Evaluation and updates of ESA-CCI global land cover map

For NWP needs

S. M. Oswald, P. Samuelsson, E. Kurzeneva , B. Palmason
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SMHI

Icelandic Met Office

FINNISH METEOROLOGICAL INSTITUTE

EUMETNET
EUROPEAN METEOROLOGICAL SERVICES NETWORK

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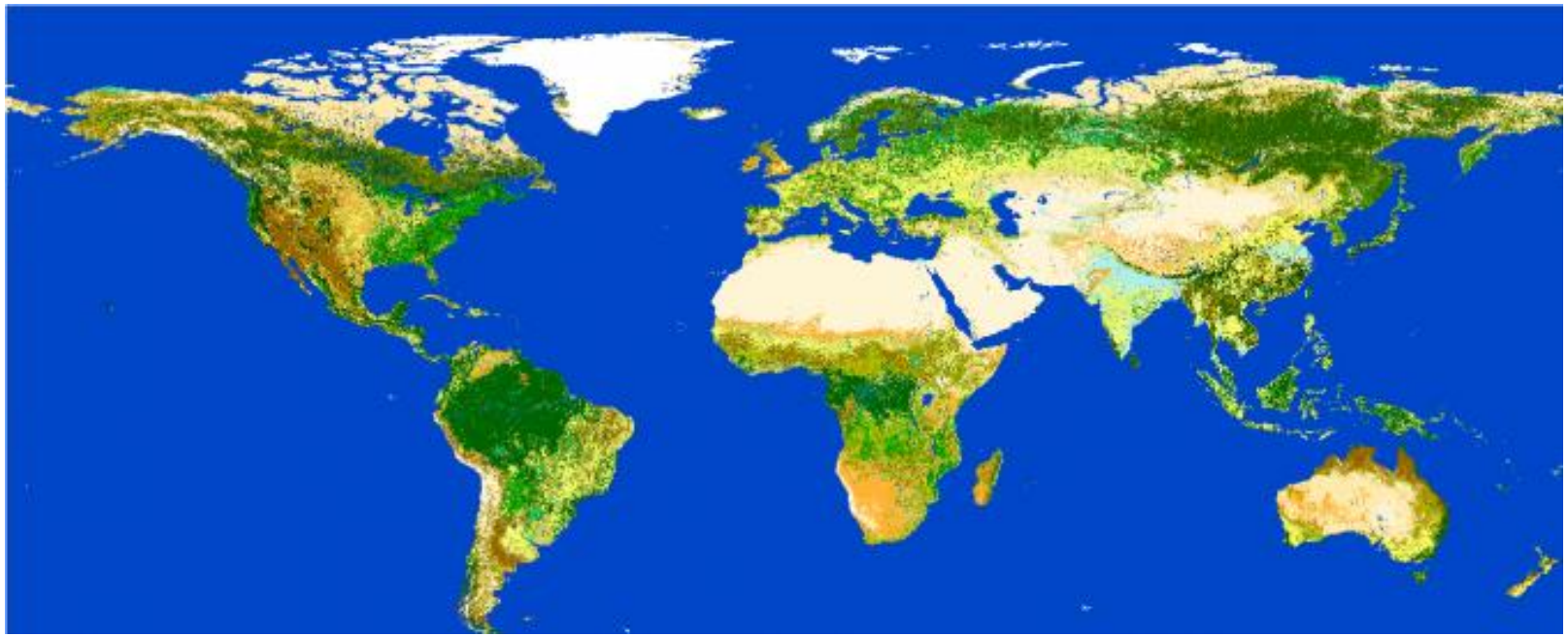
Aims given from EUMETNET

- According to the proposal supported by EUMETNET, the project should include
  - (i) gather and document reports on identified deficiencies and suggested corrections from all C-SRNWP institutes,
  - (ii) prepare and, with certain intervals, release corrected versions of the ESA-CCI land cover (LC) product which can be downloaded by the C-SRNWP partners, and
  - (iii) share the documentation and updated product with C3S so that their new releases can benefit from the work.



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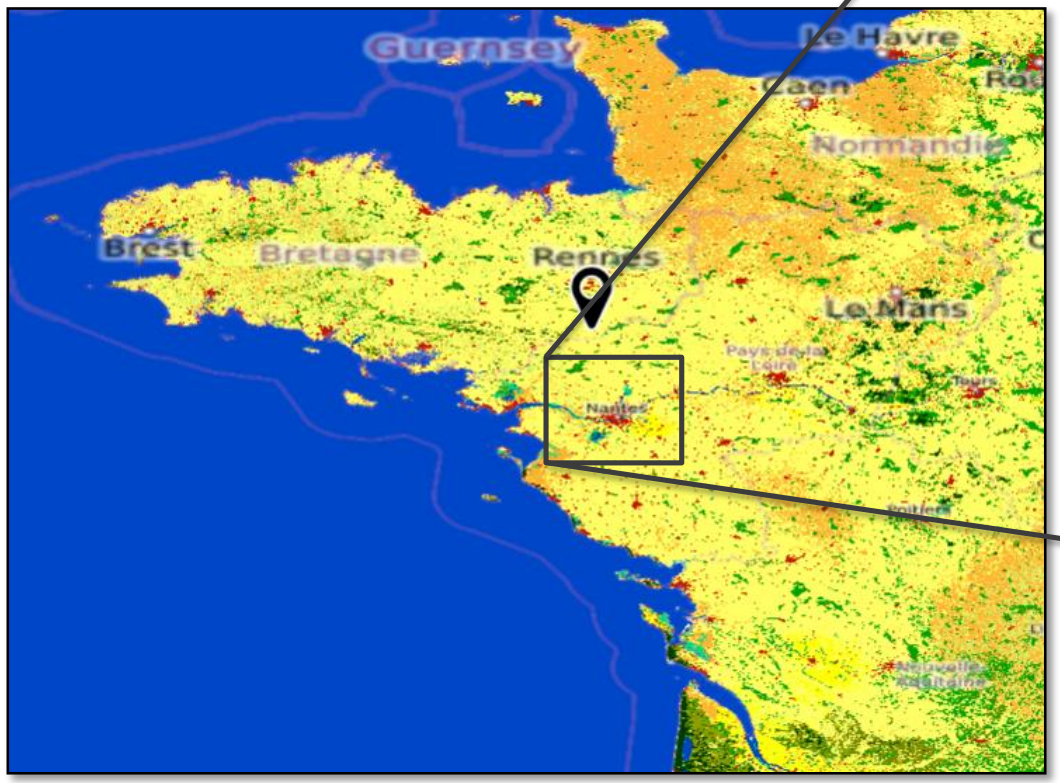
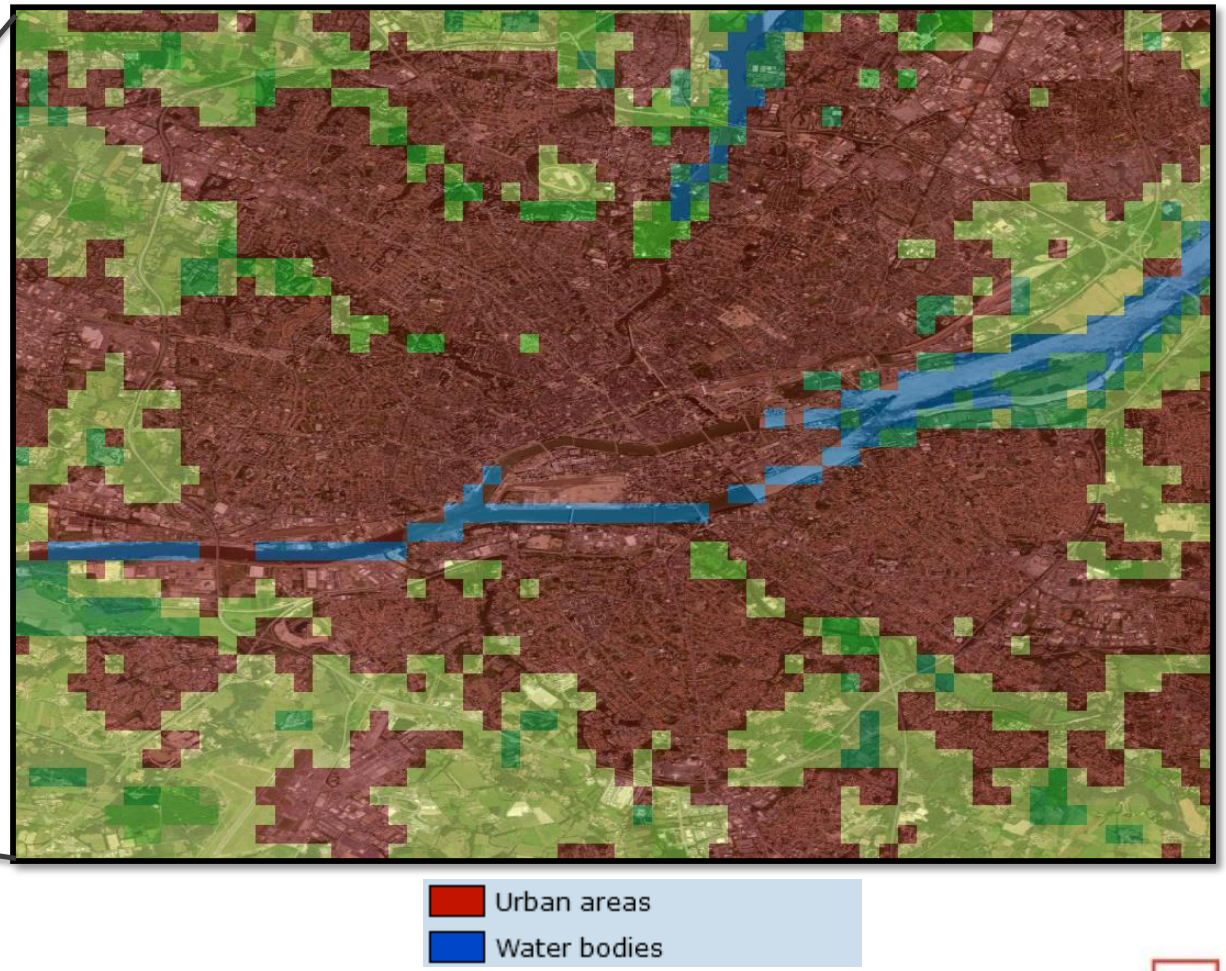
Current quality, missing information and errors

- Overall quality is good with 300m spatial resolution
- Example of Nantes in France
  - No classification for sea water
  - Urban areas just one class





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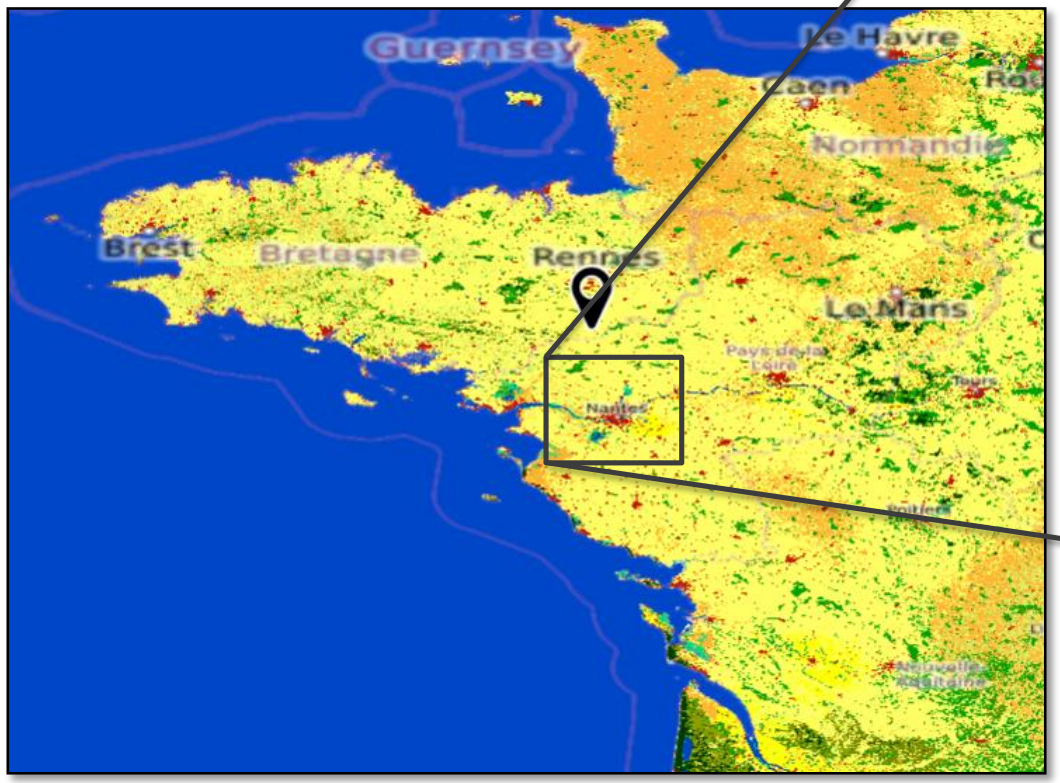
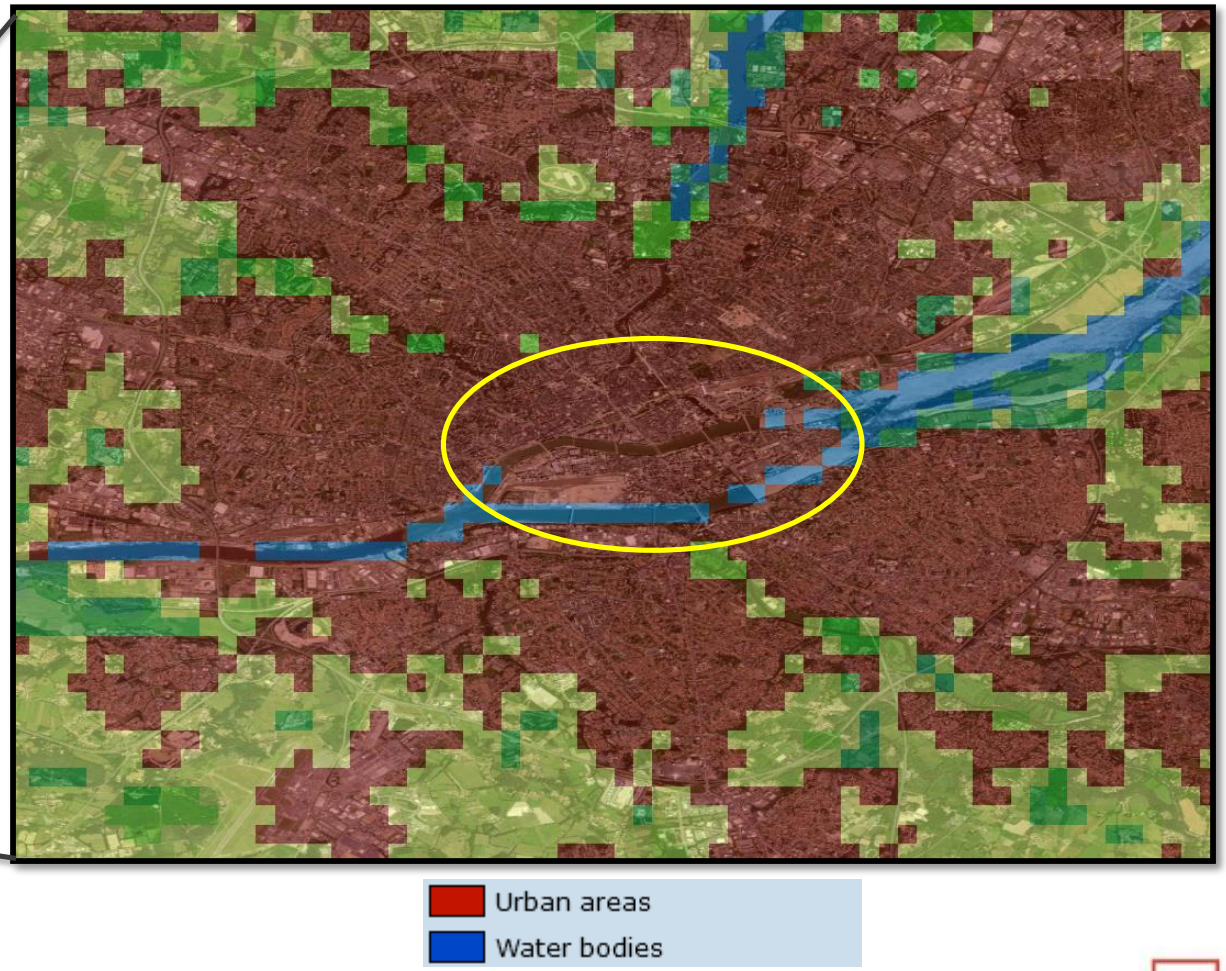
  - Water bodies sometimes too small





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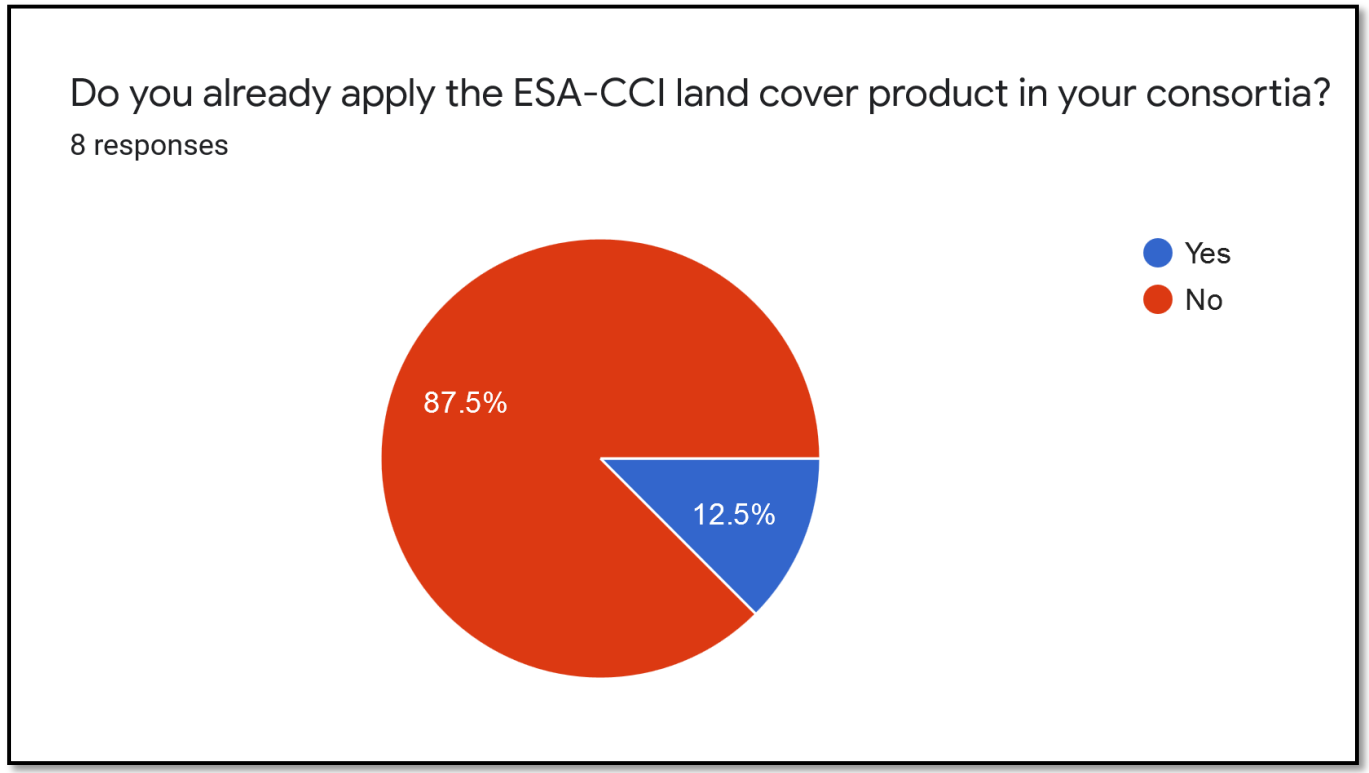
Motivation

- To understand what meteorologists need for the NWP
  - Survey with all C-SRNWP surface members
- Eight colleagues take part
  - Meteo France
  - Met Ireland
  - Metoffice UK
  - CMCC Italy
  - DWD Germany
  - OMSZ Hungary
  - ARSO Slovenia
  - CHMI Czech Republic

- **Only 1 out of 8** use the land cover map



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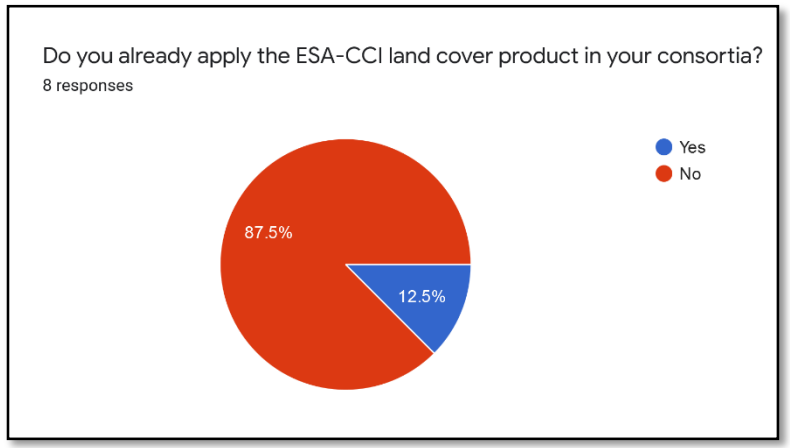
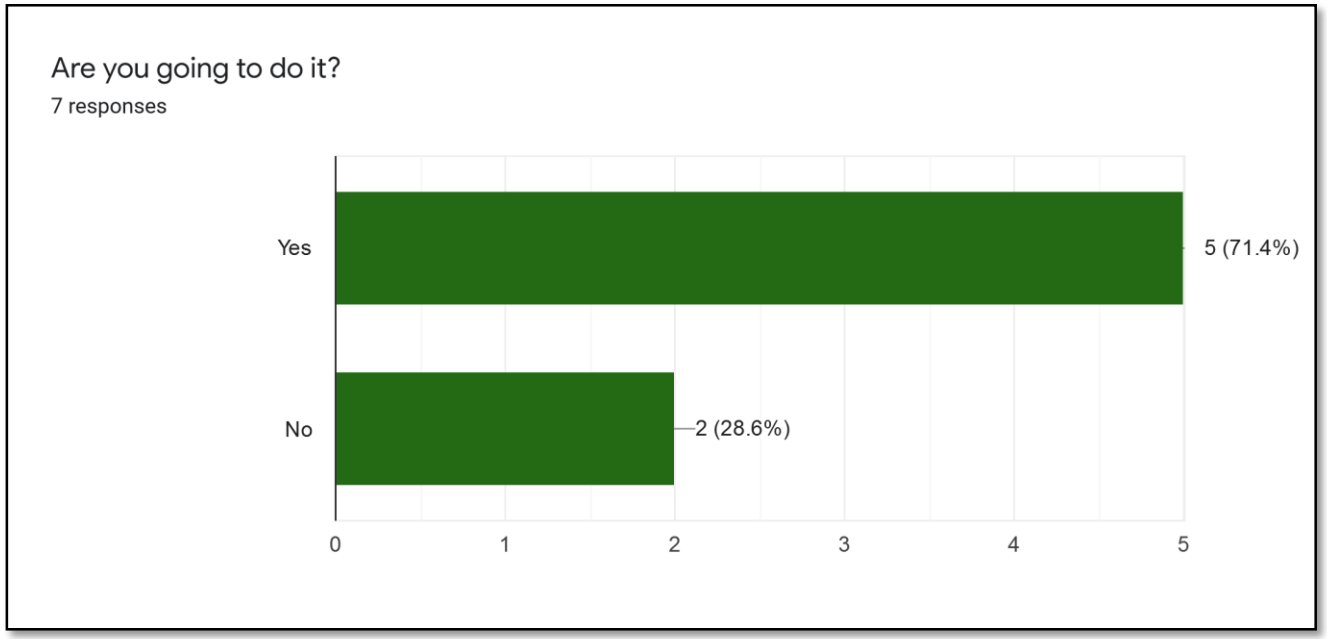
Survey with all ACCORD members

- But they would use it if:
  - The water mask is better,
  - A distinction between fresh and salt water
  - Urban areas should have more than one class





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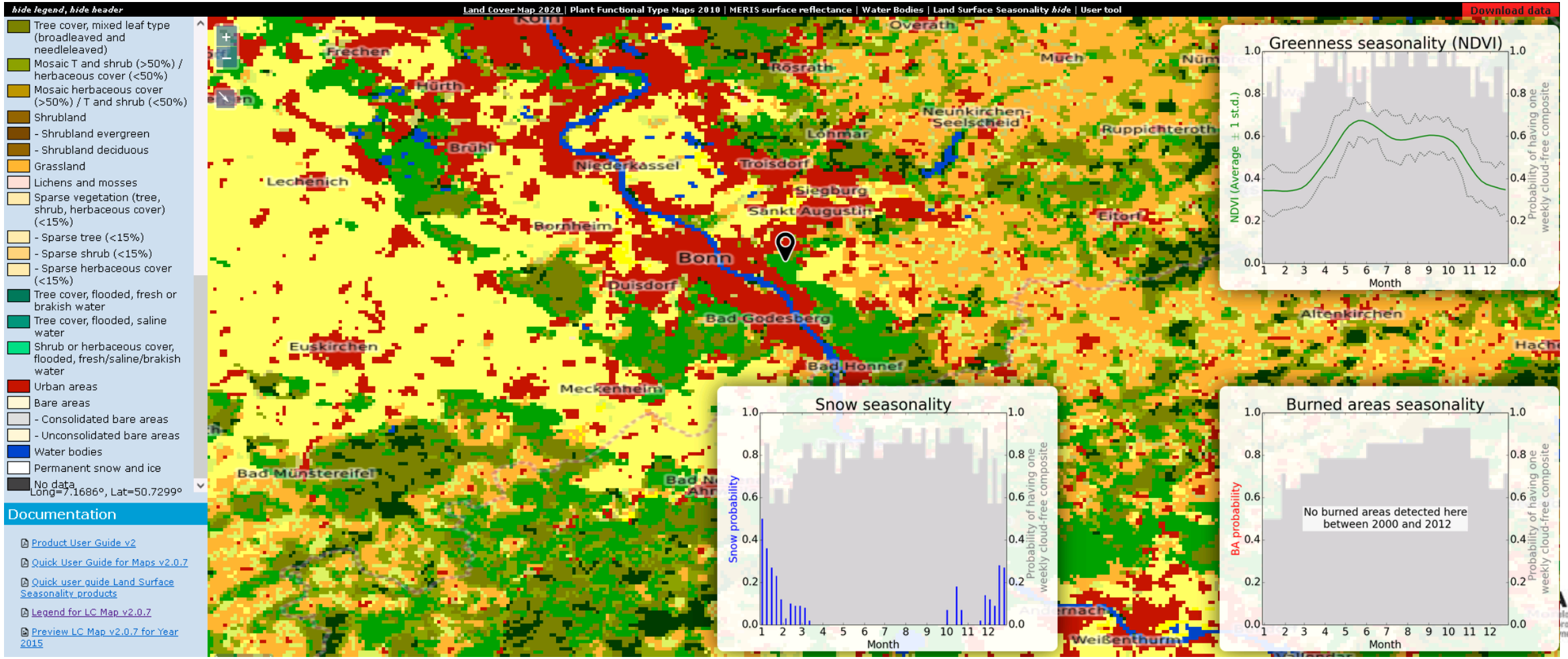
Members need

- Distinction between fresh water and salt water
- Urban areas should have more than one class



Finding a reference water mask

- Several products exists as e.g.
  - MODIS land water mask → latest from 2015
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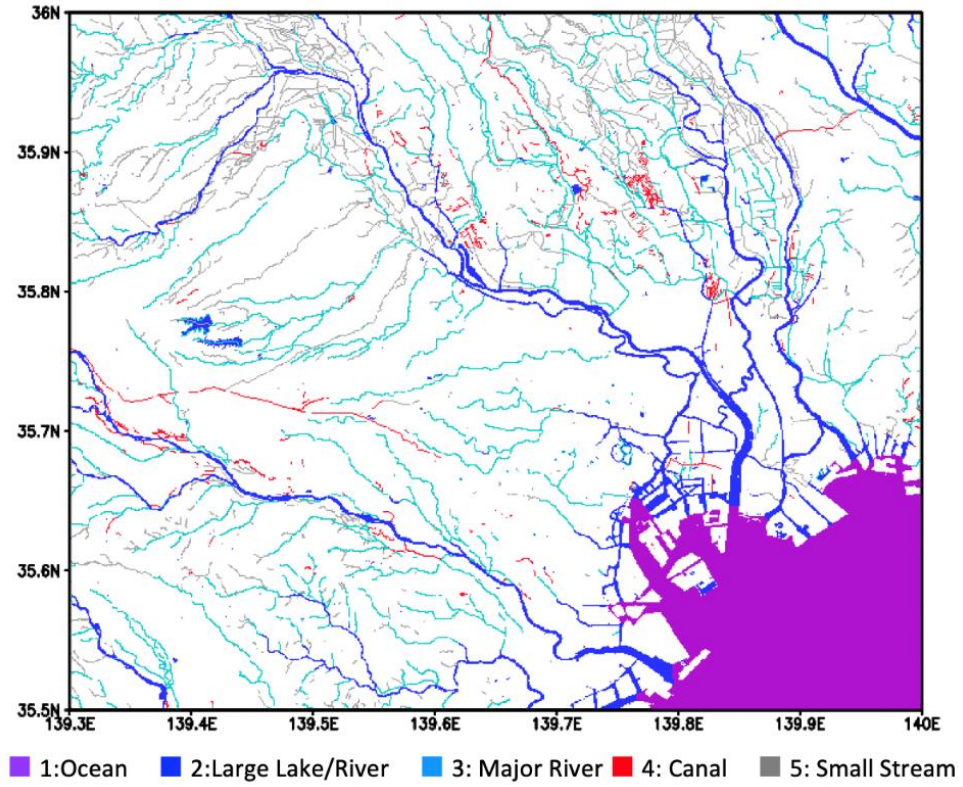
- Global Hydrology and Water Resources Engineering institute (University of Tokyo)
  - Github repository to create own global water mask

- Use of a **majority algorithm** to create a 300m water mask
  - with salt and fresh water distinction



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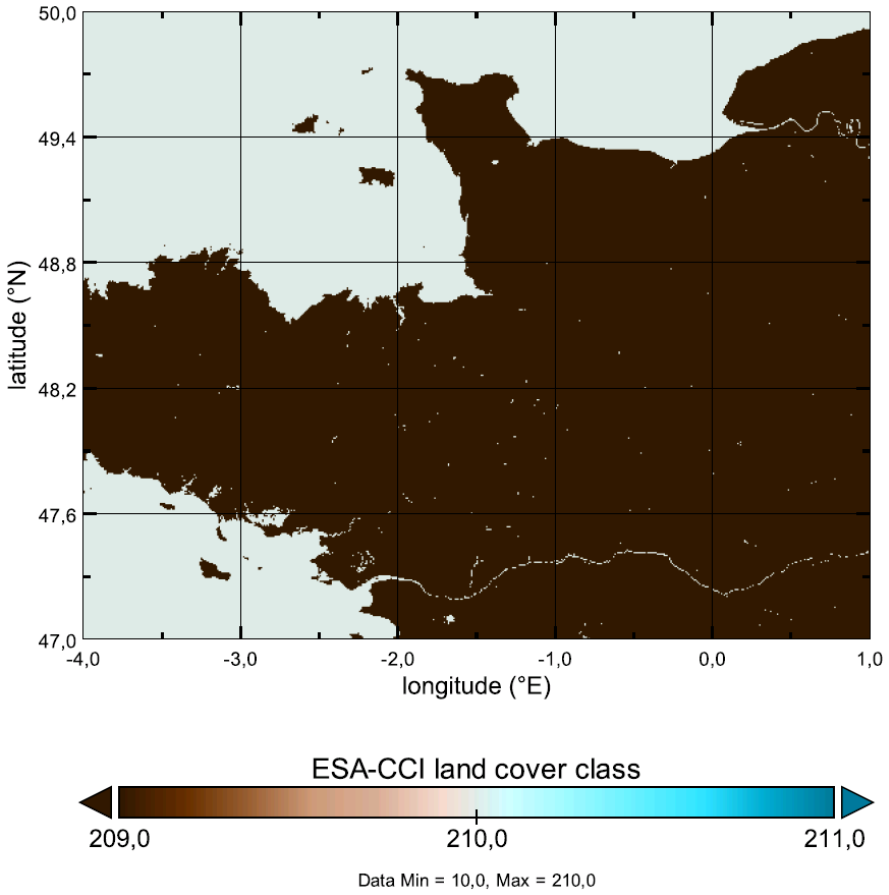
Open Street Map as reference?

- Bretagne/Normandy as example with classes of
  - Land (209)
  - Water bodies (210)



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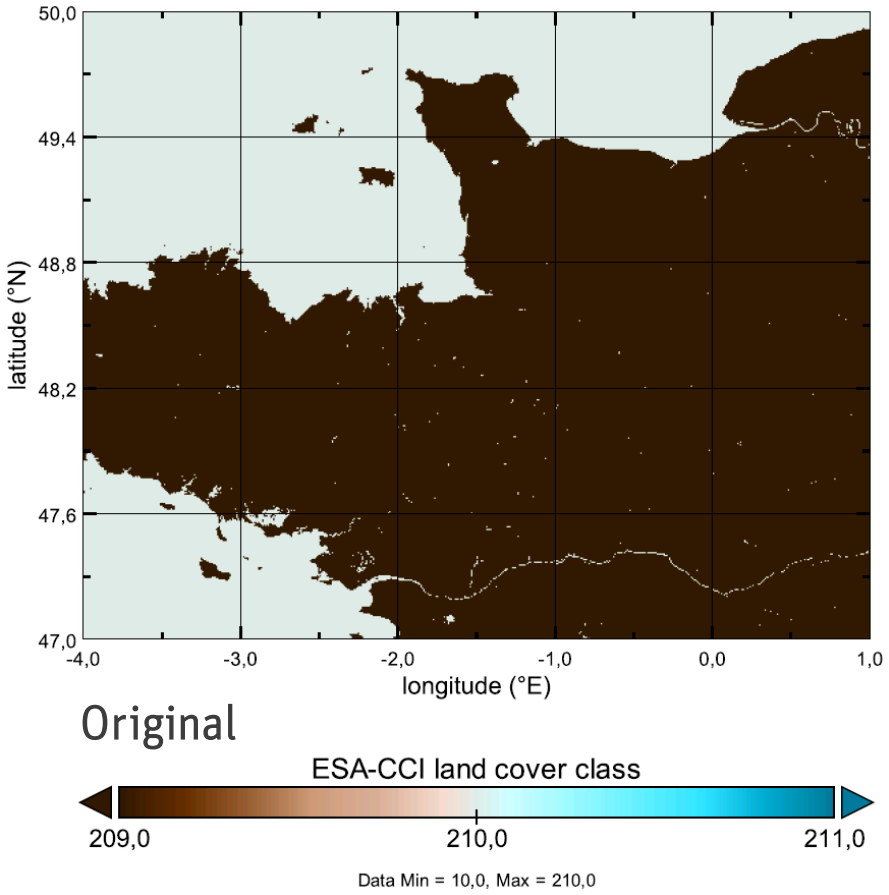
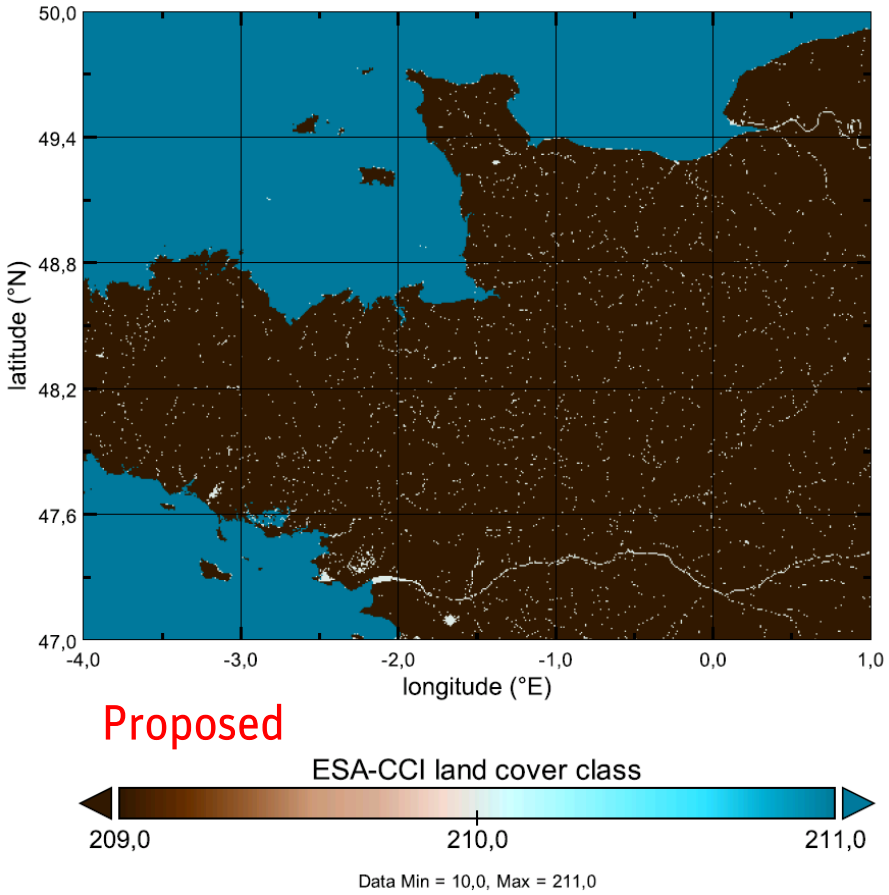
New class of saltwater (211)



Original



Proposed

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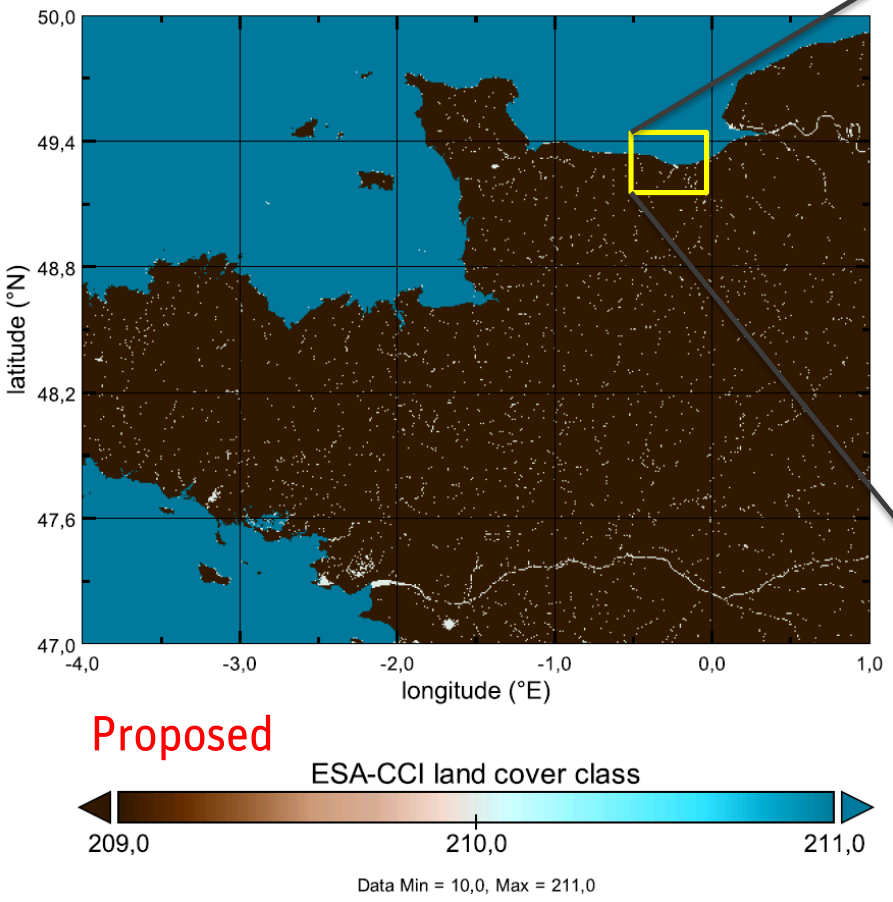
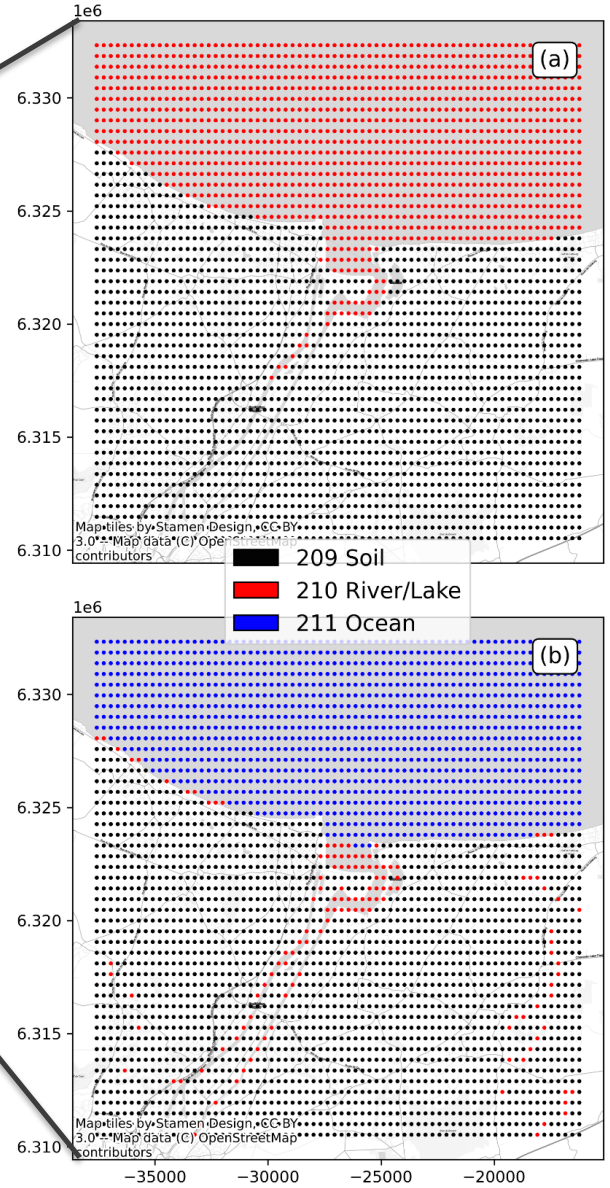
Open Street Map as reference?

- Example zoom in the area of Caen, France





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Open Street Map as reference?

- Keep in mind that ESA-CCI LC map should updated globally
- **Climate change** effects the environment quicker than we think

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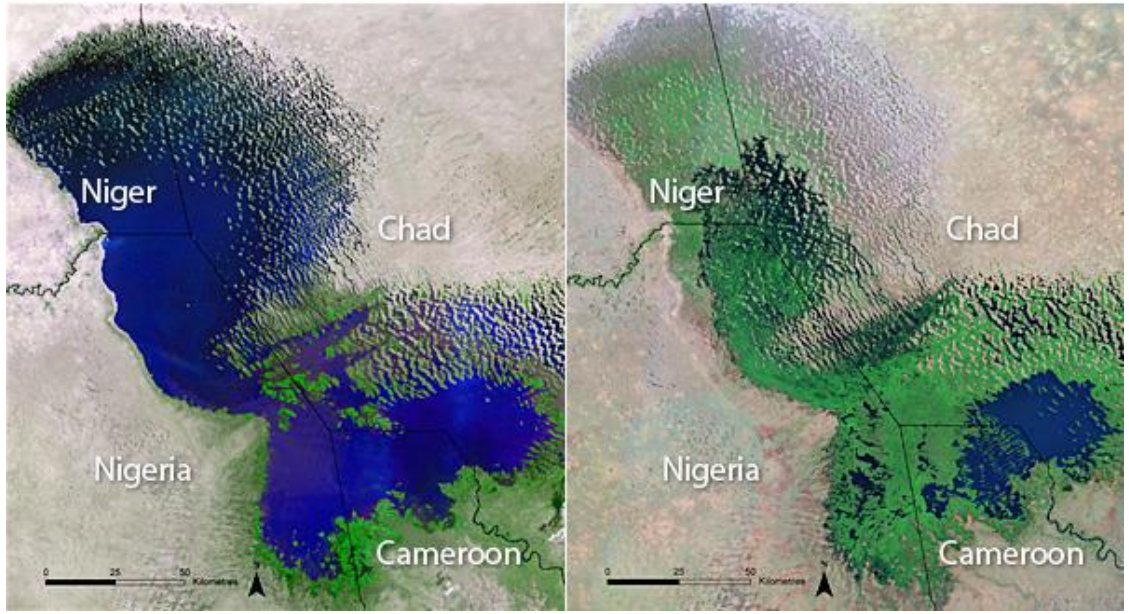
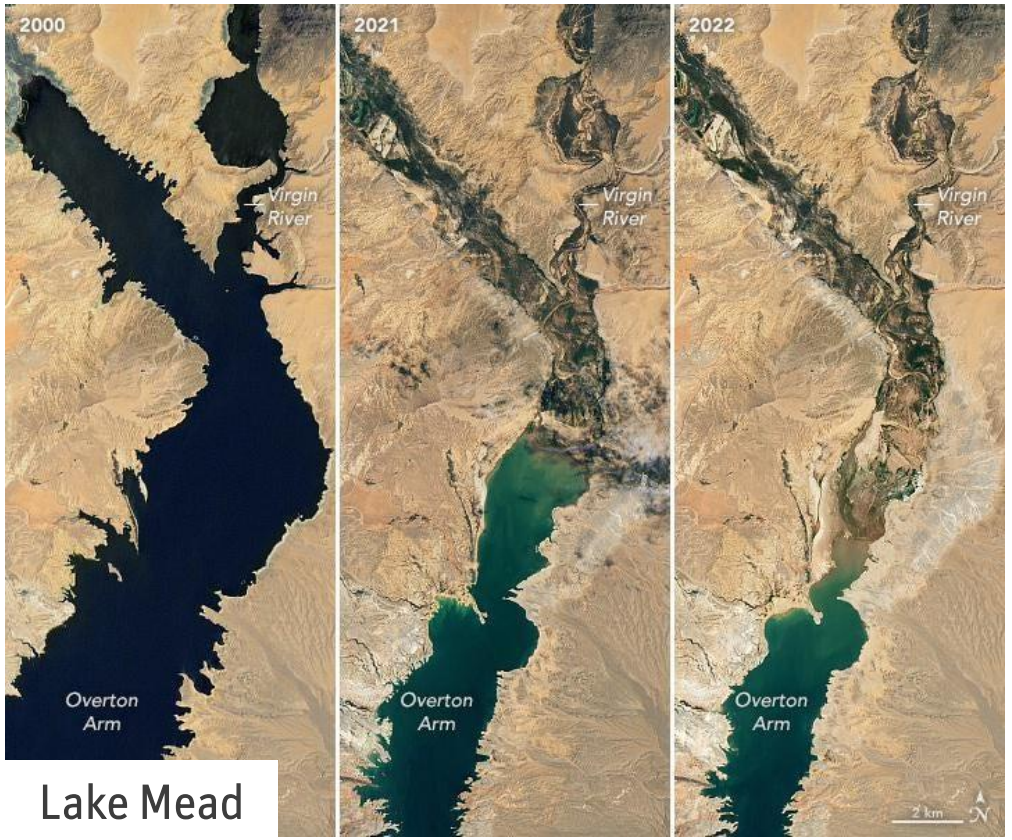
Lake Chad 1972 / 2007





Lake Mead

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Open Street Map as reference?

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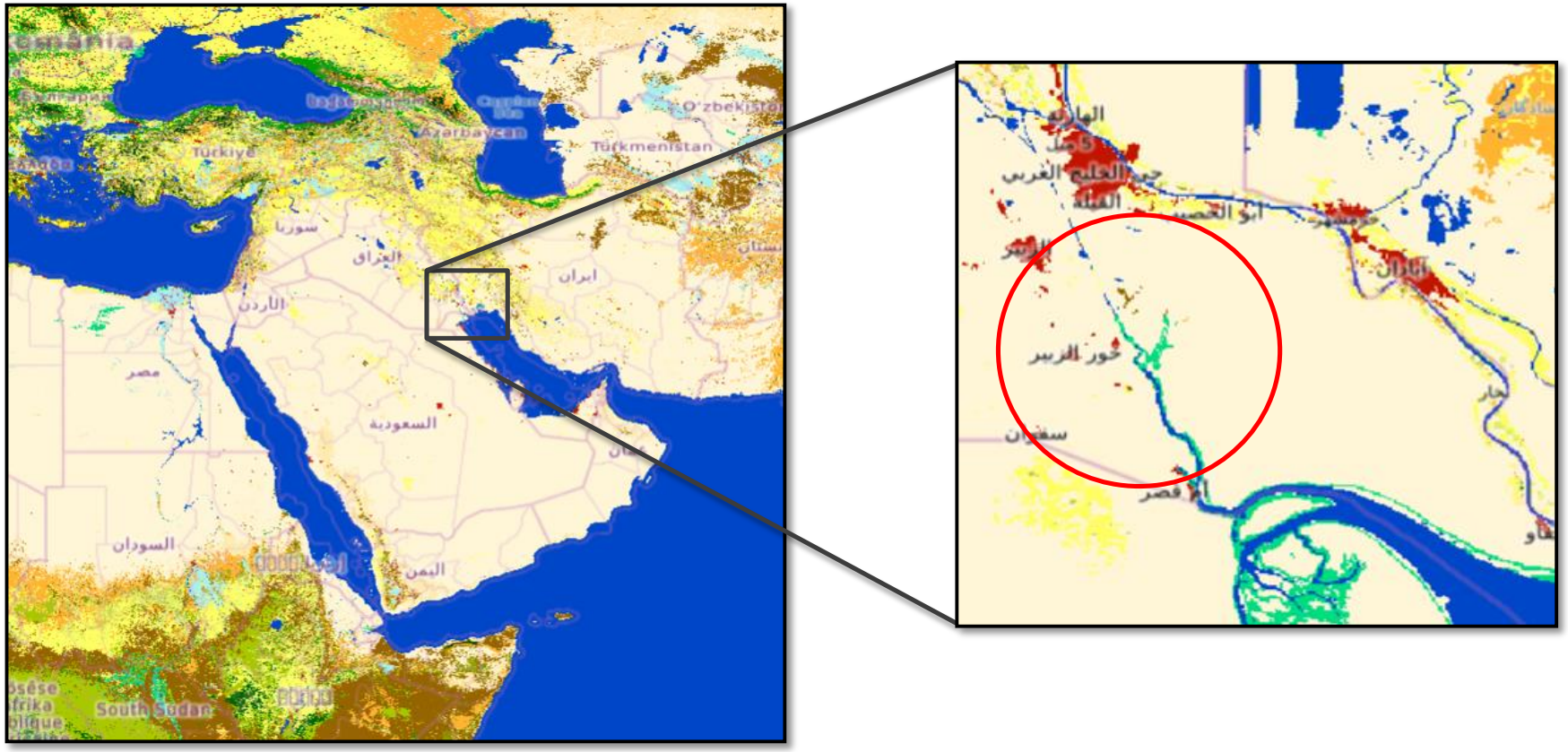
- **Climate change** effects the environment quicker than we think
- Desert and sub-tropical areas are most effected



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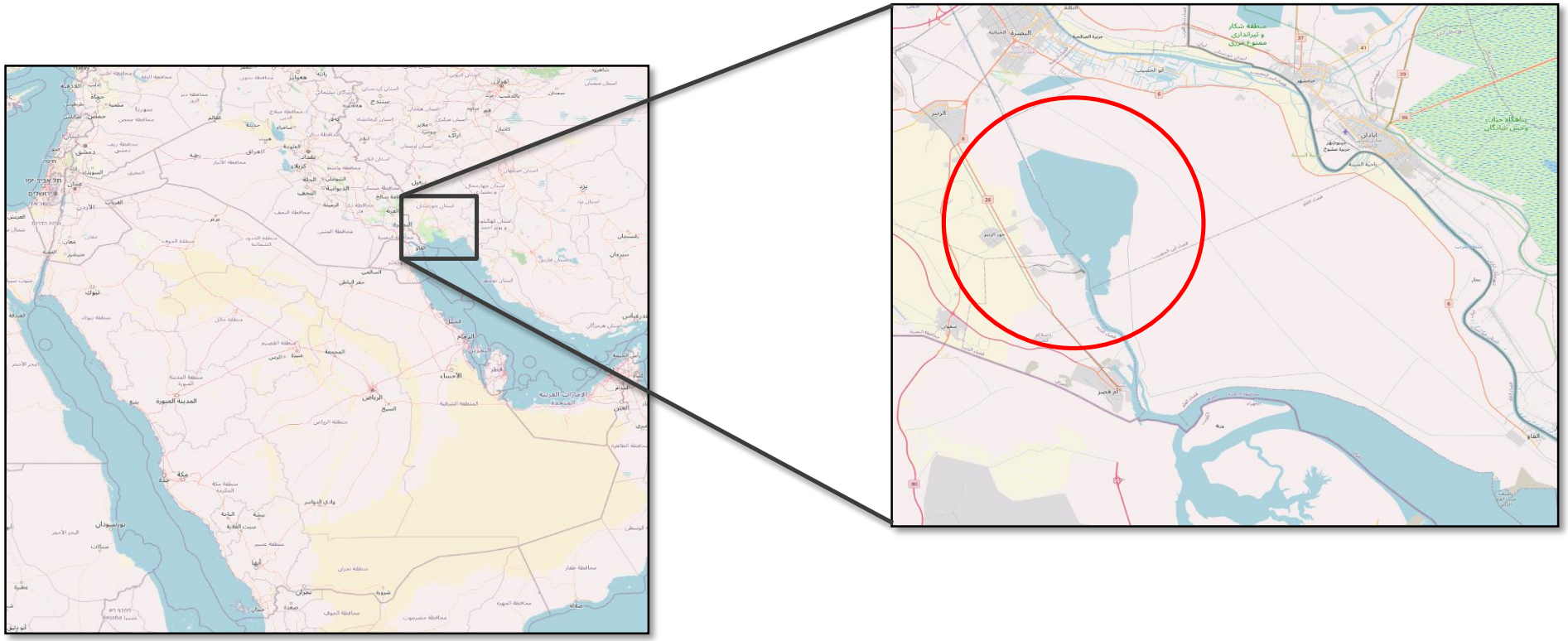
Open Street Map as reference?

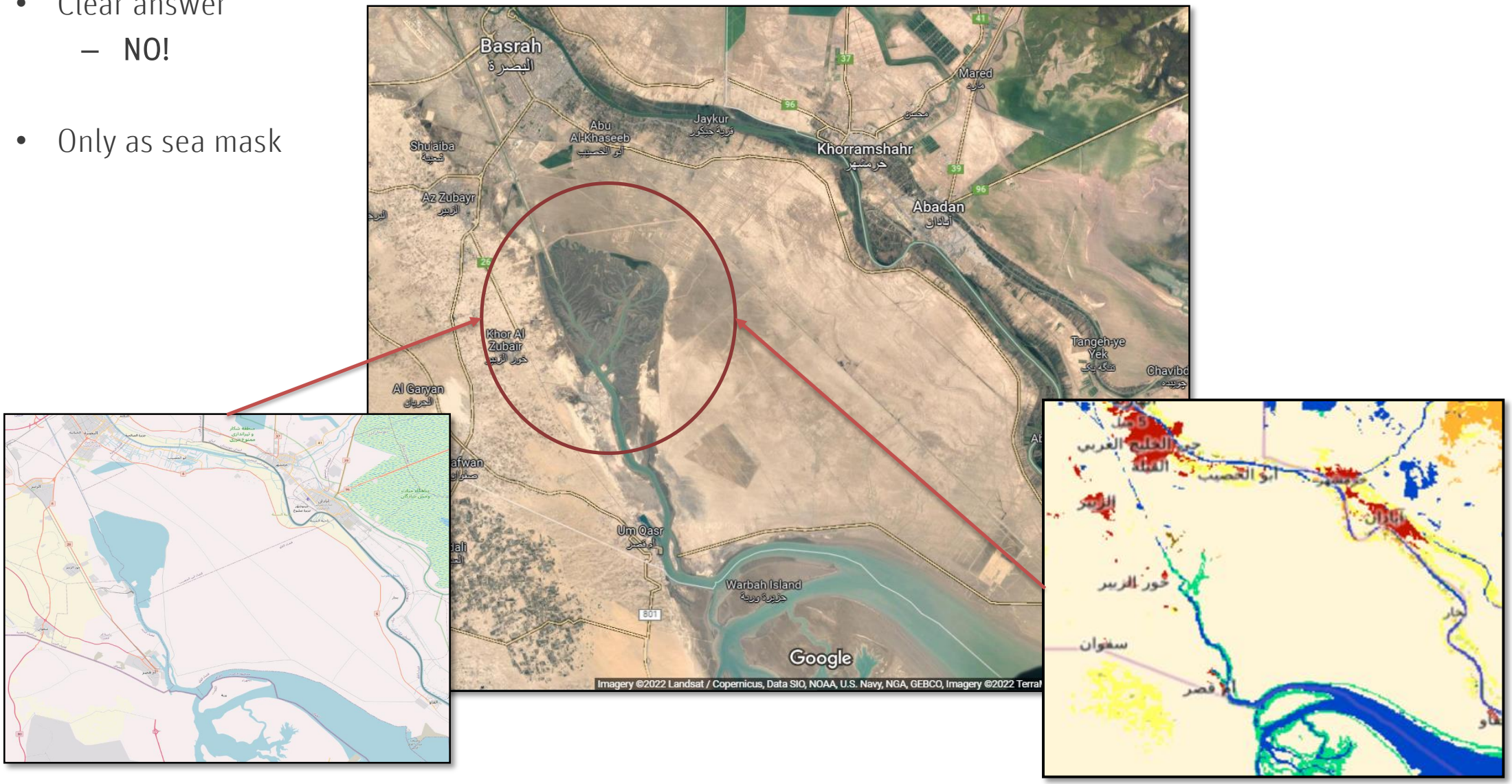
- Same area but for Open Street Map



Open Street Map as reference?

- Clear answer
  - NO!

- Only as sea mask



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GlobalLand30 – National Geomatics Center of China

- 30m resolution
  - TM5 ETM+, and OLI multispectral images of Landsat
  - HJ-1 (China Environment Satellite) and the 16-meter resolution GF-1 (China High Resolution Satellite)

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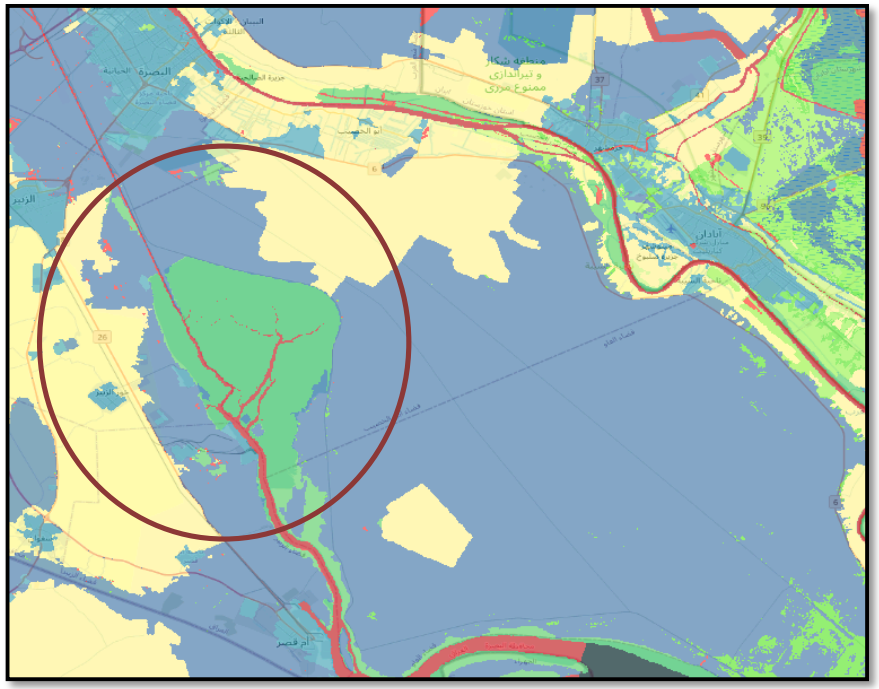

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Complete water correction

- Use **Open Street Map for Ocean** (salt water – classified as 211)
  - (Small) Islands are better covered (due to polygons)

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  - Recently generated
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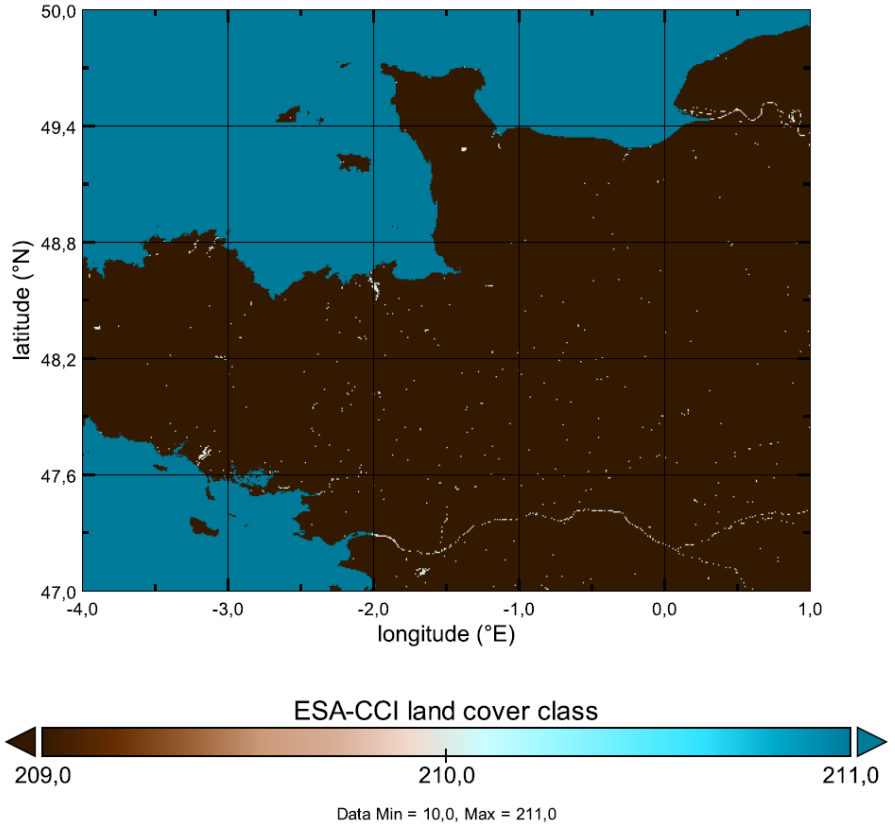

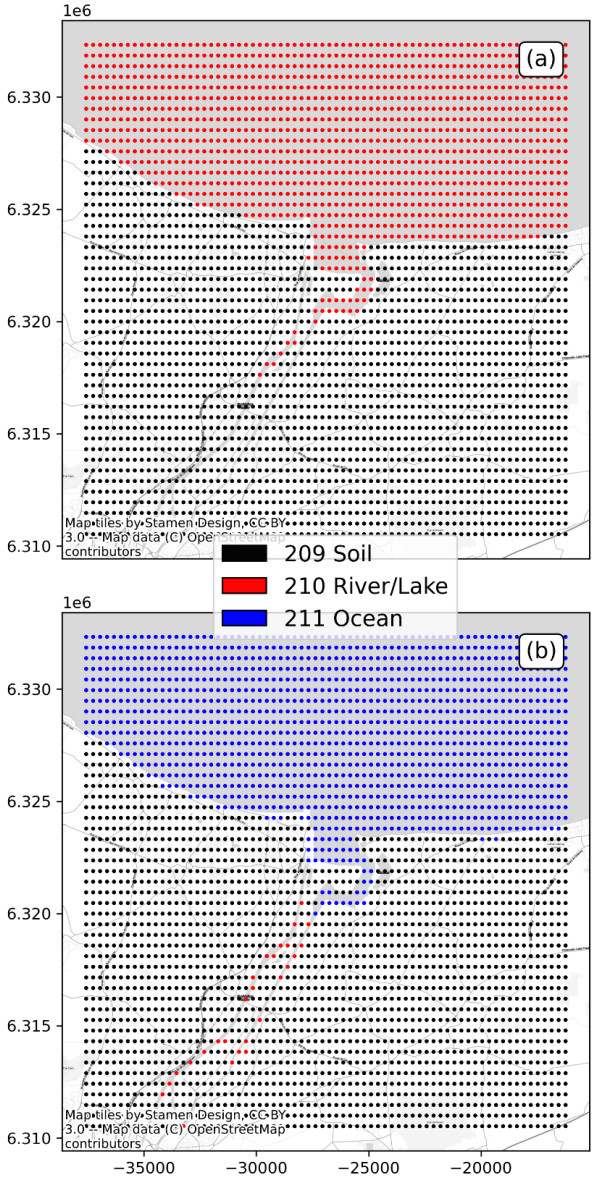

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Local Climate Zones (LCZ)

- Global map with 100m resolution (published March 2022 by Demuzere et al.)
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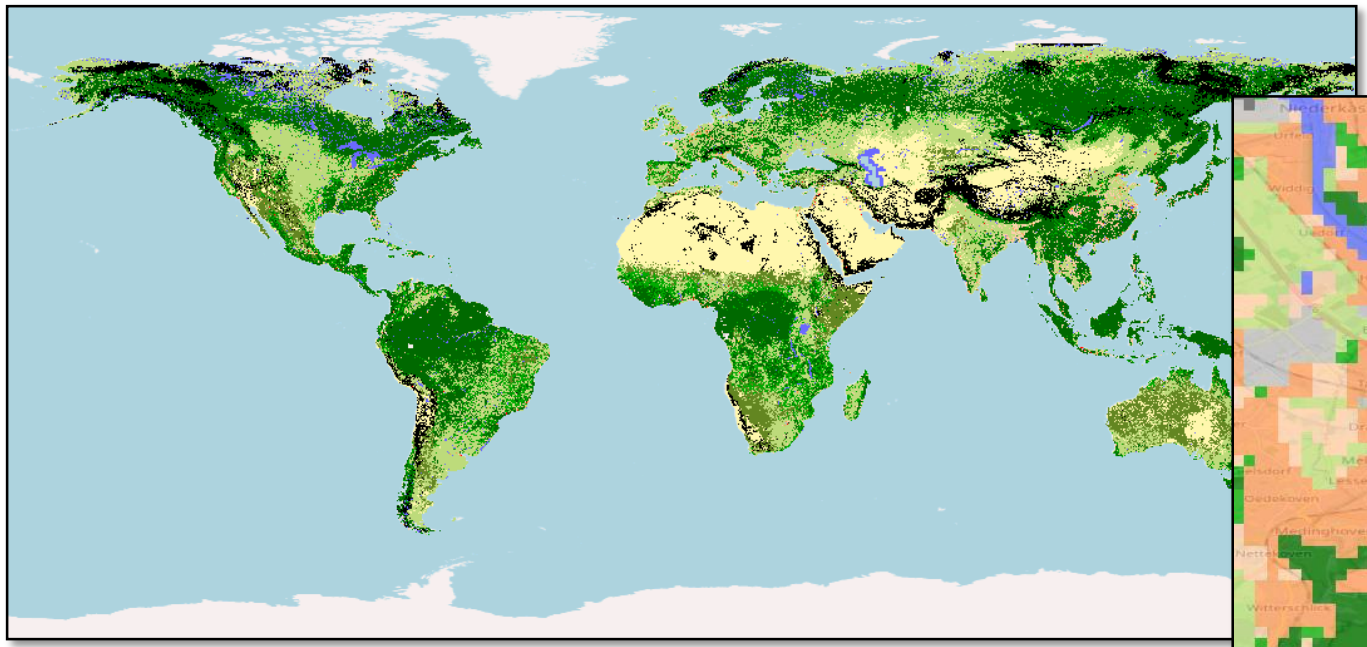

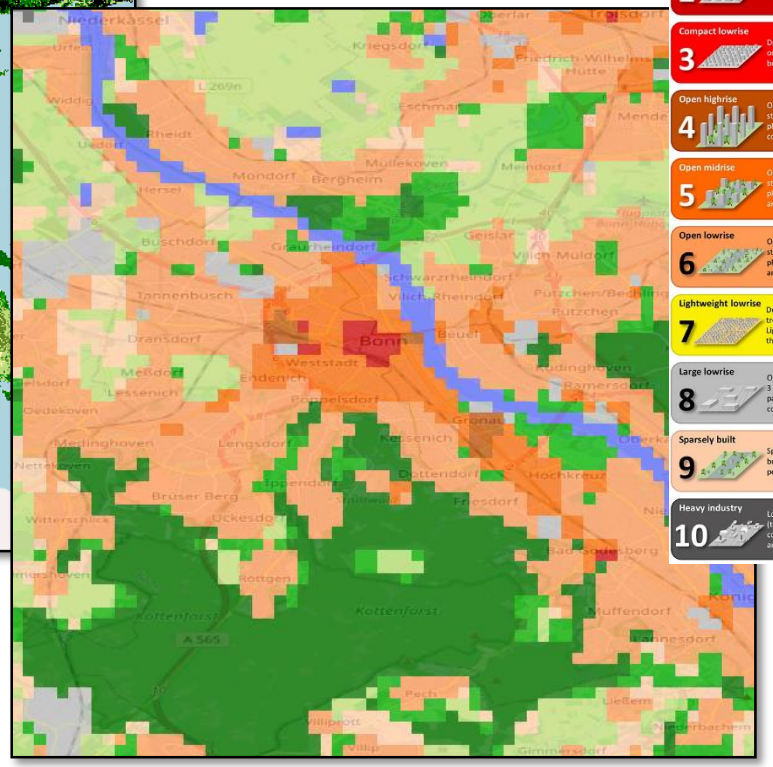

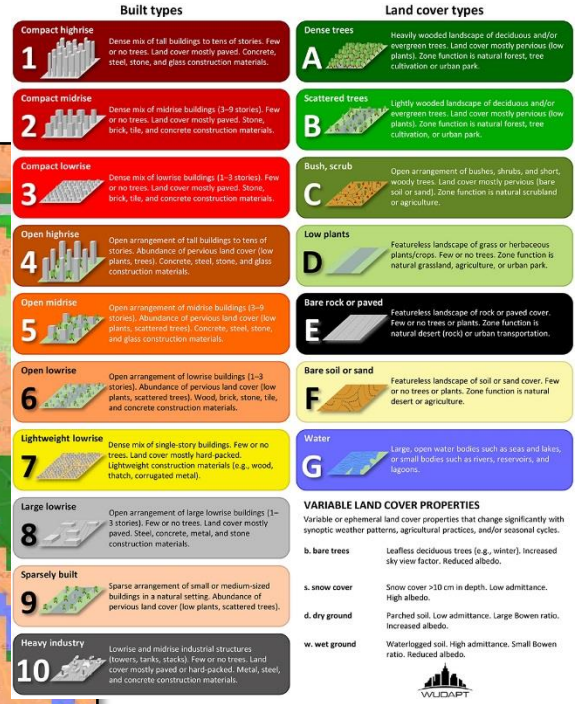

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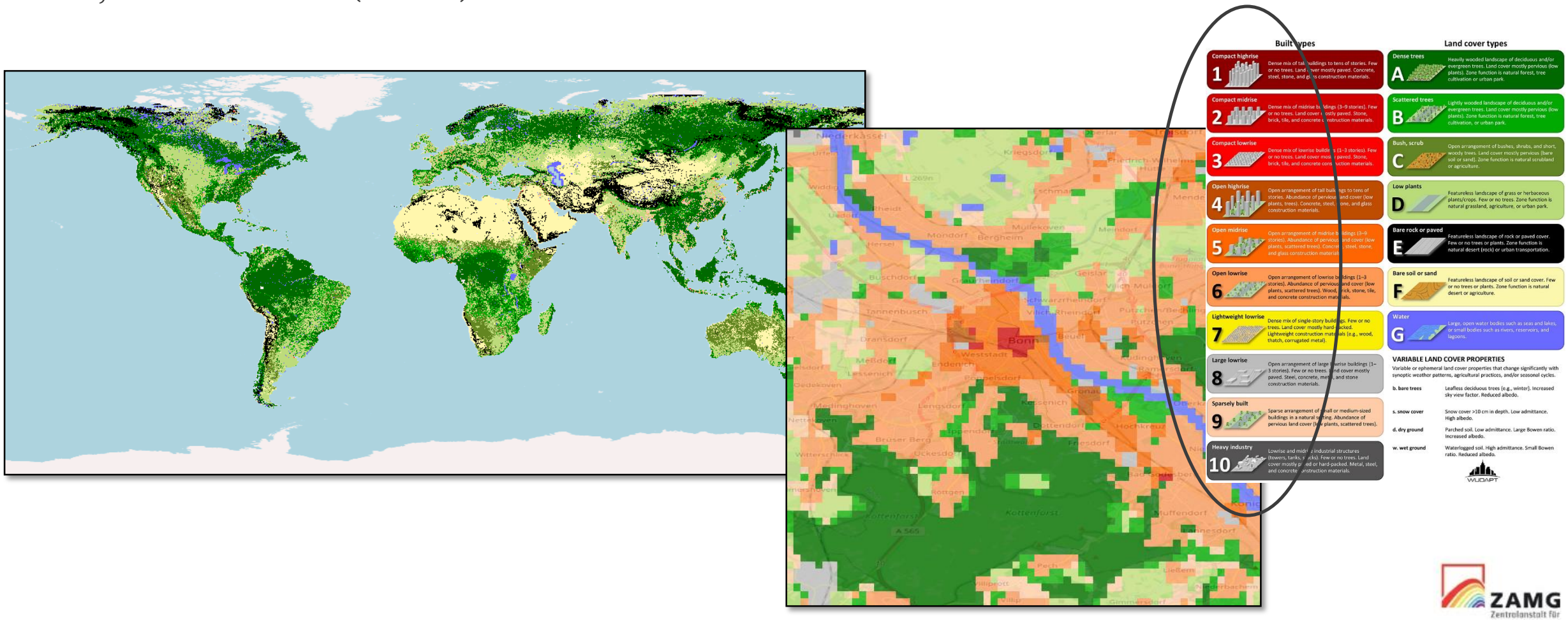

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Implement LCZ into ESA-CCI – Example of **Cologne and Bonn**

- Only urban classes which are pre-defined in ESA-CCI
  - Cells where ESA-CCI has urban classified, but LCZ not
  - → Class 6 (most common in suburban or rural areas)

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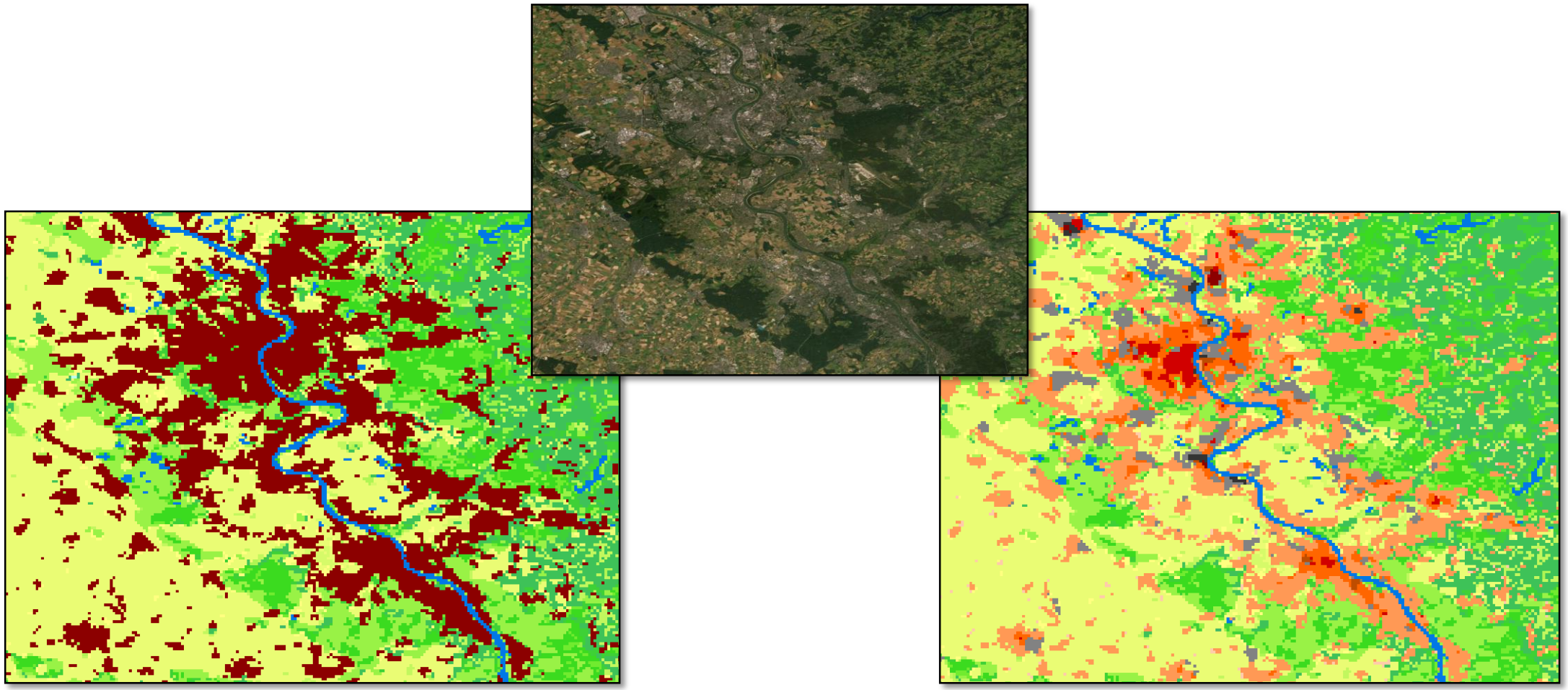

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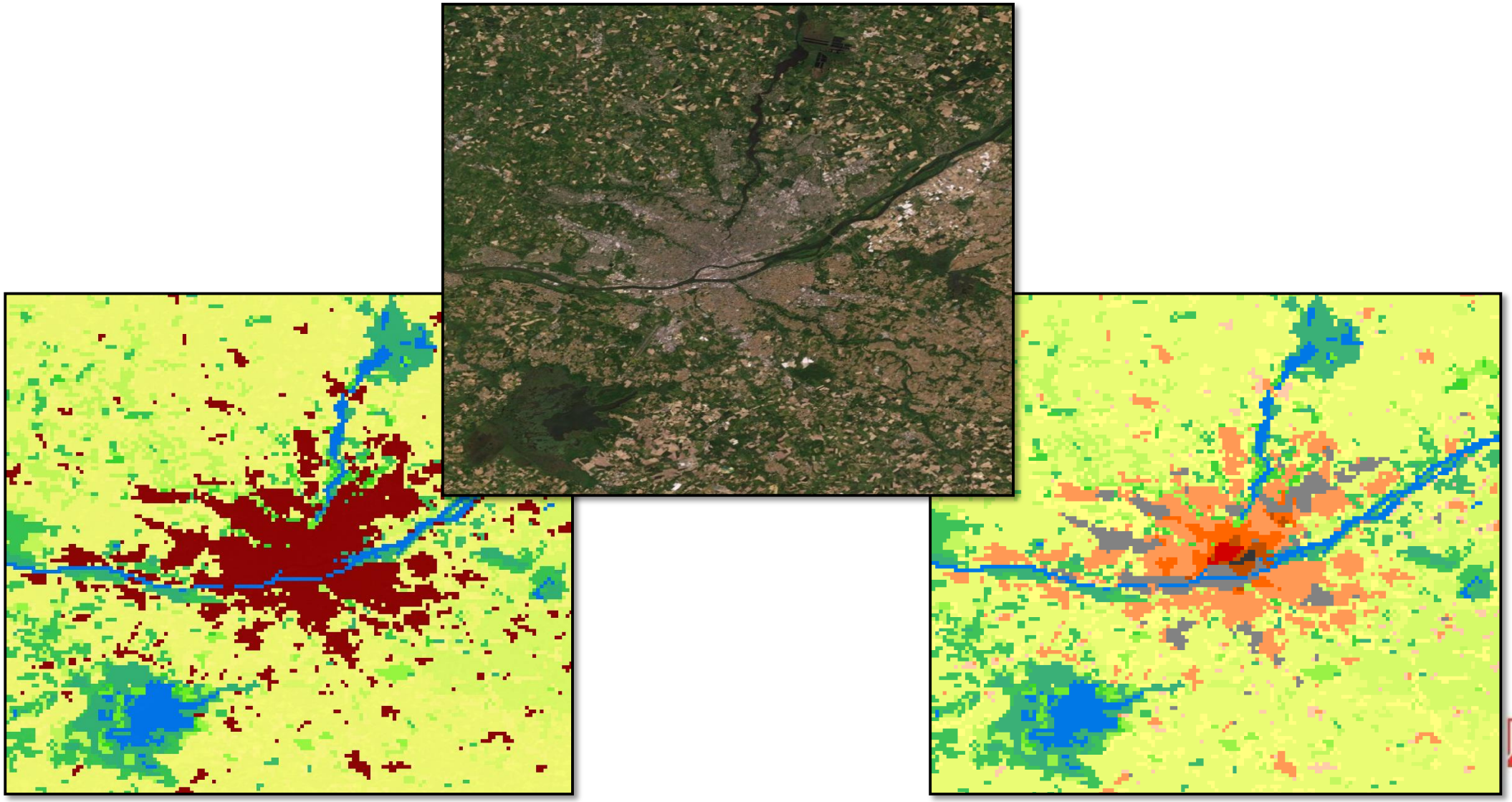

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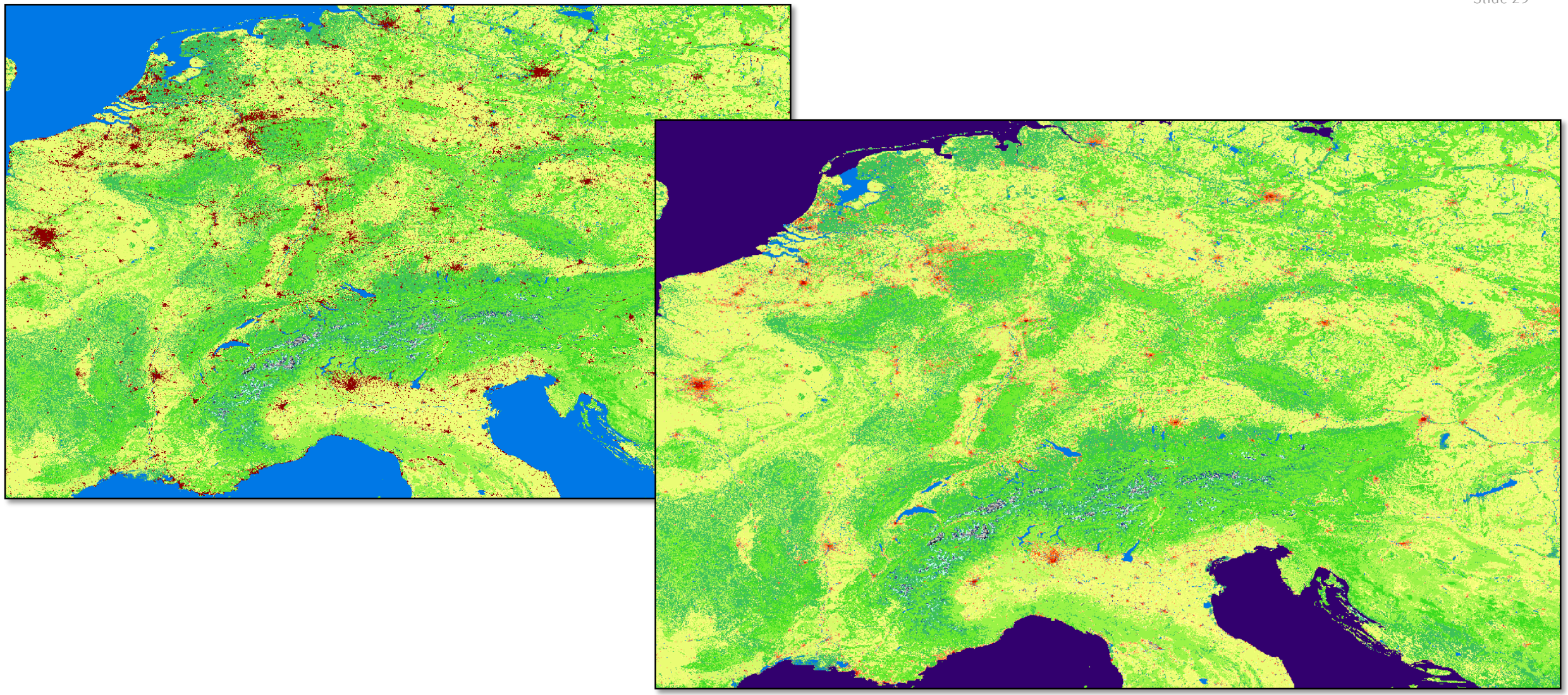
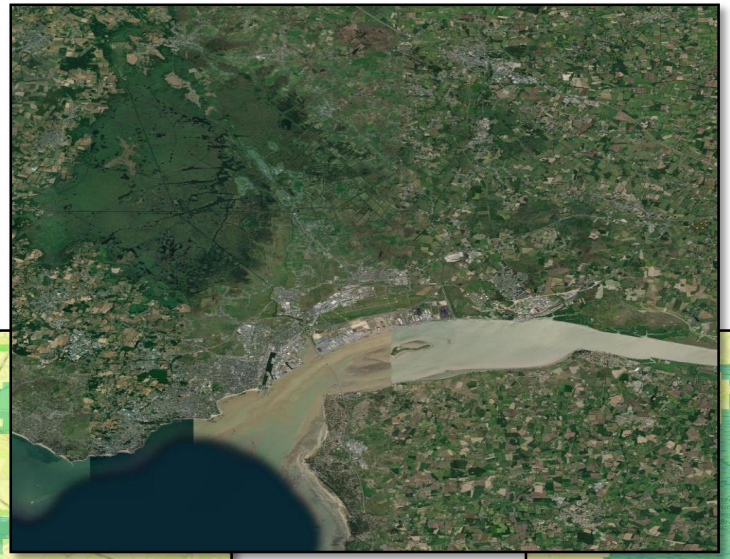
First global corrected ESA-CCI land cover map

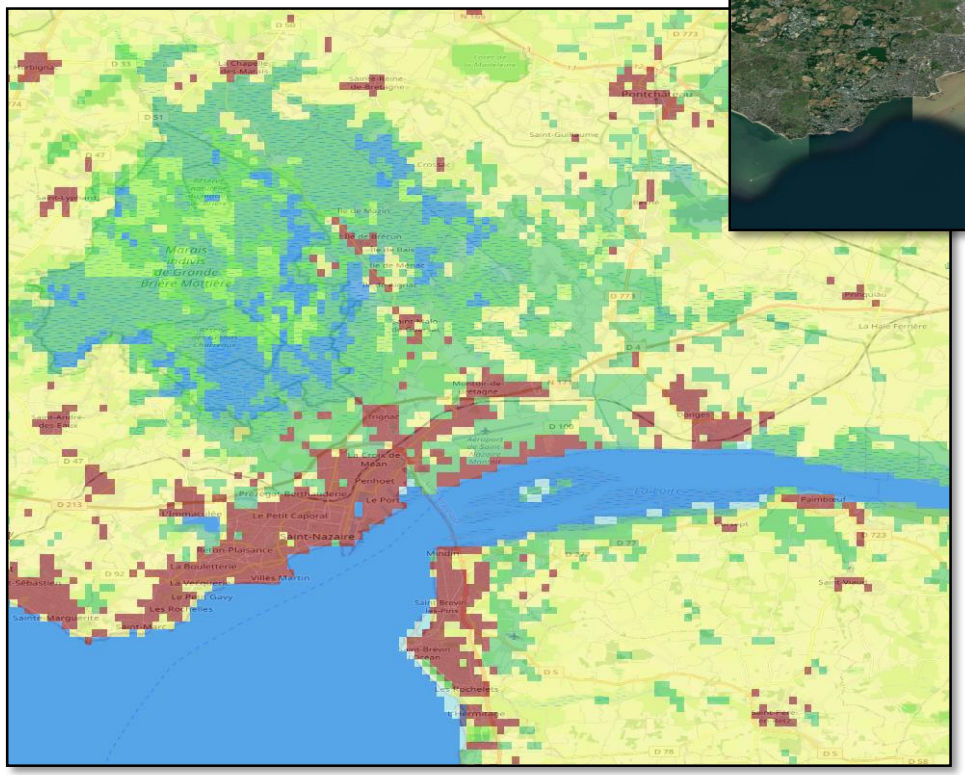
- Example for middle Europe

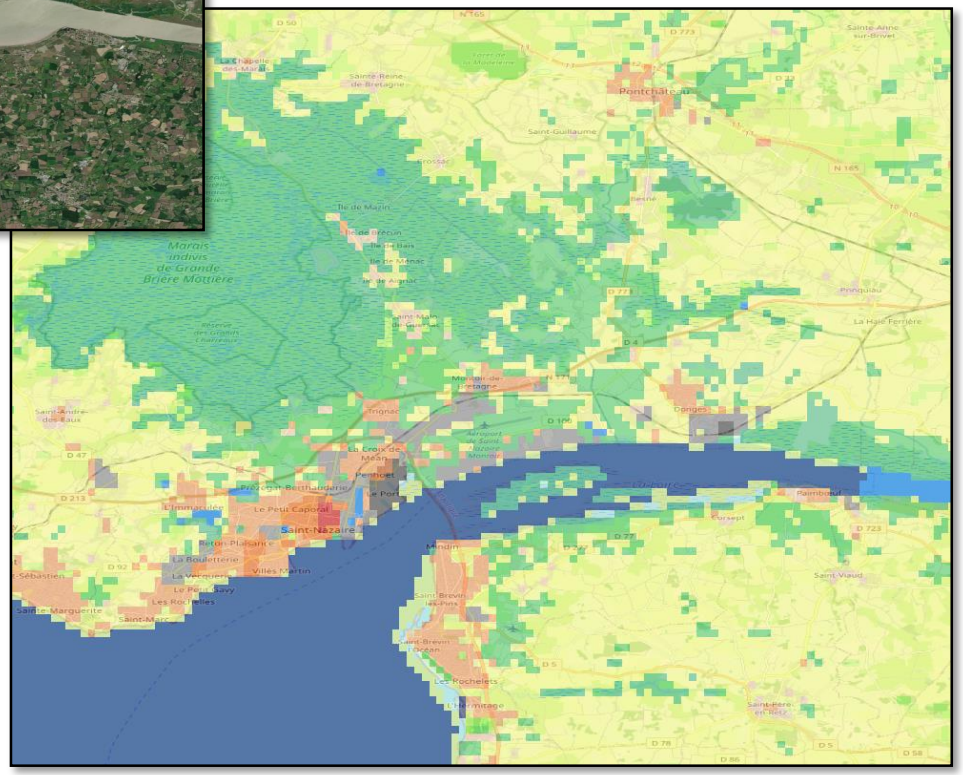


First global corrected ESA-CCI land cover map

- Example of Saint-Nazaire, France
- River mouths and their end defined by Open Street Map







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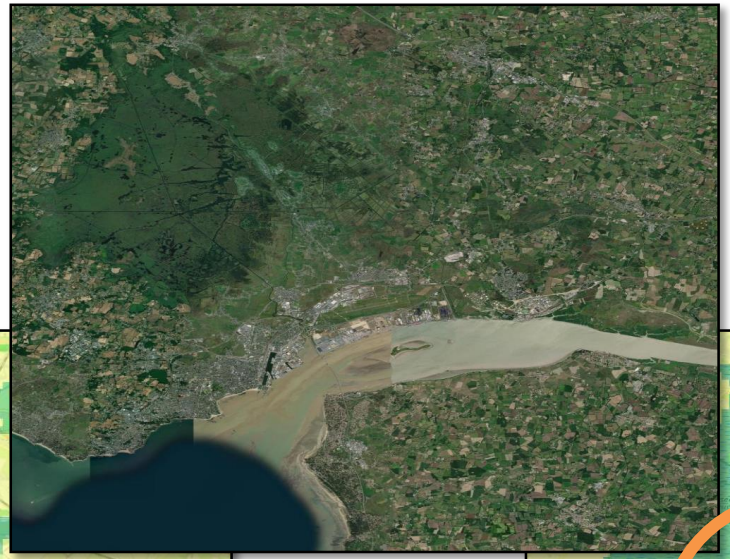
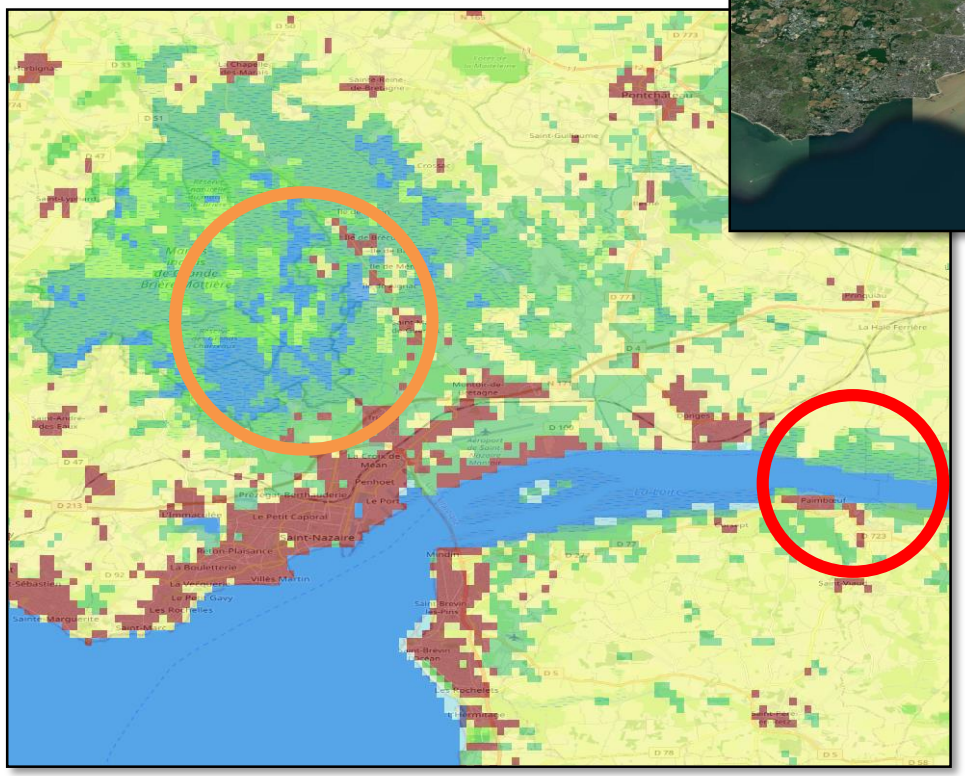
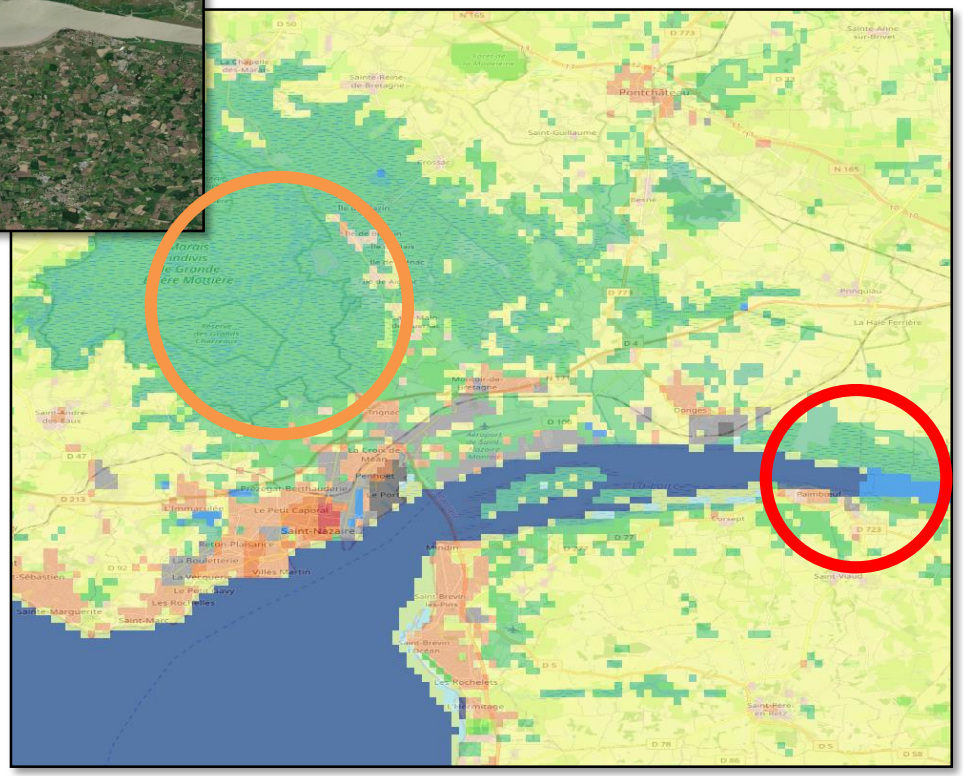
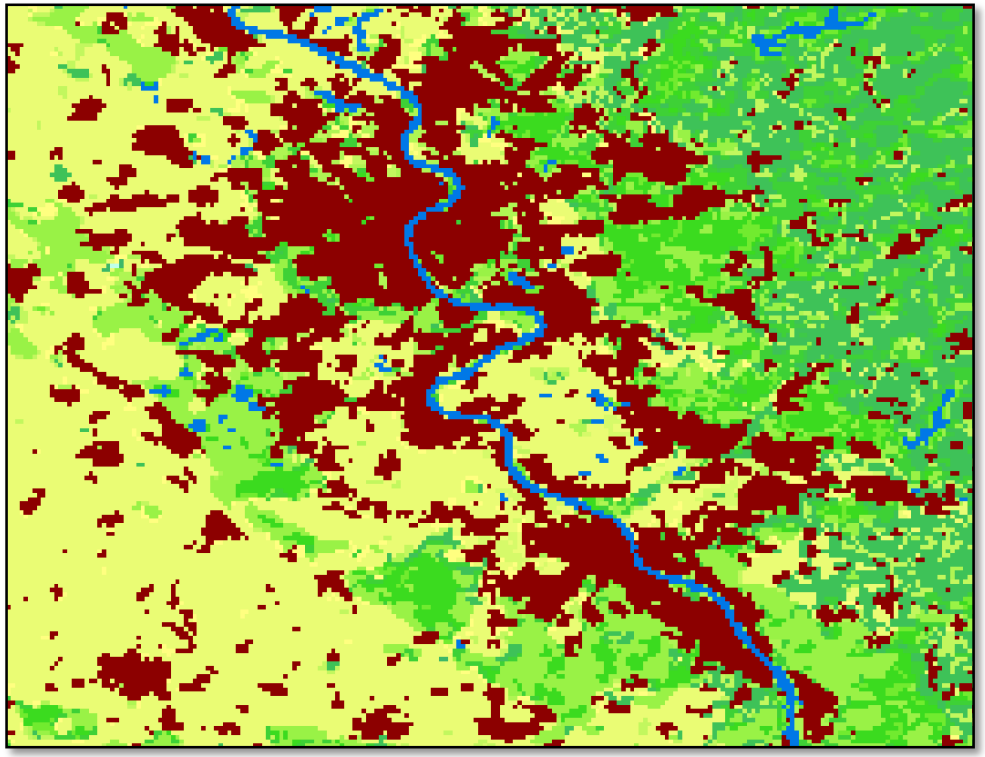


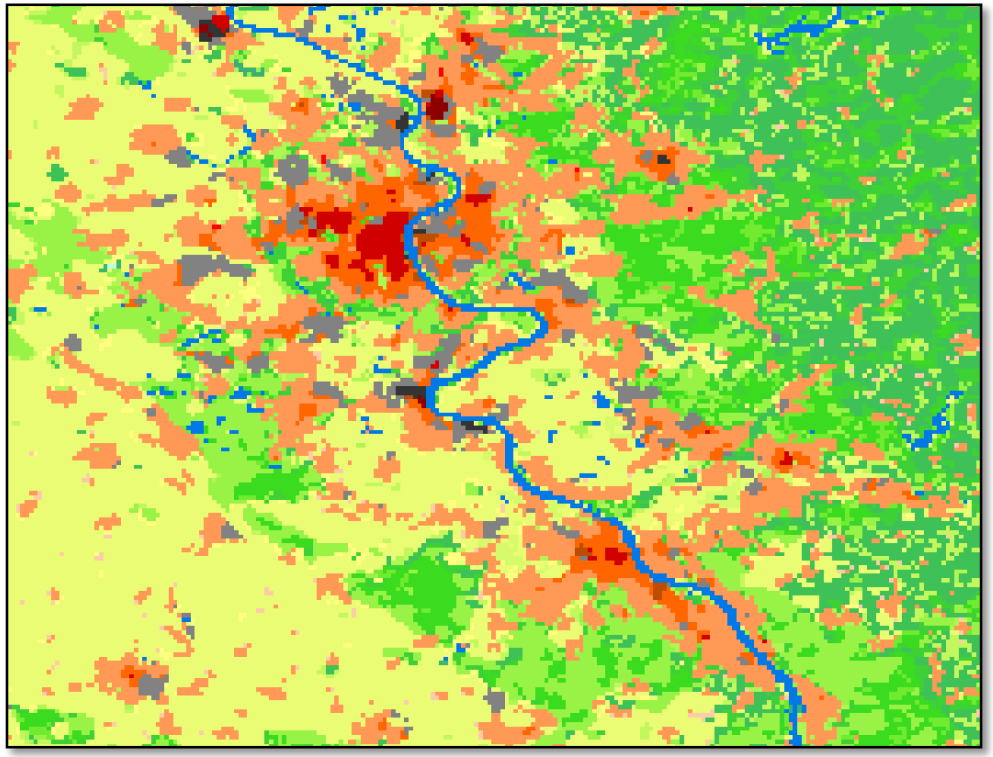




First global corrected ESA-CCI land cover map

- Example of Cologne and Bonn, Germany





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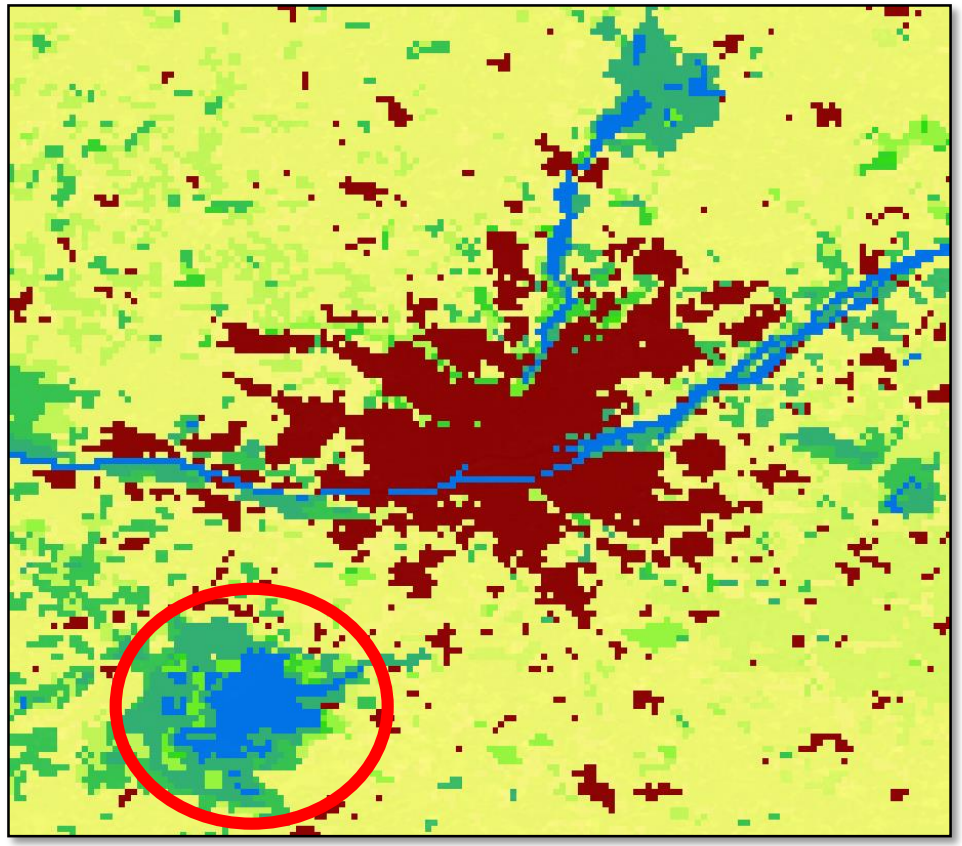

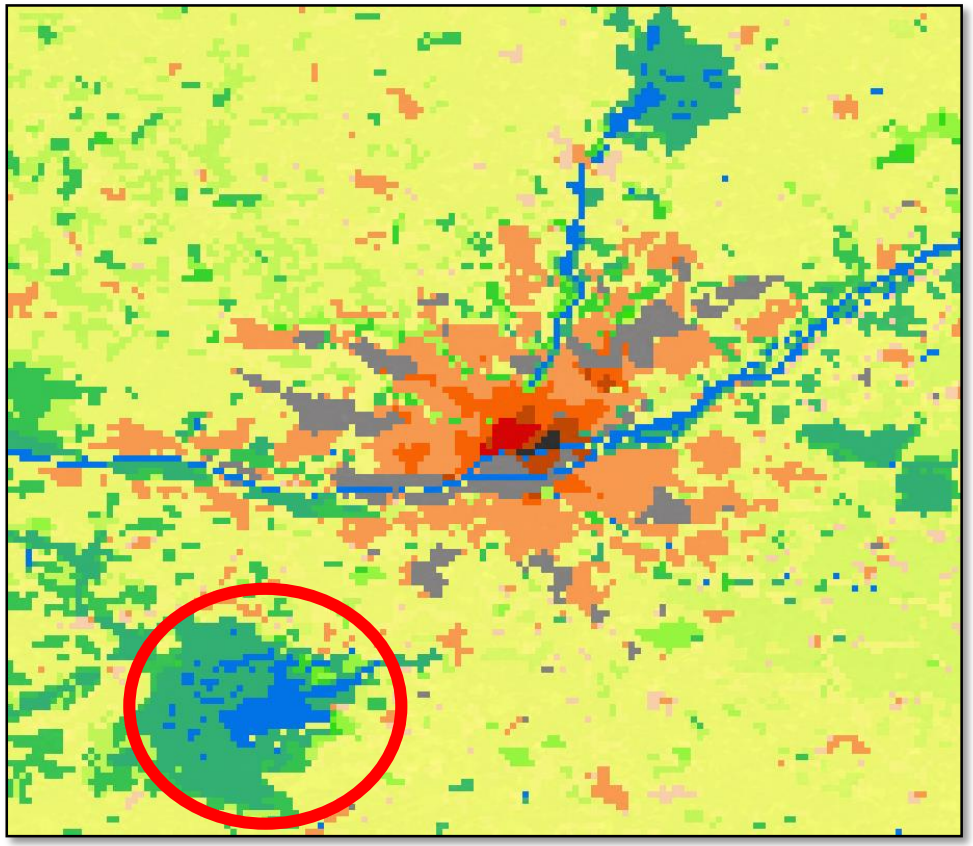

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Summary and Outlook

- Overall quality of the ESA-CCI land cover map is good…
  - …but should be modified for several NWP needs

- Here, we use the **Open Street Map**, **GlobalLand30** (China) and **Local Climate Zones** to modify
  - The distinction between salt and fresh water
  - Update rivers and lakes (rapid climate change influence)
  - Use 10 classes (LCZ pre-defined) for urban areas instead of 1

- Create a web basis where C-SRNWP members can issue wrong classifications
  - Those will be corrected as soon as possible

- Use it as reference to correct past ESA-CCI land cover maps (since 1992)?

Thank you for your attention!

Sandro Oswald
Urban climate modeling
Section Prediction models
Department Data, Methods, Models
ZAMG - Zentralanstalt für Meteorologie und Geodynamik
8053 Graz, Klusemannstraße 21

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