Global Surface Water
The where and when of inland and coastal waters

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*Google Earth Outreach
Karkheh River, Iran 21st July 1993 merged into 21st December 1999. Landsat courtesy USGS / NASA.
Karkheh River, Iran 21st December 1999 Landsat courtesy USGS / NASA
Karkheh River, Iran 23rd February 2000 Landsat courtesy USGS / NASA
Karkheh River, Iran 27th January 2002  Landsat courtesy USGS / NASA
Key question – mapping surface water dynamics

• Where has surface water occurred over the past 3 decades?
• When do water bodies fill and empty?
• What about their inter and intra-annual variability?
• How likely is it to find water in any given place and month?
• When and where have new/ex water-bodies formed/disappeared?
• What form did changes take, in terms of seasonality and persistence?
• What about trends?
Answer – Global Surface Water Explorer

32 years of 30m resolution Landsat images maps & temporal Profiles

- Occurrence
- Occurrence Change Intensity
- Seasonality
- Recurrence
- Water Transition
- Max Water Extent
- Full monthly water history

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https://global-surface-water.appspot.com/
High variability of water spectral signatures

L8 color composition: Swir2, Nir, Red
Plenty of opportunities for misclassification.
32 years of sensor issues...
Landsat archive - Geographic and temporal differences

Number of L1T

Year of the first image acquisition

Rate of image acquisition by month (1984 – 2015)
Each pixel of the 3,066,102 Landsat scenes was classified.

- 1.8 PB of data -

Processing using one CPU would have taken **1,212 years**.

Processing in Google Earth Engine took **45 days**.
Mangla Dam Lake
World
4.46 mill. Km²
3%

North America
>50%
permanent water
<5%
population

Europe (+ Russia)
>20%
permanent water
<10%
population

South America
9%
permanent water
<8.6%
population

Asia
9%
permanent water
60%
population

Africa
9%
permanent water
16%
population
90,000 km² of once permanent surface water has disappeared over the last 30 years

Over 70% of the net loss is concentrated in Kazakhstan, Uzbekistan, Iran, Afghanistan and Iraq
Sistan Lake, Afghanistan
Tharthar lake and Razazza lake, Iraq
185,000 km² of new permanent water bodies have formed, mostly due to dam building and climate change, such as accelerated glacier-melting
Balbina Dam, Brazil
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The Global Surface Water Explorer – an Information System for Decision Making and Policy Support

• Contributions to SDGs

  • Indicator 6.6.1 Change in the extent of water-related ecosystems over time
  • Indicator 15.3.1 Proportion of land that is degraded over total land area (indirect)
  • Target 15.5 Take urgent and significant action to reduce the degradation of natural habitats...
The Global Surface Water Explorer – an Information System for Decision Making and Policy Support

• Links to other SBAs or initiatives
  • UNFCCC: Global Climate Observing System (2016 Plan), Lake Area essential climate variable
  • CBD: Ecosystem function (inundation)
  • UNCCD: Part of 14 point land degradation classification (World Atlas of Desertification)
The Global Surface Water Explorer – Future Developments

- Update time series to end of 2017 (currently up to 2015)
- Produce 20m resolution using Sentinel 2 and Landsat
- Move towards operational near real-time product generation
THANK YOU

https://global-surface-water.appspot.com/

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