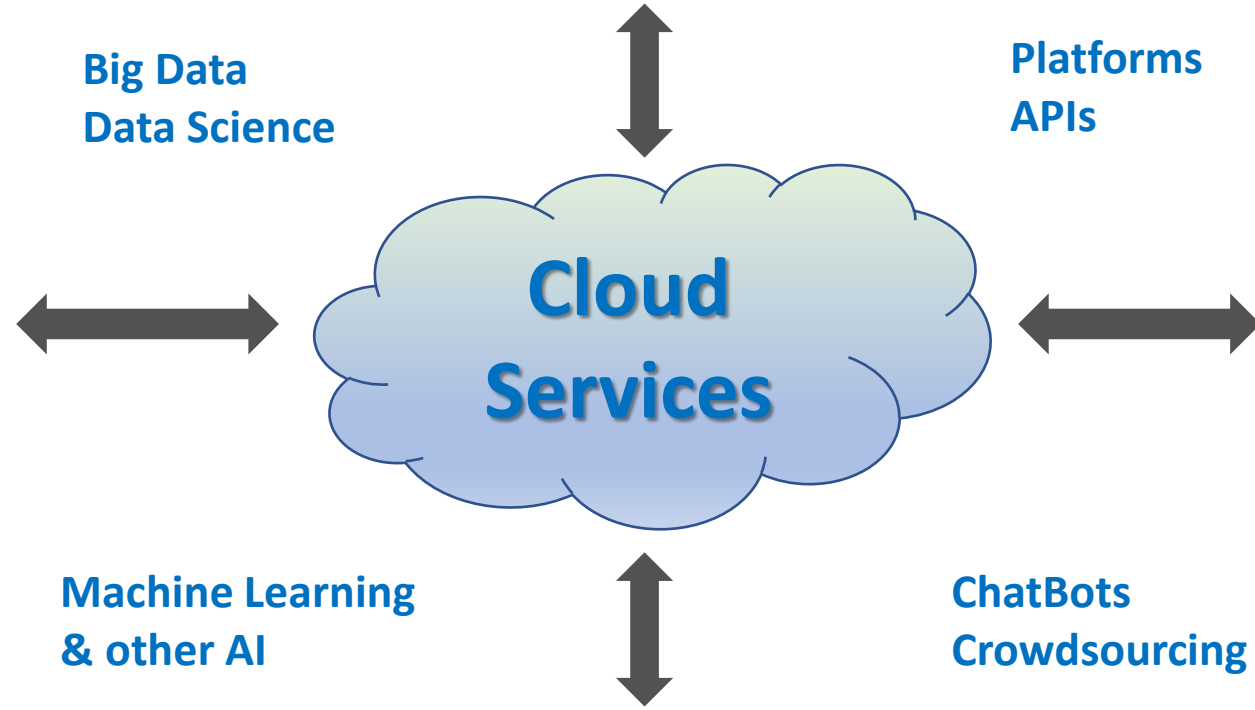


Data Rescue
GIS and other datasets



Data Management

Analytics/Models



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

Stakeholder Alerts



Operational Control Rooms



Manual Monitoring
Crowdsourcing



Automated Monitoring

"Bottom-up" Data Acquisition System → IoT

Waterbody Area Dynamics (GEE)

Mashreq Data Portal

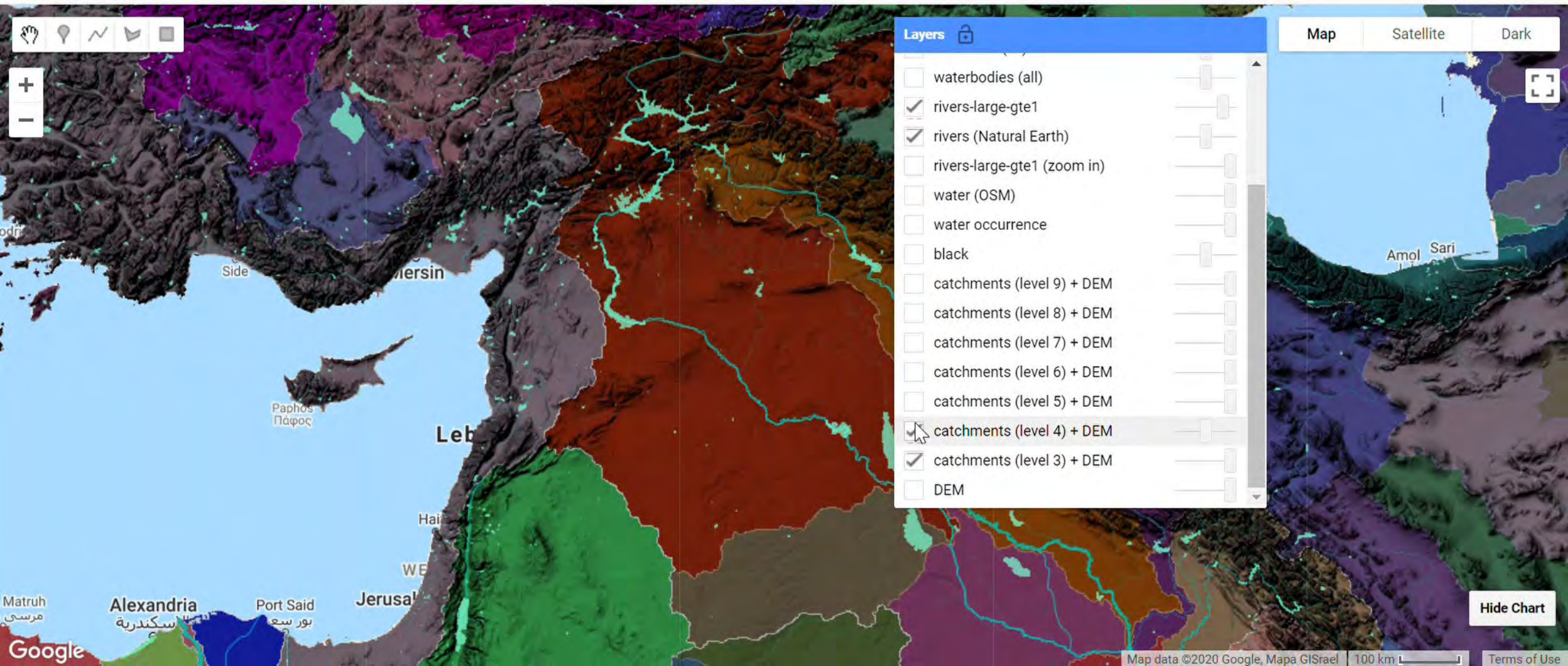
Water Watch

gena.users.earthengine.app/view/water-watch



Earth Engine Apps Experimental

Search places



- Layers
- waterbodies (all)
 - rivers-large-gte1
 - rivers (Natural Earth)
 - rivers-large-gte1 (zoom in)
 - water (OSM)
 - water occurrence
 - black
 - catchments (level 9) + DEM
 - catchments (level 8) + DEM
 - catchments (level 7) + DEM
 - catchments (level 6) + DEM
 - catchments (level 5) + DEM
 - catchments (level 4) + DEM
 - catchments (level 3) + DEM
 - DEM

Map Satellite Dark

Hide Chart

Watersheds, Topography

Water basin analysis < Back

Watershed generator

Click on stream on map to delineate its watershed



< Disclaimer

Leaflet | Esri, USGS, Esri, Garmin, FAO, NOAA, Esri, HERE, Garmin, FAO, NOAA



Nigeria Erosion and Water... 12/16/2020, 12:00 AM E.

2D Timeline Cloud Mesh

LAYERS FILES MEASURE

Ground Control Points

Photos

> Elevation Data

Orthomosaic

WORLD BANK



Point Cloud - Imo State AOI - Ni... x

sitescan.arcgis.com/projects/8c1e2f67-0b98-4366-acb0-1ad2f5d0a781/flights/d762f83c-ccce-4435-9003-fbbf4de24eb/point-cloud

Nigeria Erosion and Water...
5/23/2021, 12:00 AM L...

2D Timeline Cloud Mesh

Appearance
Point Budget: 10,000,000
Point Size: 1

P] drone flight x

sitescan.arcgis.com/projects/8c1e2f67-0b98-4366-acb0-1ad2f5d0a781/flights/05f17e79-94ec-4a88-a37a-c4d383e7bb26

nd Water...
00 PM A...

Cloud Mesh

ES MEASURE

40 km
20 mi

Earthstar Geographics | Esri, HERE, Garmin

EPSG:32631: Easting: 982804.86, Northing: 562608.18, - m (DTM)
Powered by Esri

Mesh - Imo State AOI - Nigeria I... x

sitescan.arcgis.com/projects/8c1e2f67-0b98-4366-acb0-1ad2f5d0a781/flights/d762f83c-ccce-4435-9003-fbbf4de24eb/mesh

Nigeria Erosion and Water...
5/23/2021, 12:00 AM L...

2D Timeline Cloud Mesh

Point Cloud - Abia State (NEWM... x

sitescan.arcgis.com/projects/8c1e2f67-0b98-4366-acb0-1ad2f5d0a781/flights/f7ada063-d3d5-485a-9100-da94961f0927/point-cloud

Nigeria Erosion and Water...
5/25/2021, 7:00 PM A...

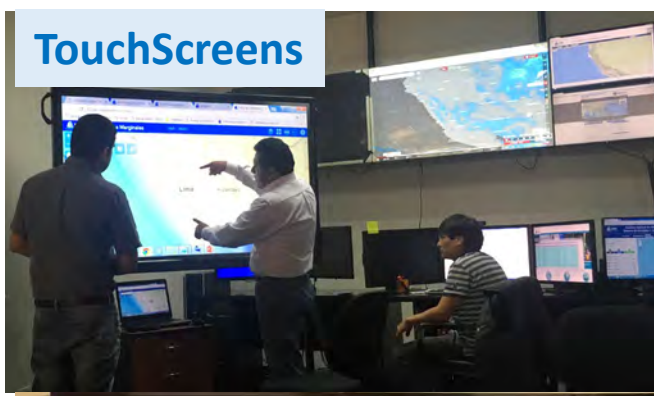
Timeline Cloud Mesh

Appearance
Budget: 1,000,000
Size: 30

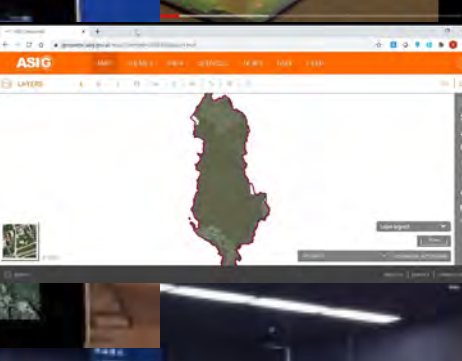
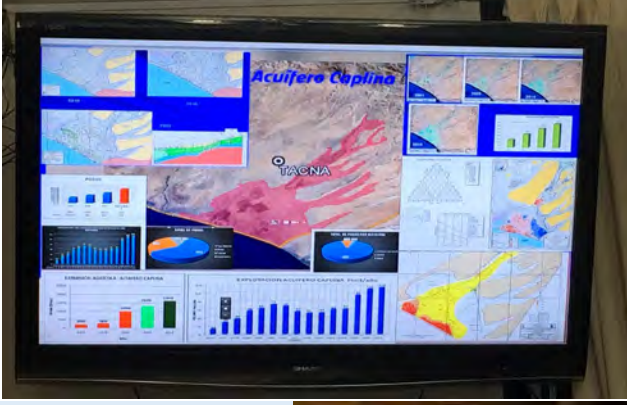
Large Displays



TouchScreens



Physical Interactive Models



Touch Tables



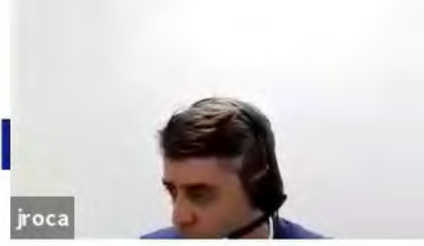
VR



Touch Projectors



Collect Field Data - Photogrammetry Models (Construction I

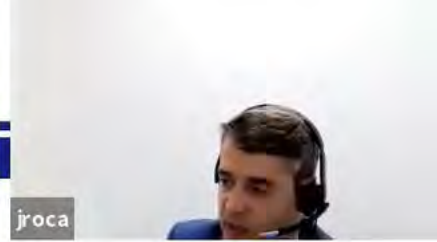


Photogrammetry model from Drone photos

Photogrammetry model from Cell Phone photos

(3D holograms visualized in the office using a HoloLens and Ada Platform)

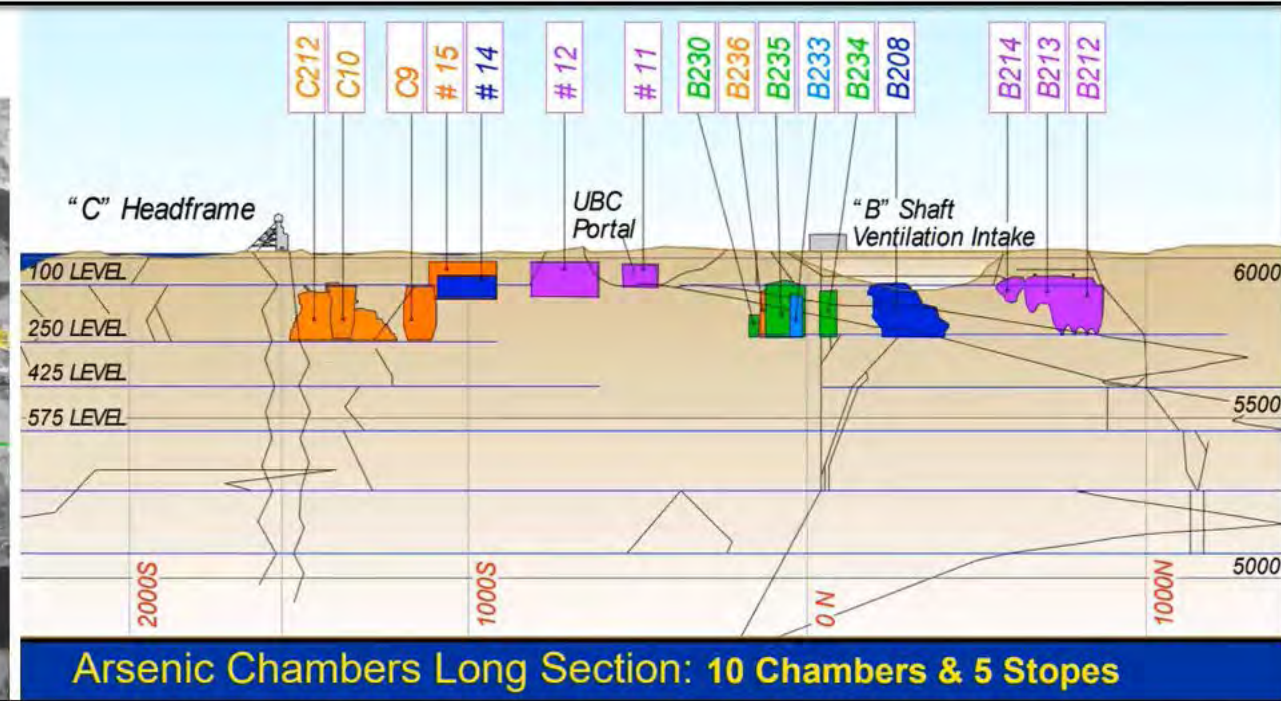
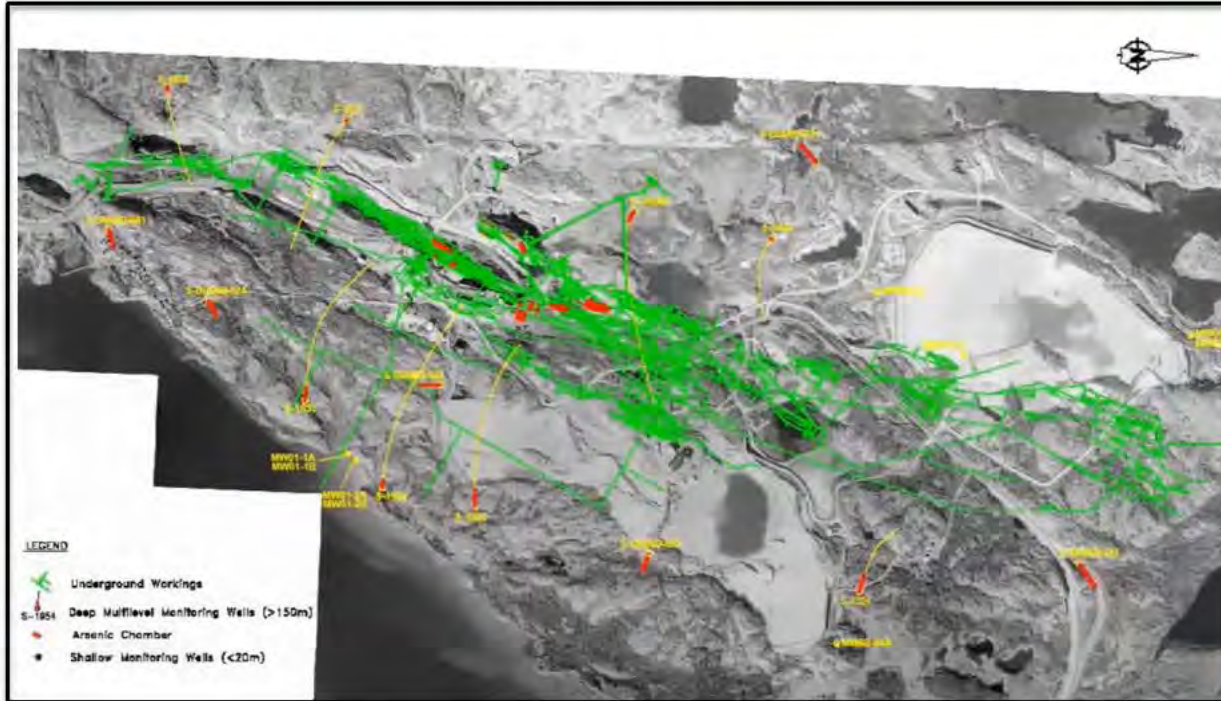
Pause



Visualization of 3D Models – Underground Visualizati

Plan View

Cross-Section



INFRASTRUCTURE, IMU SURVEY DATA, RESERVOIR MODELS, BOREHOLE DATA, GEOPHYSICS, INSTRUMENTATION, ETC.

Disrupt or Be Disrupted!

Thanks!



<http://spatialagent.org/Mashreq/>

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