Global Surface Water Explorer and its applications

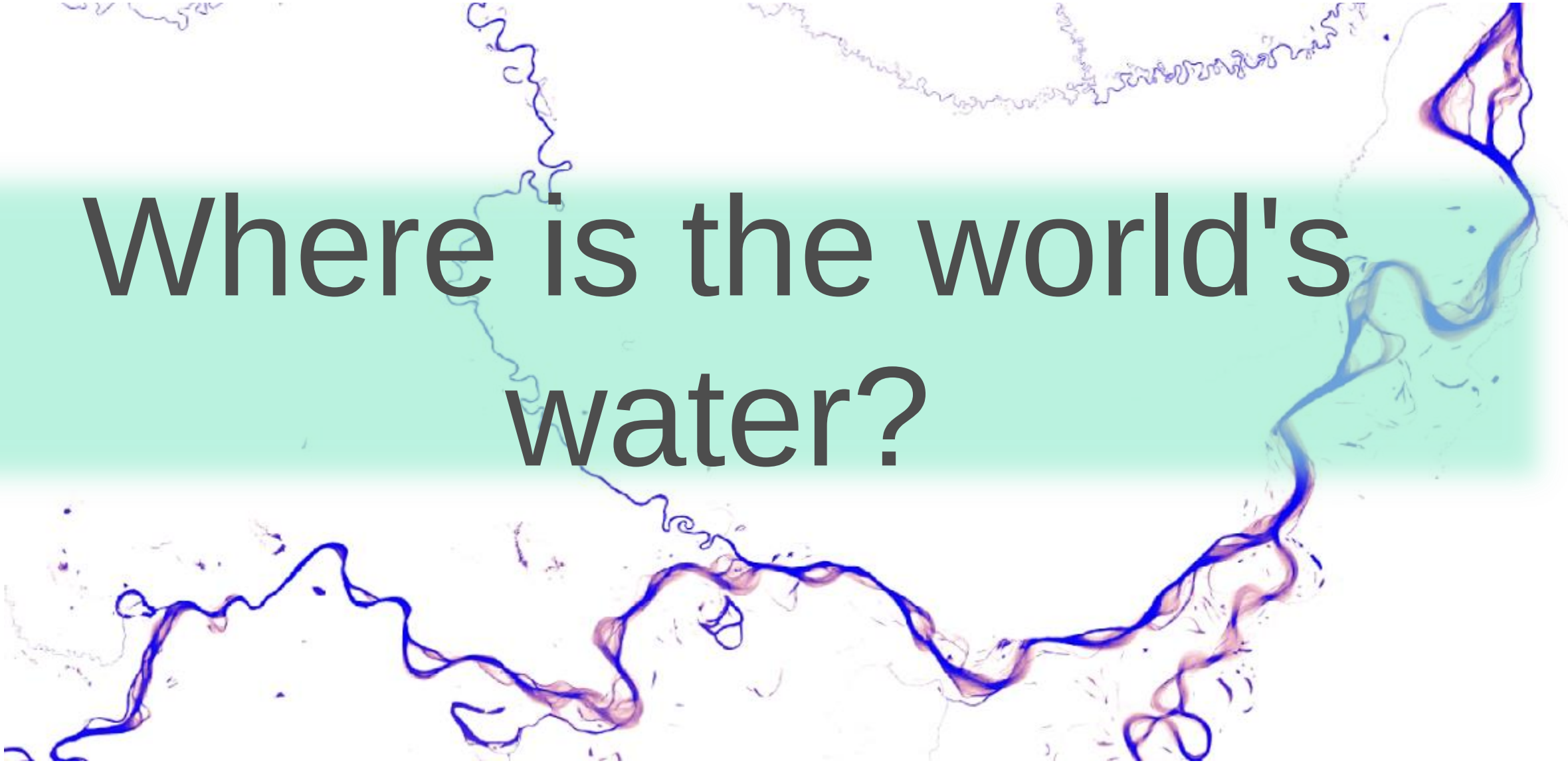
Concrete examples of how Earth observations can efficiently serve water resource management

Luca De Felice – Michael Cherlet – Luca Battistella

European Commission, Joint Research Centre (EC - JRC)

UNOOSA - 12 May 2022

Where is the world's water?



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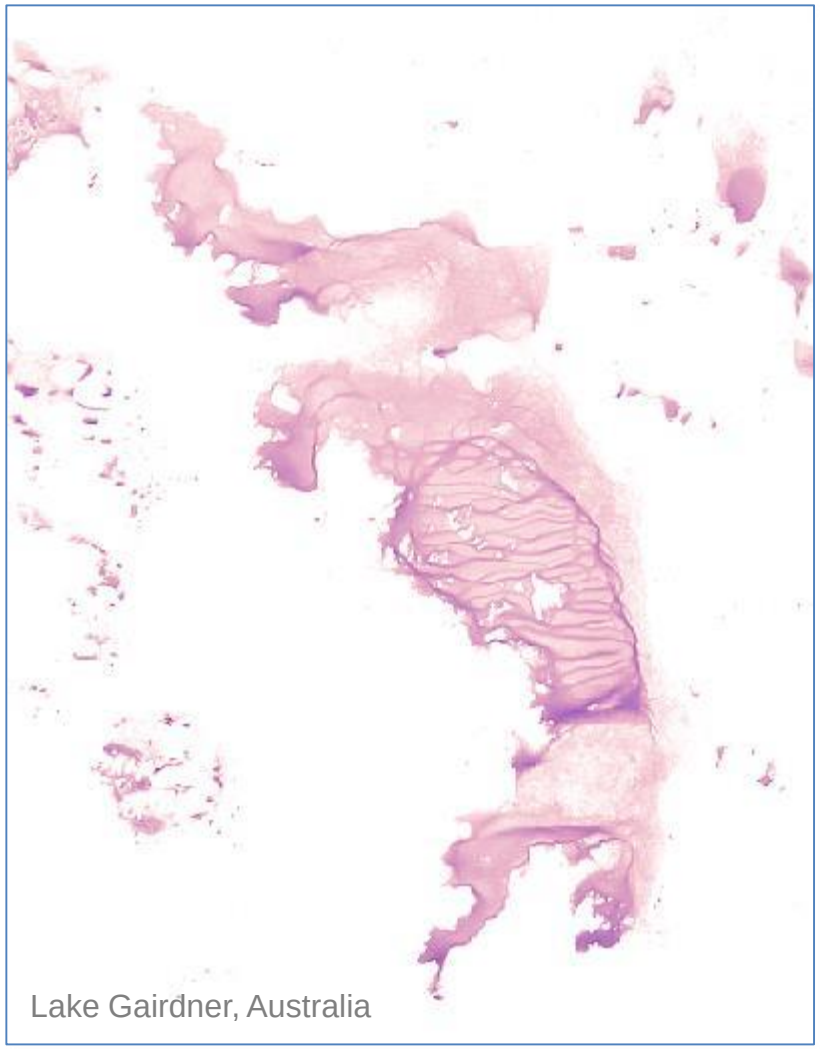
Tap, Kaboompics, Creative Commons Zero; Samish Bay, Alan Belward; Eland drinking, Hans Hillewaert, Creative Commons Attribution-Share Alike 4.0 International; River Seine barge, Alan Belward; Water lilies Lake Comabbio, Alan Belward; Jänschwalde power station, Ra Boe, Creative Commons Attribution-Share Alike 2.5 Generic; Jefferson Memorial, Alan Belward, Desalination plant, James Grellier, Creative Commons Attribution-Share Alike 3.0 Unported Stockholm Harbour, Alan Belward

Lake expansion in the Tibetan Plateau

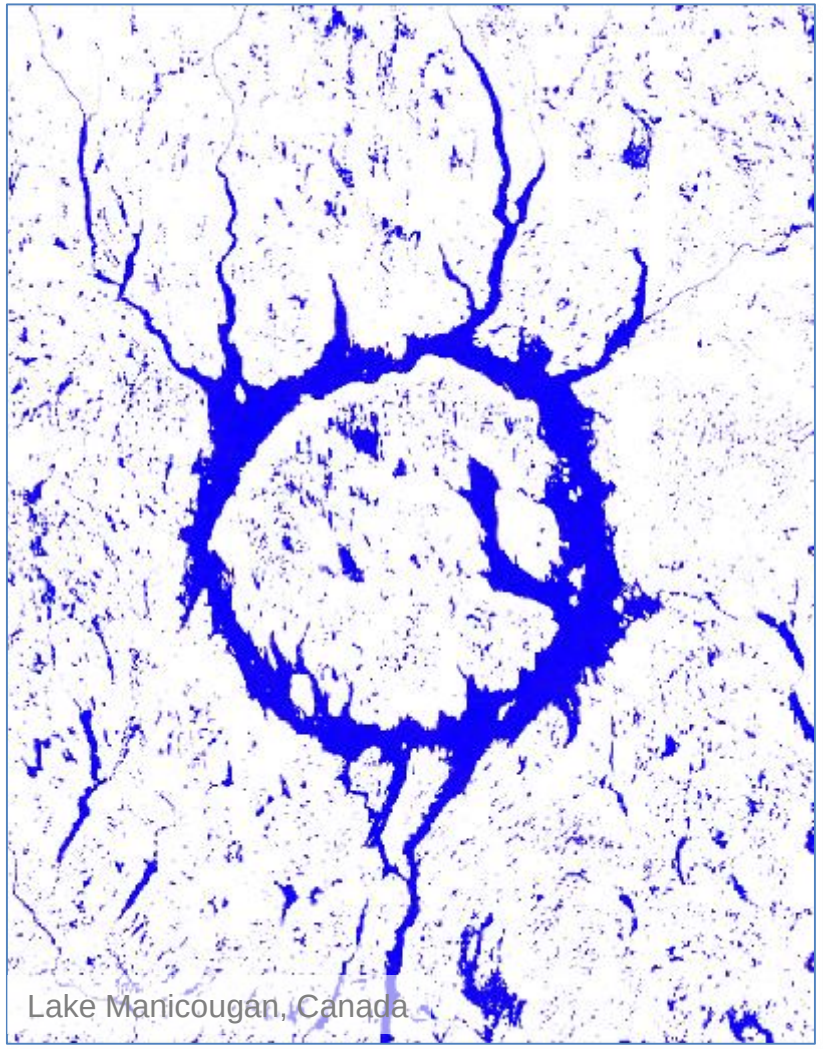
New dam (Sudan)

Disappearing lake (Lake Milh-Iraq)

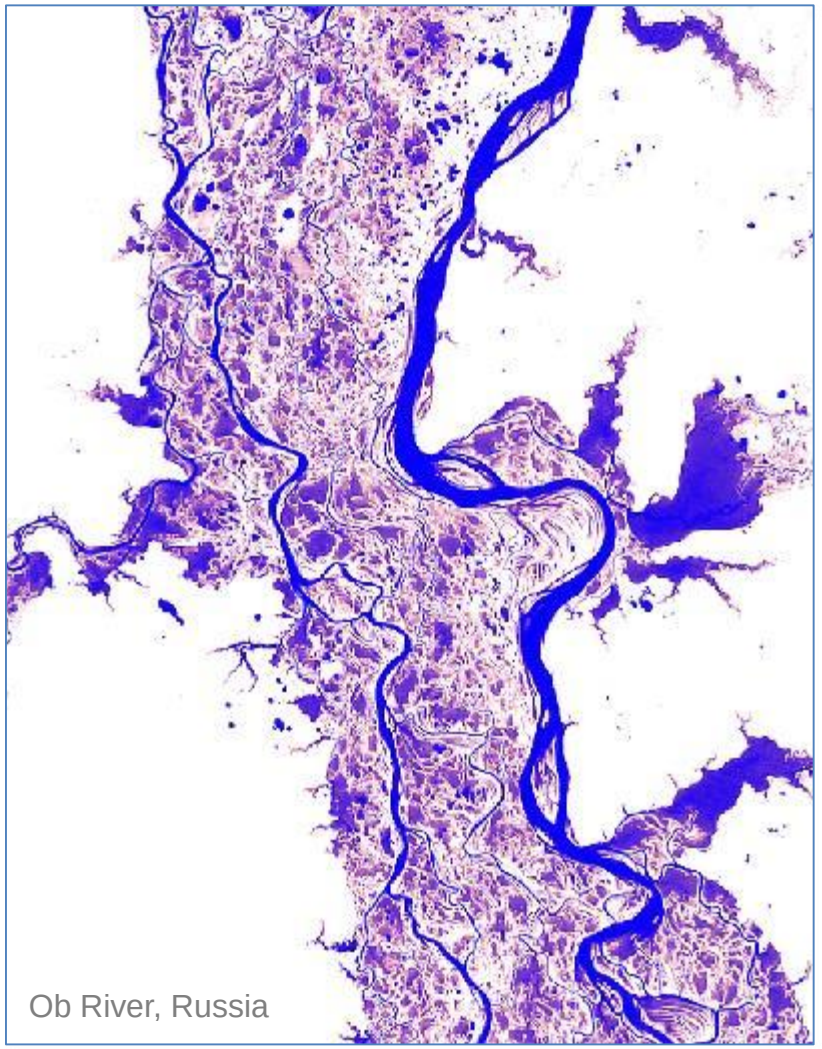
Global Surface Water Explorer (GSWE)



Lake Gairdner, Australia



Lake Manicougan, Canada



Ob River, Russia

global-surface-water.appspot.com

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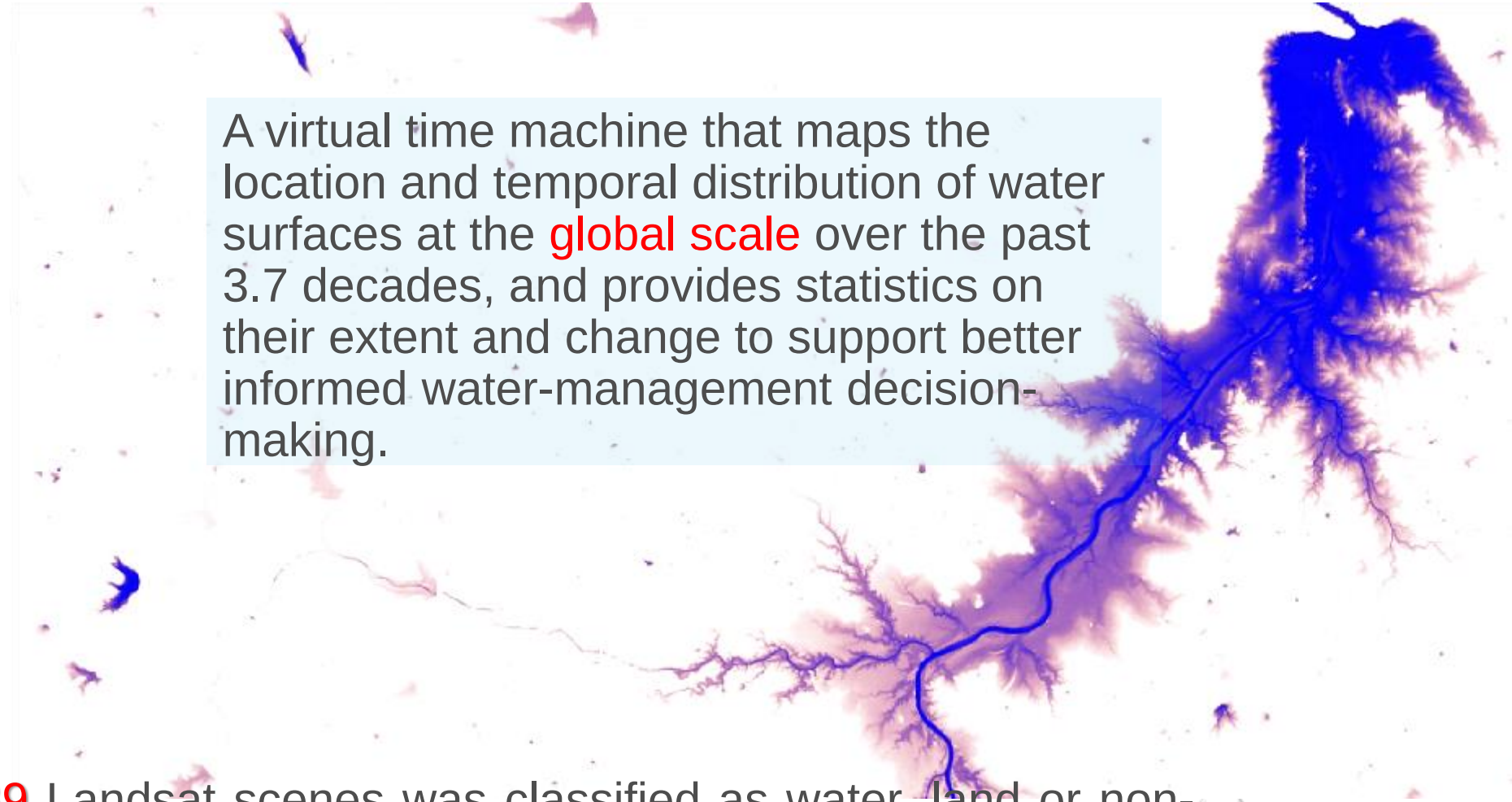
Global Surface Water Explorer

Pixel based classifier

A globally consistent and validated dataset documenting the different facets of the water **dynamics** and its changes.

A virtual time machine that maps the location and temporal distribution of water surfaces at the global scale over the past 3.7 decades, and provides statistics on their extent and change to support better informed water-management decision-making.



Each pixel of the 4,185,439 Landsat scenes was classified as water, land or non-valid observation

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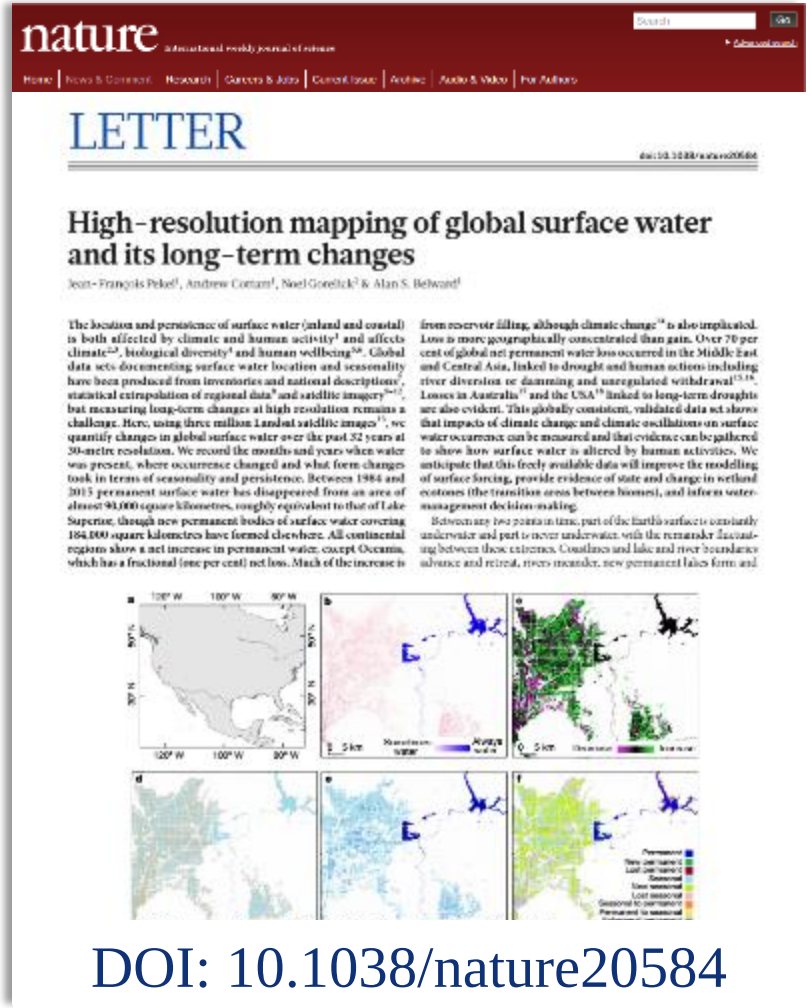


nature

LETTER

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

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

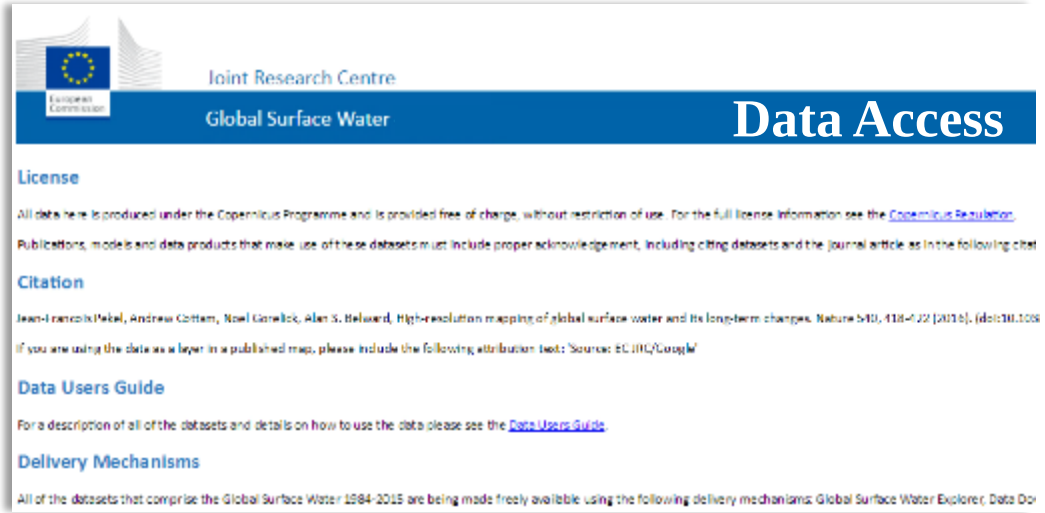
The location and persistence of surface water (inland and coastal) is both affected by climate and human activity and affects climate, biological diversity and human wellbeing. Global data sets documenting surface water location and seasonality have been produced from inventories and national descriptions, statistical extrapolation of regional data and satellite imagery, but measuring long-term changes at high resolution remains a challenge. Here, using three million Landsat satellite images, we quantify changes in global surface water over the past 32 years at 30-metre resolution. We record the months and years when water was present, where occurrence changed and what form changes took in terms of seasonality and persistence. Between 1984 and 2015 permanent surface water has disappeared from an area of almost 90,000 square kilometres, roughly equivalent to that of Lake Superior, though new permanent bodies of surface water covering 184,000 square kilometres have formed elsewhere. All continental regions show a net increase in permanent water, except Oceania, which has a fractional (one per cent) net loss. Much of the increase is from reservoir filling, although climate change is also implicated. Loss is more geographically concentrated than gain. Over 70 per cent of global net permanent water loss occurred in the Middle East and Central Asia, linked to drought and human actions including river diversion or damming and unregulated withdrawal. Losses in Australia and the USA linked to long-term droughts are also evident. This globally consistent, validated data set shows that impacts of climate change and climatic oscillations on surface water occurrence can be measured and that evidence can be gathered to show how surface water is altered by human activities. We anticipate that this freely available data will improve the modelling of surface forcing, provide evidence of state and change in wetland ecotones (the transition areas between biomes), and inform water-management decision-making.

Between any two points in time, part of the Earth's surface is constantly underwater and part is never underwater, with the remainder fluctuating between these extremes. Coastlines and lake and river boundaries advance and retreat, rivers meander, new permanent lakes form and

DOI: 10.1038/nature20584

Nature Publication

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



Joint Research Centre

Global Surface Water

Data Access

License

All data here is produced under the Copernicus Programme and is provided free of charge, without restriction of use. For the full license information see the Copernicus Regulation.

Publications, models and data products that make use of these datasets must include proper acknowledgement, including citing datasets and the journal article as in the following citat

Citation

Jean-François Pekel, Andrew Cottam, Noel Gorelick, Alan S. Belward, High-resolution mapping of global surface water and its long-term changes. Nature 540, 418-422 (2016). (doi:10.103

If you are using the data as a layer in a published map, please include the following attribution text: 'Source: EC JRC/Google'

Data Users Guide

For a description of all of the datasets and details on how to use the data please see the Data Users Guide.

Delivery Mechanisms

All of the datasets that comprise the Global Surface Water 1984-2015 are being made freely available using the following delivery mechanisms: Global Surface Water Explorer, Data Do

All data are free and open access

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Thematic Products

Maps & Temporal Profiles

- Occurrence
- Occurrence Change Intensity
- Seasonality
- Recurrence
- Water Transition
- Max Water Extent

Full monthly water history
442 monthly, 37 yearly maps

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

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Some Applications

1. Sustainable Development Goal (SDG) 6.6.1 - tracks changes in water-related ecosystems - *Freshwater Ecosystems Explorer, www.sdg661.app)*
2. Monitor reservoirs all around the world in terms of changes in their surface extent, and identification of new reservoirs;
3. Statistics about measurable changes in the extent of permanent and seasonal surface water bodies in cropland areas. "*State of the world's land and water resources for food and agriculture (SOLAW 2021)" - Food and Agriculture Organization (FAO)*

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SDG 6.6.1

By 2020, protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes

Indicator 6.6.1 (Tier I Indicator) “Change in the extent of water-related ecosystems over time “

Freshwater Ecosystem Explorer (www.sdg661.app)

Founding Partners:
United Nations Environment Programme (UNEP)
European commission Joint research Centre (EC JRC)
Google Earth engine (GEE)

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Algeria

Lakes and Rivers

Permanent water dynamics	53.33 %	24.00 Km²
Seasonal water dynamics	73.60 %	881.00 Km²

Reservoirs

Minimum water extent dynamics	73.28 %	96.00 Km²
Maximum water extent dynamics	74.67 %	112.00 Km²

Mangroves

Mangroves	*No mangroves detected here*

Wetlands

Wetlands	3189.90 Km²

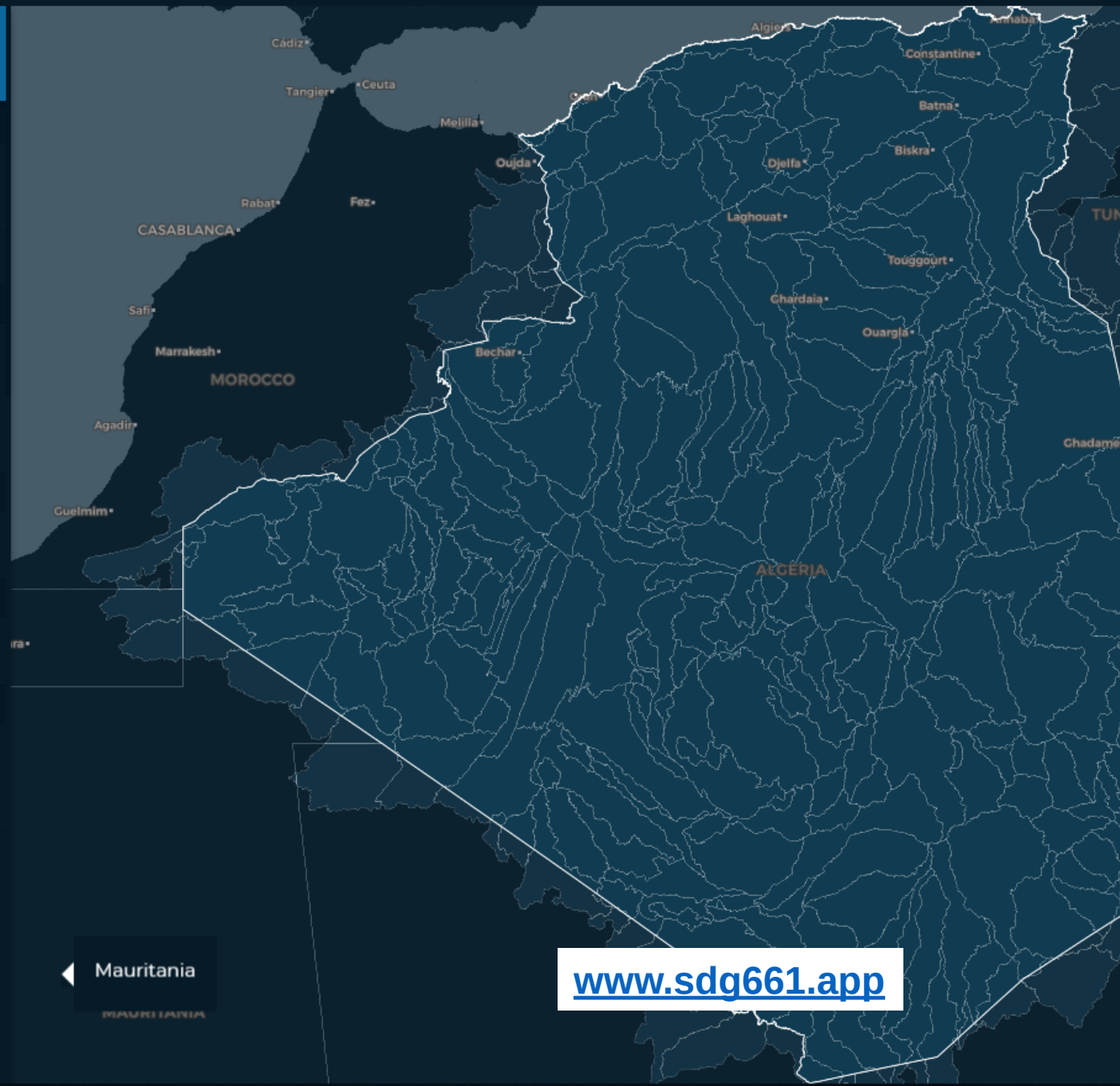
Water quality

Turbidity State	1 out of 6 lakes affected	16.67 %	Deviation Percentage
Trophic State	0 out of 6 lakes affected	0 %	Deviation Percentage

Global lakes layer (Click on a lake to display analysis)

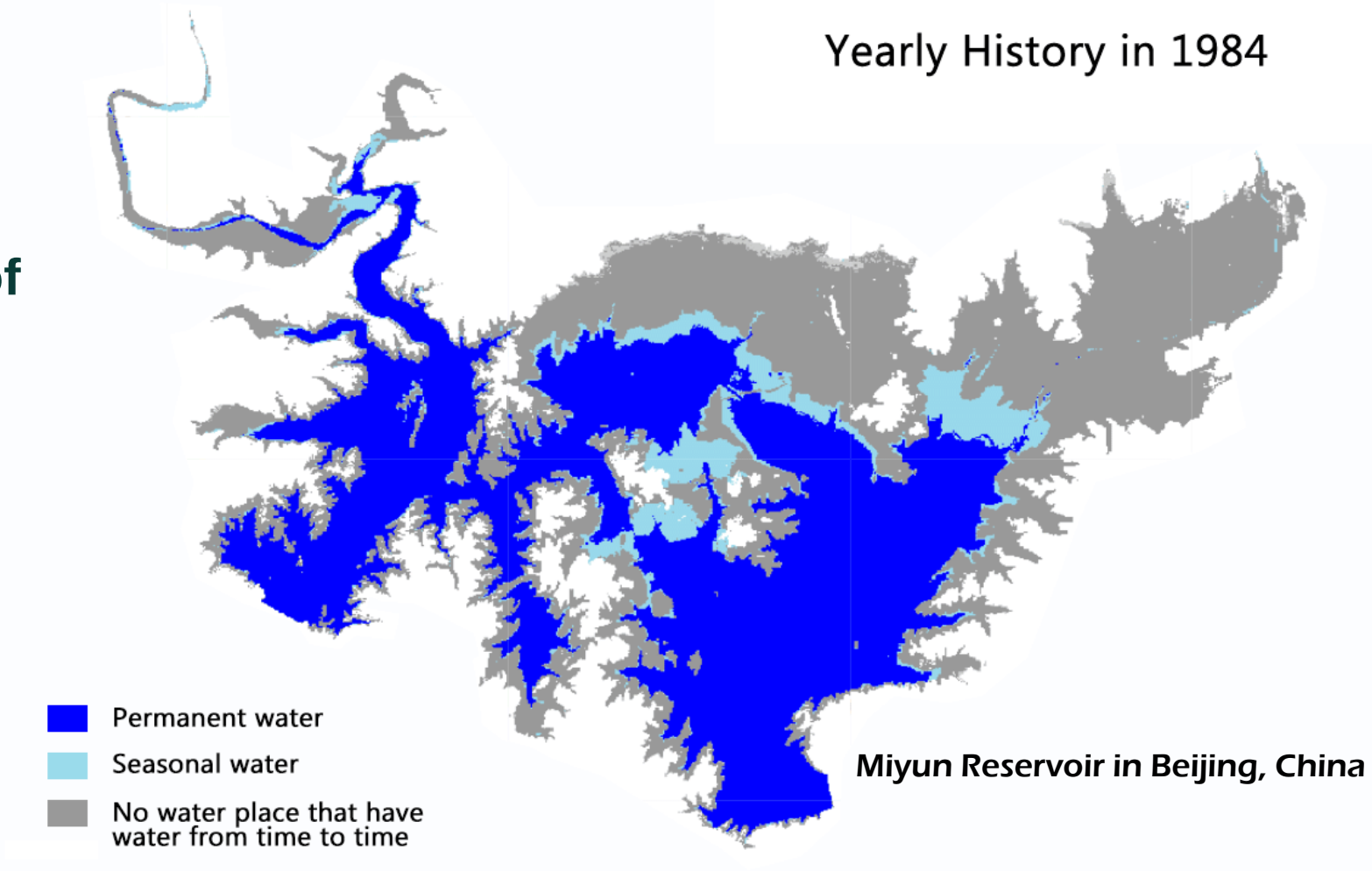
Lakes and Rivers - Advanced analysis

Add/remove map layer



Reservoirs' Spatial Extent Dynamics

- **Dynamics of spatial extent of water in reservoir**
- **Yearly seasonality footprint of water stored in reservoir**
- **Water filling year**



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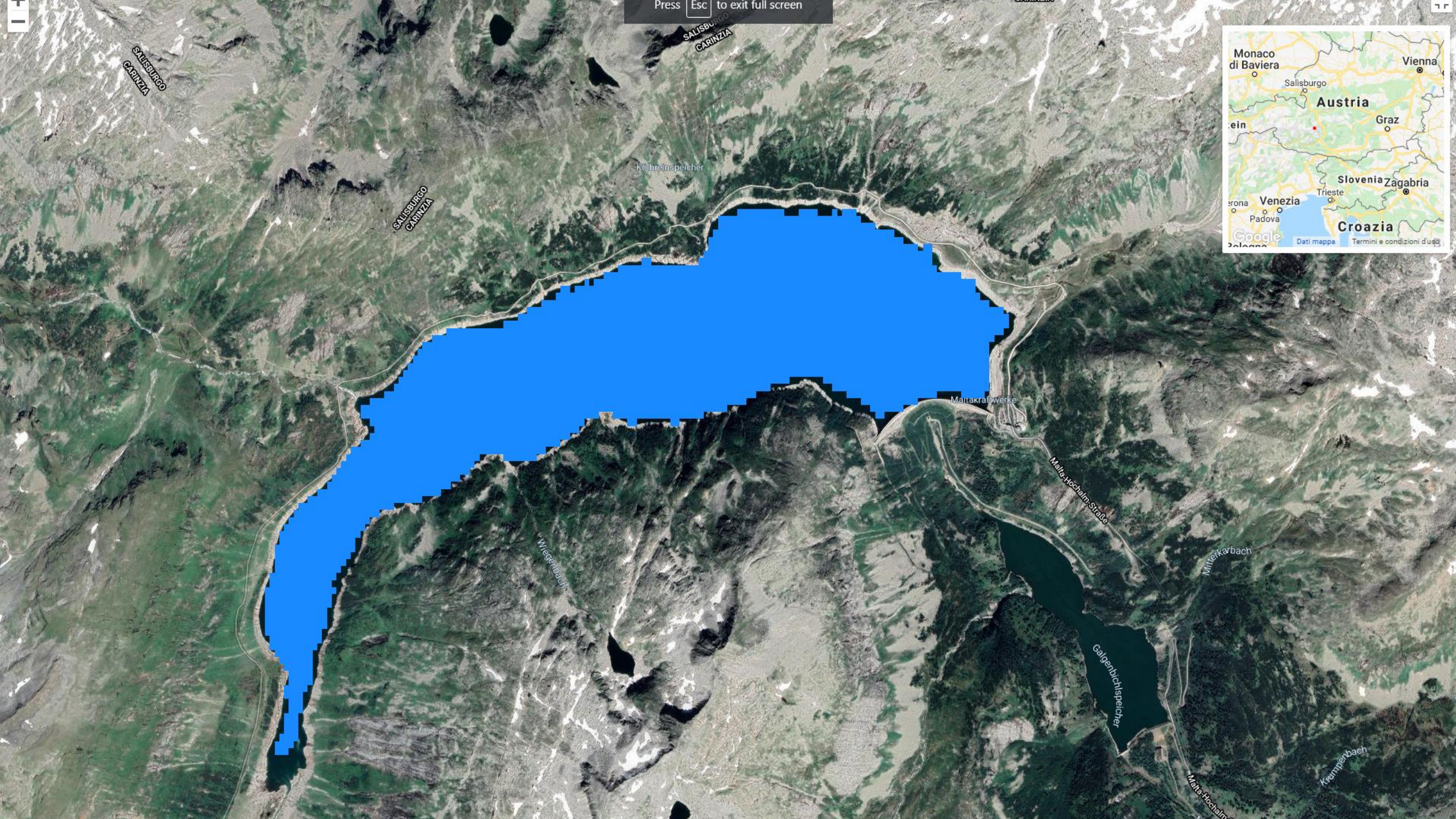
Press Esc to exit full screen
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Changes in the extent of surface water bodies in cropland areas (FAO – SOLAW 2021)

We computed the change in permanent and seasonal surface water bodies extent on irrigated and rainfed cropland using GSWE historical data

www.fao.org/land-water/solaw2021/en

Conclusions

- GSWE supports applications including water resource management, climate modelling, biodiversity conservation and food security, and facilitates the exact quantification of the extent and dynamics of inland water bodies.

- The GSWE dataset was officially endorsed by the United Nations as the official indicator for monitoring progress towards SDG target 6.6 (Ecosystems)

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Contact us!

jrc-surfacewater@ec.europa.eu

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