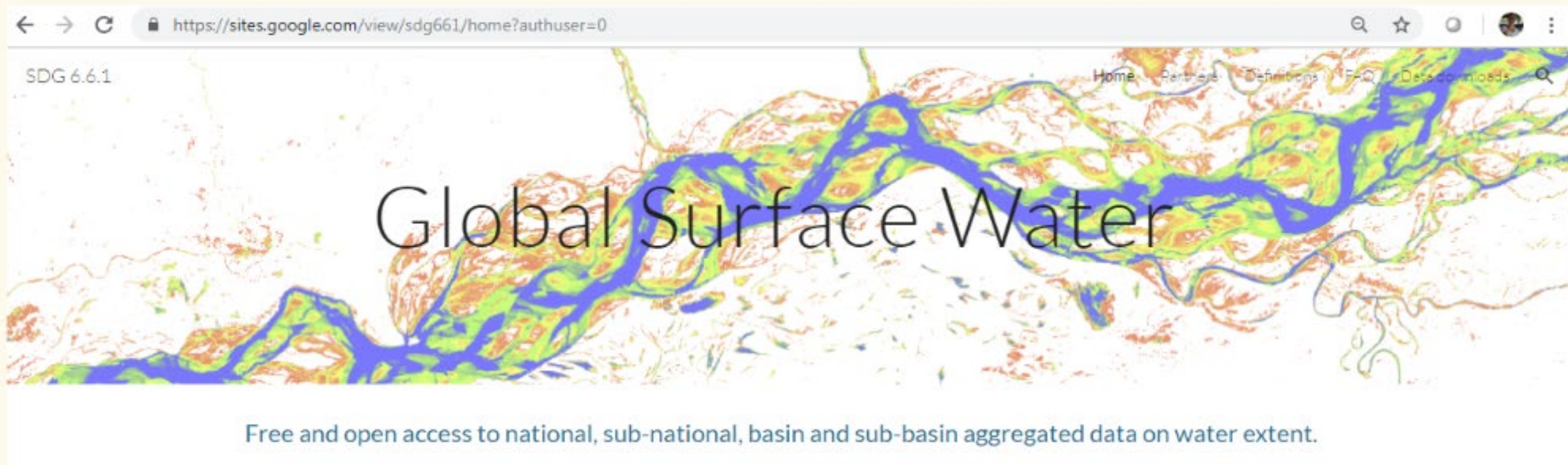


# Perspective on Global monitoring - A demonstration



SDG 6.6.1

Home Partners Definitions FAQ Data downloads

## Global Surface Water

Free and open access to national, sub-national, basin and sub-basin aggregated data on water extent.

**Jillian Campbell, UN Environment**

# Two levels of data

## **1) Global data products: Applications which provides national, sub-national and basin aggregates, for example the Global Surface Water application**

- Encourage engagement in emerging data areas
- Provide data for places where other sources of data do not exist
- Comparable across time and place
- Provides a window back in time
- Can leverage the best expertise in earth observation algorithms from around the world to the benefit of all

## **2) National data products: building capacity in countries to validate global data products and to produce national data products**

- Provide information following national definitions
- Ground truthing can be used to improve data quality
- Can integrate in situ data and modelled data

# Why we need global data products

- **The people who need access to environmental information do not have the capacity to produce or use geospatial data**

*Capacity at any juncture may be a stock, but over time it reflects the priorities of those in power, giving rise to “pockets of effectiveness” and explaining underinvestment in agencies that can challenge the status quo (e.g., statistical offices in Africa). Bulman and Lopez-Calva, Lessons from the 2017 World development report on Governance and the Law, Brookings Institute*

- **Asymmetries in data generation and data technology capacity across countries and across Ministries within countries**
- **A recent UNDP study that more than 70% of countries used less than 4 maps in their national action planning processes on biodiversity**



# SDG 6.6.1 Experience

**SDG Indicator 6.6.1: Change in the extent of water-related ecosystems over time**

**Sub-indicators:**

- Ecosystem extent
- Water quality and ecosystem health
- Quantity

**UN Environment did a data collection round in 2017 and reached out to all countries with a questionnaire to collect SDG 6.6.1 sub-indicators.**

- Around 40 countries had some data, but the data was not comparable across countries and in many cases there was little information available on the quality of data
- Many countries reported that they had no data available

# Partners

## About us

This partnership is founded on the belief that data is the foundation for our understanding of the environment. Data provides a basis for assessing change across time, for analyzing the environmental challenges facing a particular area, and for determining the need for local, national and global action on the environment. However, data on the environment is often not comparable across locations and time, it is not compiled at a frequency that can support regular analysis and it is often difficult to access and use environmental data.

[UN Environment and Google are partnering](#) with the European Union Joint Research Center (JRC), the European Space Agency (ESA), the United States National Aeronautics and Space Administration (NASA) and the Group on Earth Observations (GEO) to provide free and open data on the environment in a way that is policy-friendly, so that citizens and governments can easily assess what is actually happening to the world's natural resources, starting with data on water extent as a priority environmental issue.



The [United Nations Environment Programme \(UN Environment\)](#) is the leading global environmental authority that sets the global environmental agenda, promotes the coherent implementation of the environmental dimension of sustainable development within the United Nations system, and serves as an authoritative advocate for the global environment.

UN Environment is also the custodian for 26 Sustainable Development Goal indicators related to the environment. The data on this portal directly contributes to the official global monitoring of [SDG Indicator 6.6.1](#) on changes to freshwater ecosystem extent.



Google's mission is to "Organize the world's information and make it universally accessible and useful." Google Earth Outreach and Earth Engine are part of a broader team dedicated to leveraging and developing Google's infrastructure to address global environmental, health and humanitarian issues. Projects are often in partnership with area experts, focus on data driven approaches and visualizations at scale to bring greater transparency and awareness, create new tools to understand system dynamics and better inform decision making.

[Google Earth Engine](#) provides XXXXXXXXXXXXXXX



The European Commission is an institution of the European Union, responsible for proposing legislation, implementing decisions, upholding the EU treaties and managing the day-to-day business of the EU.

The Joint Research Centre (JRC) is the European Commission's science and knowledge service which employs scientists to carry out research in order to provide independent scientific advice and support to EU policy.



Aim: to create national, sub-national and boundary data based on the best available information and algorithms

MENU ▾ **nature**  
International journal of science

Letter | Published: 07 December 2016

## High-resolution mapping of global surface water and its long-term changes

Jean-François Pekel ✉, Andrew Cottam, Noel Gorelick & Alan S. Belward

*Nature* **540**, 418–422 (15 December 2016) | [Download Citation](#) ↓





# Spatio-Temporal Validation

Based on 40.124 validation samples



Omission < 5%  
Commission < 1%







# Definitions

## Data products

### Annual averages, five-year average and season averages

Annual and seasonal water extent in square kilometers is available for download. Additionally, five-year rolling averages are available. The annual and seasonal data show high variability between years due to periods of drought and intense rainfall. The five-year rolling averages are useful for tracking long term changes in water extent. These include the current year and four previous years, thus the five-year rolling average for 2004 in the chart would be based on 2000-2004.

The five-year averages are used for the Sustainable Development Goal (SDG) indicator 6.6.1 as the purpose of the SDG is related to tracking longer term change. Note that in the context of the SDGs, the 2000-2004 data is considered as a baseline.

### Annual permanent water and seasonal water

A permanent water surface is underwater throughout the year (whilst a seasonal water surface is underwater for less than 12 months of the year). Some locations don't have observations for all 12 months of the year (for reasons such as polar night). In these cases, water is considered as seasonal if the number of months where water is present is less than the number of months where valid observations were acquired.

A second consideration is lakes and rivers that freeze for part of the year. During the frozen period water is still present under the ice (true both for rivers/lakes and the sea). If water is present throughout the observation period (i.e. unfrozen period), the water body is considered as a permanent water surface. If the area of the water body contracts during the unfrozen period, then the pixels along the borders of the lake or river are no longer water, and those pixels will be considered as a seasonal water surface.

Gaps in the observation record are a source of uncertainty that needs to be recognised in the trends-analysis. Part of the water surface for any country may not be observed for specific years (the analysis occurs by pixel), which would underestimate the reported area. To document this uncertainty, the measured values of surface water area are presented with an estimate of the area of unobserved, but potentially surface water.

The actual permanent surface water area might be greater than the measured value due to the the lack of valid observation. As the number of observations increases, then uncertainty decreases. The uncertainty is usually largest in the early years of the archive, and falls dramatically after 1999 (when Landsats 5 and 7 were both in operation) and to close to zero after April 2013 (with the new Landsat 8 data acquisition strategy) (see Pekel et al. (2016)). Note that these limitations affect all applications based on the Landsat archive. The GSWE analysis was specifically tuned to account for and mitigate against the spatial and temporal variability of the archive.

<https://sites.google.com/view/sdg661/definitions?authuser=0>



## Aggregations

Surface water aggregations have been precomputed by political boundaries and hydrobasins. Each of these are available at two levels for a total of four sets of aggregations.

### FAO Global Administrative Unit Layers (GAUL)

GAUL has been developed by FAO to represent information on administrative units and coastlines for all countries in the world. GAUL 0 depicts national level boundaries while the first level of administrative boundaries within countries are depicted by GAUL 1. Note that the GAUL layers maybe quite large for countries with long coastlines. More information on the [GAUL site](#).

*The use of GAUL does not represent an endorsement of the boundaries in GAUL, but the GAUL has been approved by the [UN Inter-Agency and Expert Group on the Sustainable Development Goals](#) for analytical purposes in the context of monitoring sustainable development.*

### WWF HydroBASINS

HydroBASINS is a series of polygon layers that depict watershed boundaries and sub-basin delineations at a global scale. The goal of this product is to provide a seamless global coverage of consistently sized and hierarchically nested sub-basins at different scales (from tens to millions of square kilometers), supported by a coding scheme that allows for analysis of watershed topology such as up- and downstream connectivity. The current data product provide information for Hydrobasin level 3 and 4. More information on the [HydroBASINS site](#).

**EXAMPLES**



# Flooding in Pakistan: increase in seasonal water



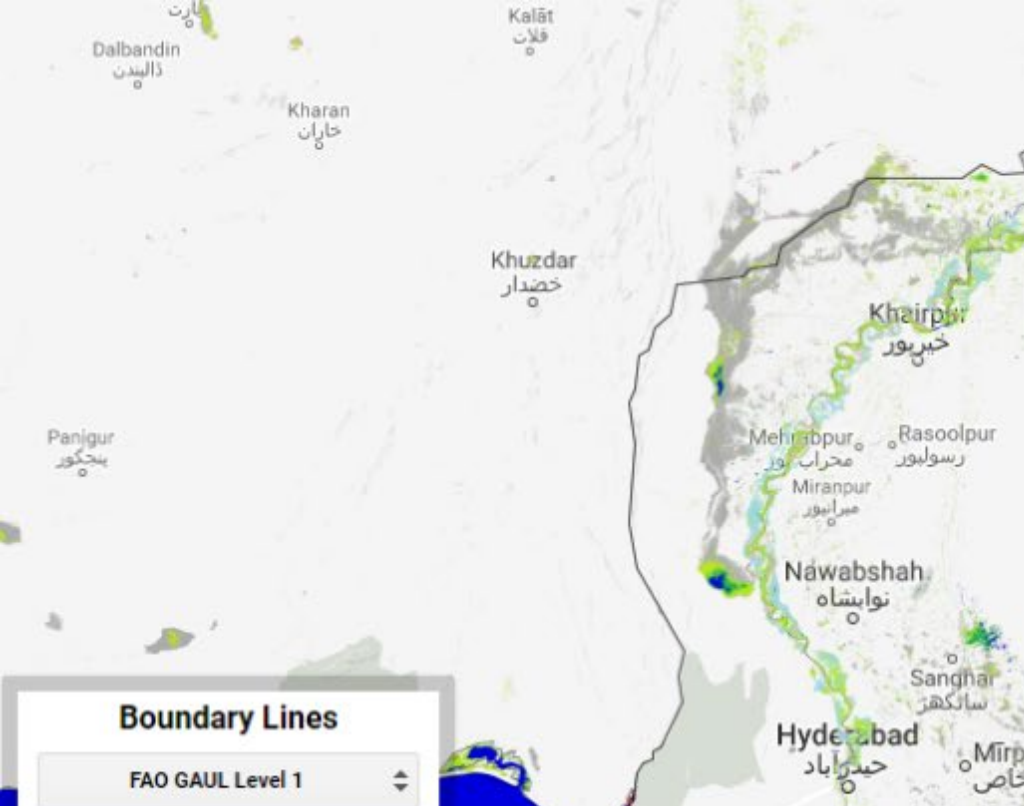
August 19, 2010



July 31, 2009

NASA Landsat images (<https://earthobservatory.nasa.gov/>)





**Boundary Lines**

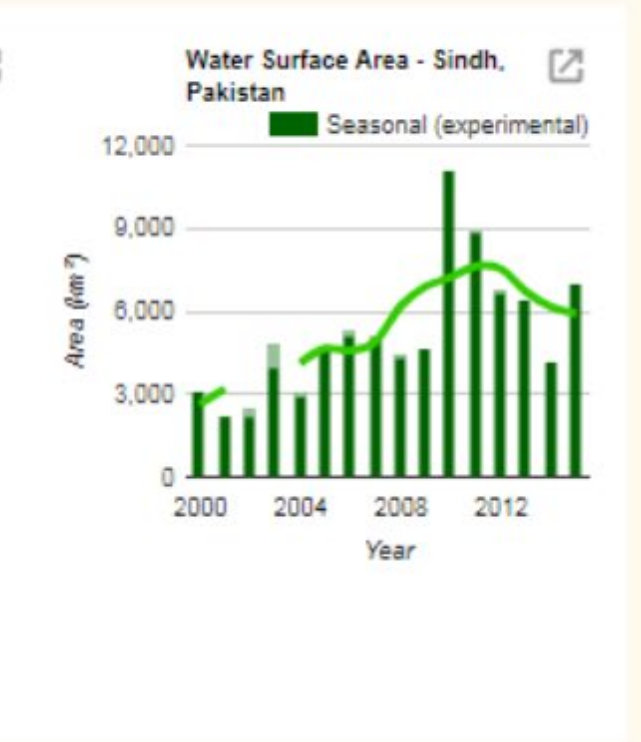
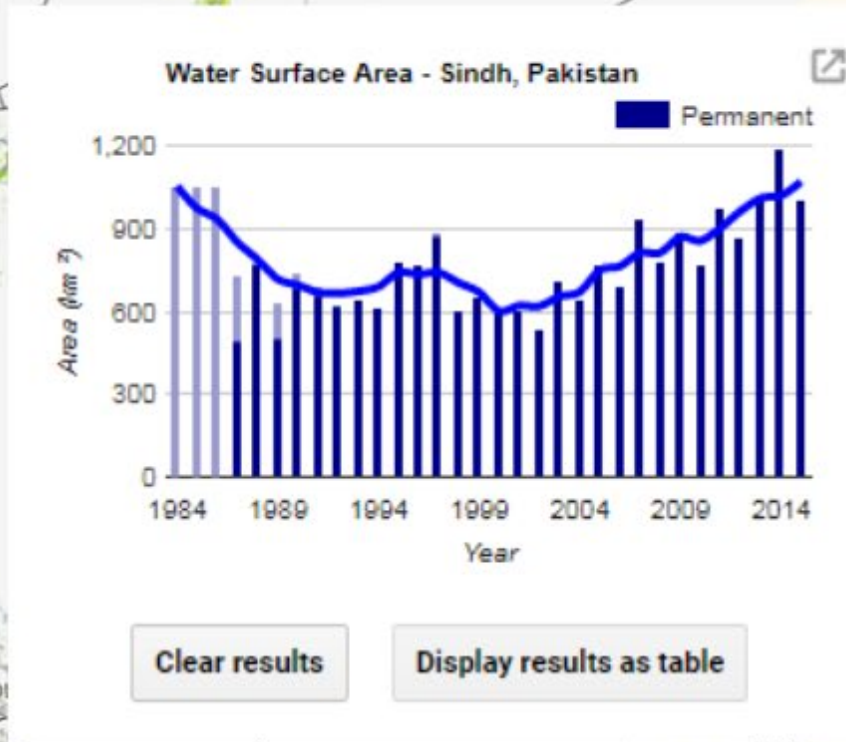
FAO GAUL Level 1

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**Transitions 1984 - 2015**

- Permanent
- New Permanent
- Lost Permanent
- Seasonal
- New Seasonal
- Lost Seasonal
- Seasonal to Permanent
- Permanent to Seasonal
- Ephemeral Permanent
- Ephemeral Seasonal

Source: Global Surface Water Layer (JRC)



- Greater water surface area
- Increased seasonal fluctuation

(<https://sites.google.com/view/sdg661>)



# Great Salt Lake, Utah: shrinking lake

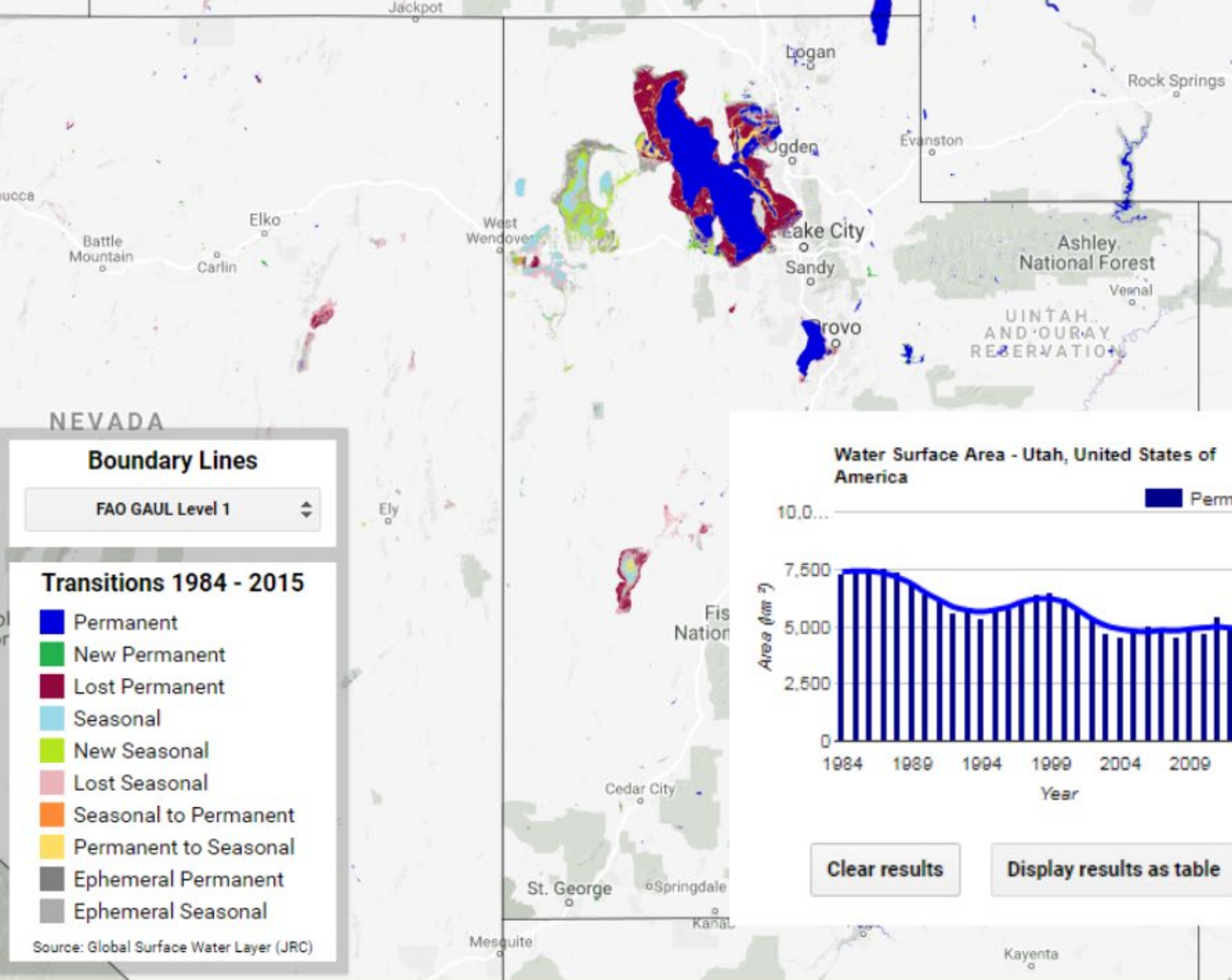


September 24, 2011



September 20, 2016

NASA Landsat (<https://earthobservatory.nasa.gov/>)



- Declining water surface area

(<https://sites.google.com/view/sdg661>)

NEVADA

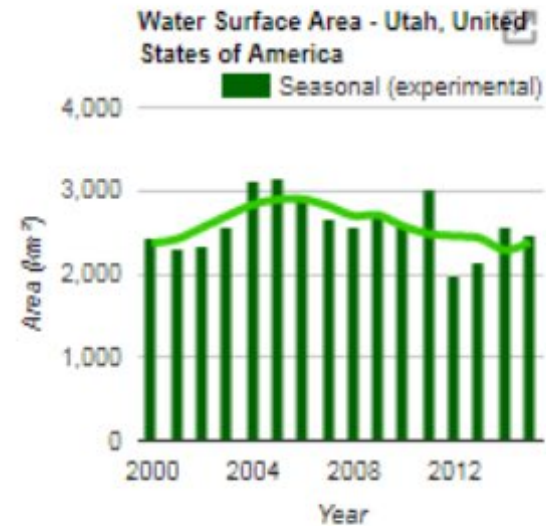
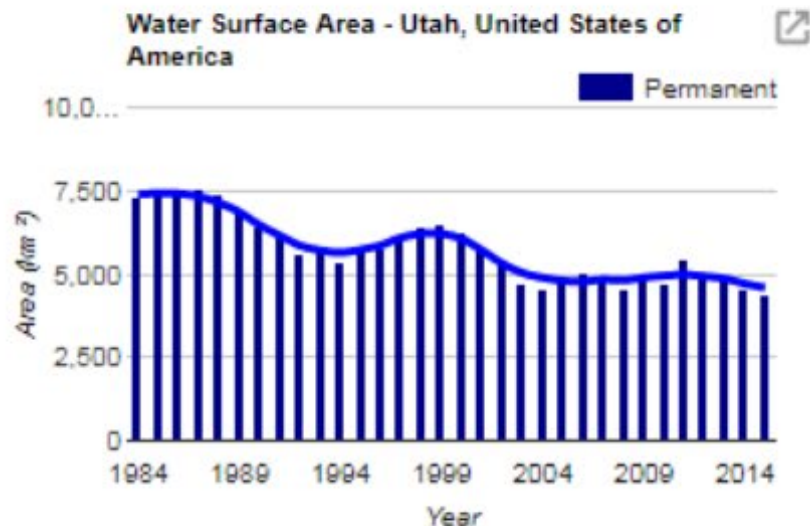
**Boundary Lines**

FAO GAUL Level 1

**Transitions 1984 - 2015**

- Permanent
- New Permanent
- Lost Permanent
- Seasonal
- New Seasonal
- Lost Seasonal
- Seasonal to Permanent
- Permanent to Seasonal
- Ephemeral Permanent
- Ephemeral Seasonal

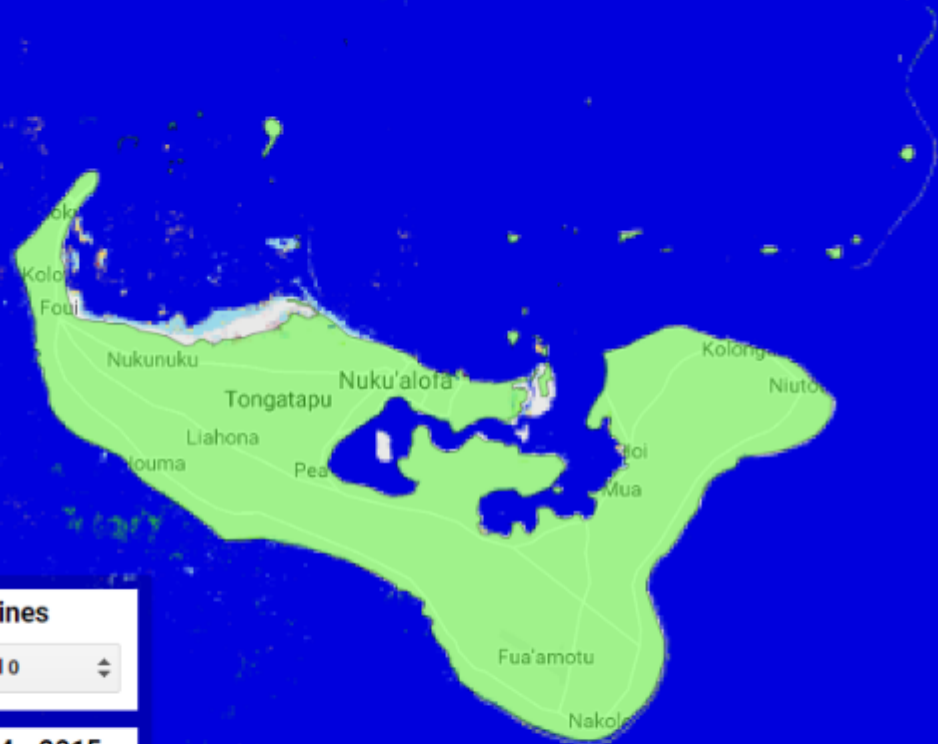
Source: Global Surface Water Layer (JRC)



Clear results    Display results as table



# Questionable quality for some regions



## Boundary Lines

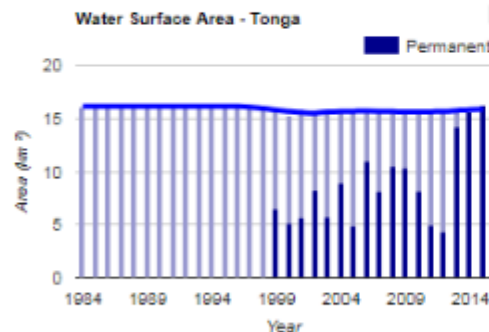
FAO GAUL Level 0

## Transitions 1984 - 2015

- Permanent
- New Permanent
- Lost Permanent
- Seasonal
- New Seasonal
- Lost Seasonal
- Seasonal to Permanent
- Permanent to Seasonal
- Ephemeral Permanent
- Ephemeral Seasonal

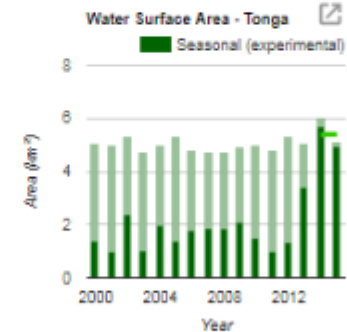
Source: Global Surface Water Layer (JRC)

- We recommend using extreme caution when the observation rate is less than 90%. Not the high level of uncertainty in Tonga (the light coloured lines represent water that maybe permanent, but there is insufficient information)



Clear results

Display results as table

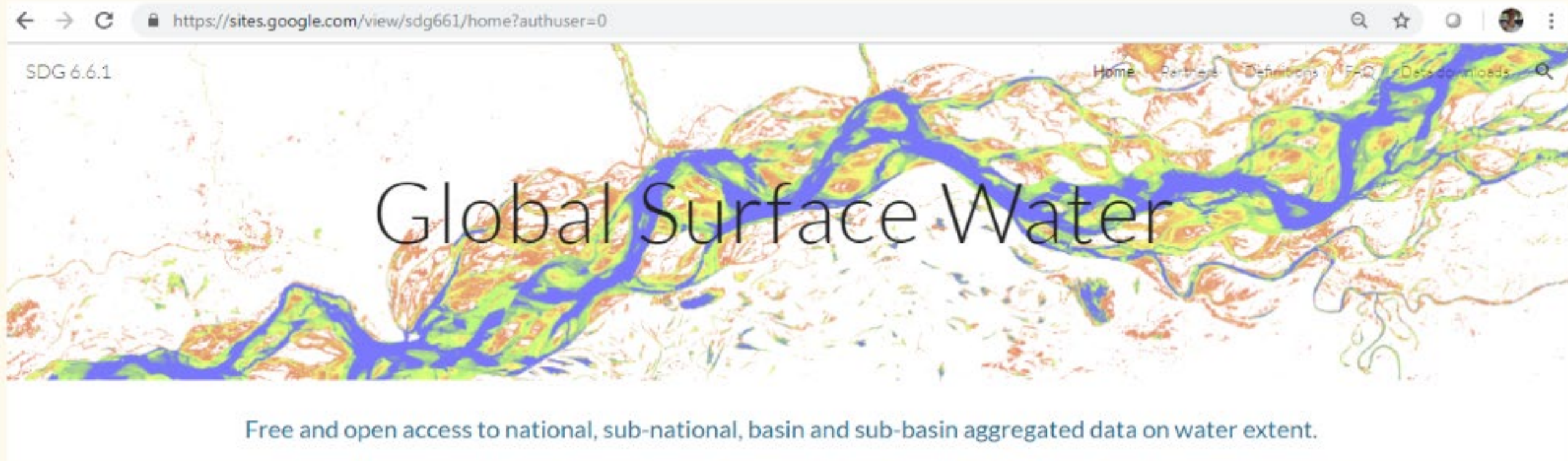


# Next steps

- Expand to additional data products which relate to UN Environment's mandate
- Improve data quality through utilizing additional LandSat images and adding Sentinel
- Partnerships aimed at building capacities in countries
- Promoting ground truthing and integrated analysis



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SDG 6.6.1

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