Progress and Challenges in Acquiring Reliable Data for Hydrological Modelling in the Arab Region

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The Arab Center for the Studies of Arid Zones and Dry Lands (ACSAD)
- river flow (peak, volume)
- Surface runoff (peak, volume)
- recharge to groundwater
- Actual evapotranspiration (ET)
Hydrological modeling

The following models were selected to simulate hydrological process over the Arab region

- **HYPE model** (HYdrological Predictions for the Environment)
- **VIC model**
- **HEC-HMS**
HYPE (HYdrological Predictions for the Environment)

- Swedish model developed at SMHI
- Simulates rainfall-runoff process
- The model is a dynamic, semi-distributed, process-based, integrated catchment model. It uses well-known hydrological and nutrient transport concepts and can be applied for both small and large scale assessments of water resources and status. The catchment is divided into subbasins which in turn are divided into classes (calculation units) depending on land use, soil type and elevation.
HEC-HMS

- HEC-HMS is GIS-based *semidistributed rainfall-runoff* model developed by Hydrologic Engineering Centre (HEC) of United States Army Corps of Engineers (USACE),
Test basins

test basins were selected from different area in the Arab region to evaluate and calibrate the selected models

• Mejerda watershed – Tunisia
• Wadi Dayqah - Sultanate of Oman
• Nahr el Kabir Al-Junoubi–Syria
• Nile river
• Euphrates river
Data requirement

- Challenges: Most Arab countries don't have land use map
- Alternatives: GlobCover : European Space Agency

For curve number, ET calculation
GlobCover Land Cover

- GlobCover LC v2 was developed as part of the GlobCover project, a European Space Agency (ESA) initiative in partnership with JRC, EEA, FAO, UNEP, GOFC-GOLD, and IGBP.
- GlobCover Land Cover: is a global land cover map at 10 arc second (300 meter) resolution.
- Its 22 global land cover classes are defined within the UN Land Cover Classification System (LCCS).
Data requirement

**Land use map**

- **Challenges**: Most Arab countries don’t have land use map
- **Alternatives**:  
  - Develop land use map using satellite images such as MODIS or landsat  
  - Develop land use map using google earth
Example: Mejerda basin– Tunisia
Using google Earth image
Example: Nahr el Kabir Al-Junoubi-Syria using Lansat TM imagery
Data requirement

Soil map

For soil infiltration, curve number

• Challenges: Most Arab countries don’t have soil map

• Alternatives:
  – Digital Soil map of the World
Soil map of the World

- The vector data set is based on the FAO-UNESCO Soil Map of the World.
- 1:5,000,000 scale,
Example: Mejerda basin—Tunisia
Data requirement

- Topographic maps
- DEM - 90 m
- DEM - 30 m

Topographic data

For watershed and stream delineation and TC, and watershed characteristics
Hydrosheds DEM

• provided from USGS website on free public domain with resolution of 90 m. The USGS HydroSHEDS is based on high-resolution elevation data obtained from NASA's Shuttle Radar Topography Mission (SRTM).

• this data set were tested in several area in the Arab countries
Example: elevation map for WADI DAYQAH - SULTANATE OF OMAN using DEM-90 m
Topographic data

• **Challenges**: data quality
Data requirement

- Daily or monthly time series

Stream flow Data for model calibration and validation

Graph showing discharge over time for different locations.
Stream flow Data

• Challenges:
  – data availability

• Alternatives:
  – Global Runoff Data Centre
Global Runoff Data Centre
Global Runoff Data Centre

Syria
Tunsia
Stream flow Data

• Challenges:
  – Data quality
<table>
<thead>
<tr>
<th>Date</th>
<th>MAZARA 3 AT MAZARA</th>
<th>URAYAT NEAR QURAYAT</th>
<th>WATCH rainfall data</th>
<th>TAYYIN NEAR BAYYAD discharge</th>
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Discharge measurement at Nahr el Kabir Al-Junoubi-Syria

Current meter

Staff stage measurement
Discharge measurement (khor Arbaat-sudan)
Data requirement

- precipitation data

- precipitation time series (daily data)
precipitation data

- Challenges:
  - data availability

- Alternatives:
  - NCDC: National Climatic Data Center

![NCDC Logo](image.png)

Climate Data Online

Climate Data Online (CDO) provides free access to NCDC's archive of historical weather and climate data in addition to station history information. These data include quality controlled daily, monthly, seasonal, and yearly measurements of temperature, precipitation, wind, and degree days as well as radar data and 30-year Climate Normals. Customers can also order most of these data as certified hard copies for legal use.
Climate Data Online

- Annual Summaries
- Daily Summaries
- Monthly Summaries
- Nexrad Level II
- Nexrad Level III
- Normals Annual/Seasonal
- Normals Daily
- Normals Hourly
- Normals Monthly
- Precipitation 15 Minute
- Precipitation Hourly
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8 stations
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precipitation data

• Challenges:
  – data availability

• Alternatives:
  – TRMM: TROPICAL RAINFALL MEASURING MISSION
TRMM rainfall data

- TRMM is a joint mission between the National Space Development Agency (NASDA) of Japan and the National Aeronautics and Space Administration (NASA) of the United States as part of the Earth Observing System (EOS). TRMM provides global (50N-50S) data on rainfall using microwave and visible-infrared sensors. Instantaneous rainfall estimates are obtained every three hours with a 0.25º x 0.25 º footprint (Fig. 20). Launched in 1997, TRMM provides continuous coverage.

- Data available 1998 - present
Data requirement

- Evapotranspiration data
- Temperature
- Relative humidity
- Wind speed
- Solar radiation
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DISCOVER DATA BY

DATASET
Browse descriptions, documentation, samples, and links for NCDC’s past weather and climate datasets.

SEARCH TOOL
Search for and access past weather and climate data by station name or identifier, ZIP code, city, county, state, or country.

MAPPING TOOL
Find and view past weather and climate data by station name or identifier, ZIP code, city, county, state, or country.
Data requirement

- Location of important features such as reservoirs or diversions
- Reservoir characteristics: rating curves, spillway
- Reservoirs use and regulation
Data requirement

- Groundwater, major aquifers
- Water use
Thank you