Monitoring water productivity using remote sensing for efficient water management

07 – 19 April 2021

IHE Delft Institute for Water Education
Delft, Netherlands
Who we are?

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IHE Delft online platform – OCW

Our training is here:
You are all enrolled and must have received an email.

Introduction to RS for AgWater Management

Schedule of the day

**The live virtual classroom** [4:00 PM to 5:00 PM (Iraq time)]

*This live session starts at 4:00 PM (Iraq time). With the link, you can also get the recordings.*

- Introduction to the course
- Meet the participants
- Introduction to RS for AgWater Management
- Quiz

🧩 Reading/Reflection exercise on case study, potential of using RS for WP analysis

Based on the paper by Karimi et al. (2019) below, discuss the following topics:

1. Which of the performance indicators discussed in the paper are you familiar with? is there an unfamiliar indicator?
2. Define the bright spots and hot spots.
3. How do the authors identify the bright spots?
4. What additional indicators or criteria do you suggest identifying bright spots? or which indicator/s would you consider dropping?

**The reference** by Karimi et al. (2019) is on Global Satellite-Based ET Products for the Local Level Irrigation Management: An Application of Irrigation Performance Assessment in the Sugarbelt of Swaziland. Download it from [here](http://example.com).
Monitoring water productivity using remote sensing for efficient water management

Agenda
Navigating through the course
Quick introduction of the participants

- Let us do a quick poll and learn about each other!
IHE Delft Institute for Water Education is the largest international graduate education institute in the field of water. The institute confers fully accredited MSc degrees and PhDs.

Since 1957 the Institute has provided education to more than 23,000 water professionals from over 190 countries, the vast majority from the developing world.

124 PhD fellows* are currently enrolled in water-related research. The Institute carries out numerous research and capacity development projects throughout the world.

*PhD fellows active per 31-12-2018
Alumni network

- 23,000 Alumni in the world
- 190 Countries
- 87% Graduates in the water sector

Alumni number:
- 851-1200
- 501-850
- 302-500
- 151-300
- 51-150
- 0-50
Core activities

Education & Training

IHE Delft offers a wide range of flexible, high quality, specialized educational programmes to respond to the needs of diverse clients from the water sector. These include MSc and PhD programmes, along with online and short courses.

Research & Innovation

With over 140 academic staff and 124 PhD fellows active in water-related, problem-focused and solution oriented research on development issues, IHE Delft has a vibrant multicultural and multidisciplinary research atmosphere.

Institutional Strengthening

IHE Delft strives to strengthen the programmes of universities and research institutes as well as the knowledge and capacity base of ministries and other water sector organizations.

Capacity development

*PhD fellows active per 31-12-2018 including staff
Sustainable Development Goals

A few examples of IHE Delft’s contribution:

• **Contributing to new SDG6 indicator**
  With UNESCO, OECD, WHO and CapNet, IHE Delft is developing a new water education indicator for SDG6a.

• **IHE Delft Graduate School for Water and Development**
  The research of the PhD fellows at the Graduate School contributes to the global challenges for sustainable water use and management.

• **Close cooperation with the Dutch Ministeries**
  IHE Delft actively contributed to the integrated monitoring of water and sanitation related SDG targets (GEMI) initiative which is developing the baseline process for monitoring SDG 6 on water and sanitation.

• **IHE Delft is a partner of UN-Water**
  UN-Water is the coordinating body for actions aimed at the implementation of the water related SDGs.
IHE Delft offers a wide range of flexible, high quality, specialized educational programmes to respond to the needs of diverse clients from the water sector.

- MSc programmes
- Short courses
- Online courses
- Tailor-made training

www.un-ihe.org
IHE Delft offers 5 accredited international Master of Science programmes, with a total of 17 specializations. The programmes are designed for professionals who want to deepen their expertise, and wish to gain substantial insight into the global water agenda.

**MSc programmes**

**Water Management and Governance (106 ECTS)**
The scientific study of water resources with practical planning and management skills.

**Urban Water & Sanitation (106 ECTS)**
Water supply, sanitation and water engineering and management, particularly in urban areas.

**Environmental Science (106 ECTS)**
Conservation and prudent use of natural resources for the benefit of society.

**Water Science & Engineering (106 ECTS)**
Hydrological and hydraulic processes and modelling tools for improved water management in coastal zones, river basins and agricultural areas.

**Sanitation (68 ECTS)**
One-year programme focusing on non-sewered sanitation, delivering graduates with the qualifications required by the sanitation sector.
Remote sensing for Agriculture Water Management

Dr. Sajid Pareeth

IHE Delft Institute for Water Education
Delft, Netherlands
Remote sensing is the science of obtaining and interpreting information from a distance, using sensors that are not in physical contact with the object being observed.
Quick Poll

Can you identify remote sensing features of human beings/animals?

A) Hear and detect
B) Touch and detect
C) See and detect
D) None of Above
E) A & C
Platforms

Sensing from 1 meter to 36,000 km height

Platforms are:
- Ground based
- Airborne
- Spaceborne
Remote Sensing – Why map/monitor and What??

Monitor Geographical, Biological and Physical characteristics of Land and Water !!!!
Towards providing sustainable development, it is important to have up-to-date temporal and spatial databases of land uses and natural resources – At Regional, Basin, National and Global levels – Information flow from analysts to managers to decision makers – Data dissemination networks based on these databases
Factors:

- Population growth
- Economic expansion
- Increasing demand for natural resources
- Land degradation and ecosystem destruction
- Pollution, climate change
- Food shortage and poverty
- Biodiversity loss
- Etc.
Key questions !!

- **What, Where and How** much?
- How does the resource change over time?
- How can we use these information for successful interventions?
Multi spectral images from NASA

- Most commonly used – Landsat, MODIS sensor (Aqua/Terra Satellites)
  - Sensor/Satellite?
  - There are many other satellite based products from NASA.
Multi spectral images from ESA

<table>
<thead>
<tr>
<th>SPACE COMPONENT: THE SENTINELS</th>
<th>Key Features</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SENTINEL-1:</strong> 4-40m resolution, 3 day revisit at equator</td>
<td>2 Sats in orbit</td>
</tr>
<tr>
<td><strong>SENTINEL-2:</strong> 10-60m resolution, 5 days revisit time</td>
<td>2 Sats in Orbit</td>
</tr>
<tr>
<td><strong>SENTINEL-3:</strong> 300-1200m resolution, &lt;2 days revisit</td>
<td>2 Sats in Orbit</td>
</tr>
<tr>
<td><strong>SENTINEL-4:</strong> 8km resolution, 60 min revisit time</td>
<td>1st Launch in 2020</td>
</tr>
<tr>
<td><strong>SENTINEL-5p:</strong> 7-68km resolution, 1 day revisit</td>
<td>1 Sat in Orbit</td>
</tr>
<tr>
<td><strong>SENTINEL-5:</strong> 7.5-50km resolution, 1 day revisit</td>
<td>1st Launch in 2021</td>
</tr>
<tr>
<td><strong>SENTINEL-6:</strong> 10 day revisit time</td>
<td>1st Launch in 2020</td>
</tr>
</tbody>
</table>
How many satellites in total are orbiting around Earth or other planets?

A) 100
B) 500
C) 1000
D) 5000
E) 10000
Some facts!!

- Do you know how many satellites are there in our orbit now??
  - Around 5000!!!!
  - Around 2000 active ones
  - 700 of them are monitoring Earth – Geo/Physical and Weather
  - What would be other satellites used for ??

- First image of earth in the year 1960
  - Around 60 years back !!!!!!!

- Satellites **orbit** around Earth continuously monitor Land and Water resources
  - Forests, Agriculture, Cities, Water
Applications of RS

- Land & Water use mapping
- Drought monitoring
- Floods
- Forest fire monitoring
- Earth quake
- Coastal area monitoring
- Urban planning
- Biodiversity Conservation
- Etc.
Remote sensing for agriculture water management (RS4AWM)

- Increased use of satellite data for agriculture (irrigation) water management by late nineties

- Still hold the same importance and more research with newer satellite missions

- Data from new satellites trigger high resolution mapping of various parameters in AWM
  a) Consumptive water use (Actual EvapoTranspiration - ETa)
  b) Crop Water Productivity (CWP)
  c) Crop types
  d) Water stress
  e) Rainfall (Precipitation)
  f) Irrigation performance indicators

<table>
<thead>
<tr>
<th>Remote sensing deliverables</th>
<th>Water use/ productivity</th>
<th>Performance diagnosis</th>
<th>Strategic planning</th>
<th>Water rights</th>
<th>Operations</th>
<th>Impact assessment</th>
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<td>Daily ET(^a)</td>
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</tbody>
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\(^a\) ET = evapotranspiration.

Bastianssen et.al, 2000
Major types of data from Earth observation satellites!

- **Vegetation**: Vegetation index maps at 250m to 1km resolution provide phenological patterns and vegetation stress.

- **Climate**: Climatic variables like rainfall and temperature provide drought information due to erratic patterns.

- **Bio-physical**: Bio-physical variables like landcover can be used as a limiting factor influencing climate-vegetation interaction.

Remote sensing data from Earth observation satellites
Remote sensing based databases - WaPOR

- FAO has developed WaPOR, a publicly accessible near real time database using satellite data
- Monitoring of agricultural water productivity.
- Africa and Near east upto Iran
- At different levels
  - Level 1 (250 m)
  - Level 2 (100 m)
  - Level 3 (30 m)
- In this training (WP & WA) you will use WaPOR data (Level 2)
- Day 1 Afternoon, you will go through WaPOR introduction videos given in OCW
WaPOR database
Tasks For you!

- Watch Additional videos given in tab “April 7”
- Installing QGIS software
  - You will find a video here on how to do it!

- Reading/Reflection task
- Additional materials

IMPORTANT: Recording of live sessions available in the same platform
Next session! – April 8, 4:00 PM to 5:00 PM

- See you in OCW under the tab 8 April
Thank you!
Sajid Pareeth: S.Pareeth@un-ihe.org