System of Environmental Economic Accounting

Carbon Accounts

Session 3: Introduction to the Carbon accounts (hands-on work and ARIES for SEEA model)

Regional Training Workshop on an Accounting Approaches to Climate Change Policy

Nairobi, 4-5 September 2023

United Nations

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- Introduction to SEEA EA accounts
- Other SEEA-related frameworks
- Carbon accounts
- Introduction to ARIES for SEEA
- Global regulation model (Tier 1) model in the ARIES for SEEA
- Reflections from today's session

SEEA EA Framework – Illustrative Example

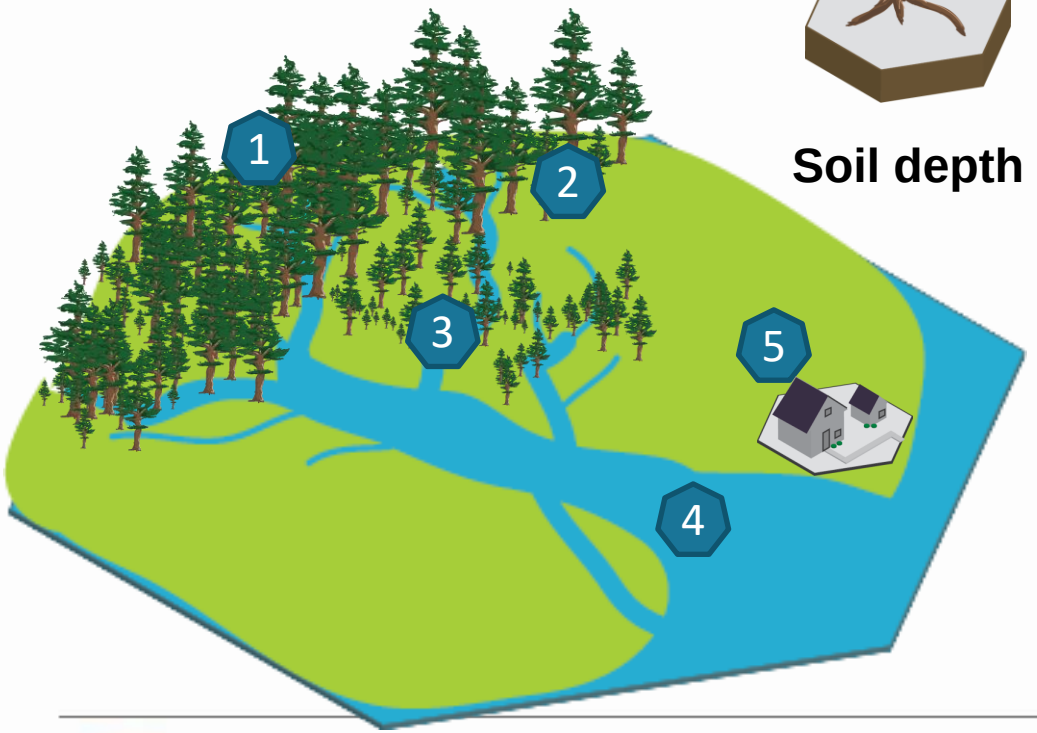
1 **Extent**

2 **Condition**

3 **Services**

4 **Benefits**

5 **Beneficiaries**



Soil depth

Water filtration

Clean water

People

Ecosystem types:

1. Forest ET (high tree density)
2. Sparse vegetation ET (shrubland)
3. Wetland ET
4. Coastal ET
5. Urban ecosystem

SEEA EA Framework – Illustrative Example

1 **Extent**

2 **Condition**

3 **Services**

Soil depth

Water filtration

Run-off (or Quickflow), which occurs when there is more water than the land can absorb and the excess liquid flows across the surface of the ground

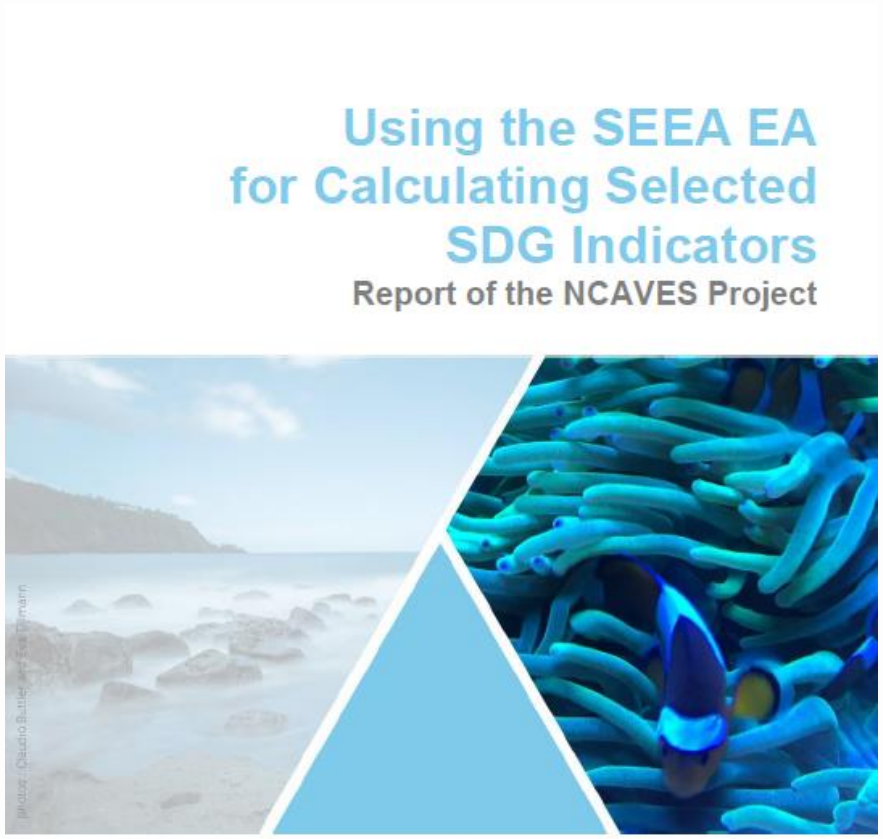
Baseflow, which is water seeping into the stream from groundwater

SEEA EA and SDGs

- SDG 15.1.1: Forest area as a proportion of total land area
- SDG 15.3.1: Proportion of land that is degraded over total land area

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

- SDG 11.7.1: Average share of the built-up area of cities that is open space for public use for all, by sex, age and persons with disabilities



Carbon accounts

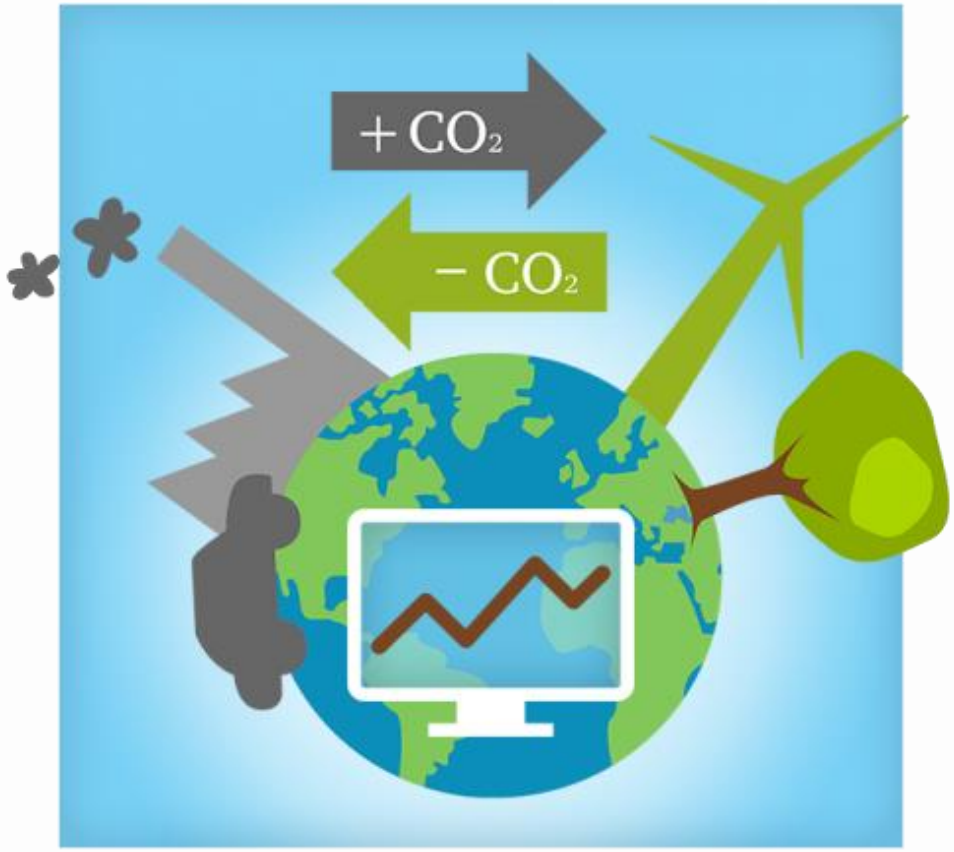
- Limiting carbon emissions is considered one of the most important action against climate change
- Carbon credits are traded globally and a fast growing market
- Accounting for a emission is a non-trivial task
- Reporting of unclear or unsuccessful mechanism has led to scandals and mistrust on the reliability of carbon credits emission:

I. The Guardian - Verra's worthless carbon offsets
II. Double counting of carbon credits in national inventories

- NCA-perspective - Two main approaches to account for greenhouse gas(es):

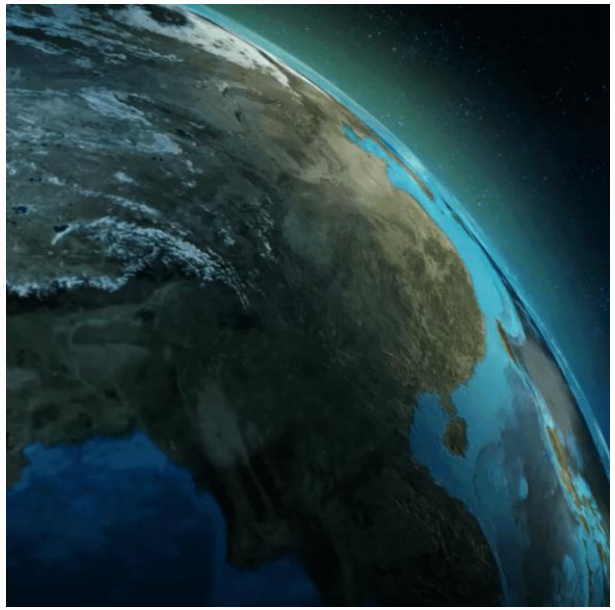
i. carbon retention (stock)
ii. carbon sequestration (fluxes)

- IPCC 2006 default factors -> Guidance that officially governs the current submission of GHG inventories



ARIES for SEEA

for rapid, standardized account creation



- Global, customizable models approach enables:
  ⟹ **SEEA EA compilation**[1]
- **Faster & easier** to learn than other biophysical modeling approaches
- **Automate production** of accounting tables, maps & reports
- Support adoption of SEEA EA providing an **easy-to-use application**
- Infrastructure for the SEEA community to **share & reuse** interoperable data & models

SEEA

1: anywhere on the earth with global data,
but models can be improved using local data (and models) where available.

Global Climate Regulation

Total ecosystem carbon storage is computed as **the sum of the carbon mass stored in aboveground and belowground vegetation**, plus the amount stored in the first 200 cm of **soil**. The results are expressed in CO_2 tons/he

Methodology

Vegetation carbon storage (summed aboveground and belowground biomass carbon), using a multilayer lookup table[1] based on:

I. Land cover type
II. Ecofloristic region (FAO classification)
III. Continental region
IV. Presence of frontier forests (i.e., intact forest landscapes a proxy for forest age)
V. Recent occurrence of fires

Caveats to the Ruesch and Gibbs model

- Does not account for **forest age** or **successional stage** (aside from presence of frontier forests and burned areas)
- Potential **errors at the edges** of continents or ecoregions
- Data are not provided for carbon storage in wetlands
- Introduce a model to address this limitation in mangroves

1: This method was first published by **Ruesch,** Aaron, and Holly K. Gibbs. **2008**. New IPCC Tier-1 Global Biomass Carbon Map for the Year 2000. Available online from the Carbon Dioxide Information Analysis Center [http://cdiac.ornl.gov], Oak Ridge National Laboratory, Oak Ridge, Tennessee

Simplified version of multi-layer look-up table to model above & belowground carbon storage

land_cover_type	ecofloristic_region	continental_region	frontier_forest	burned_land	carbon_stock
landcover:BroadleafForest	ecology:TropicalRainforest	geography:AfricanRegion	*	false	200
landcover:BroadleafForest	ecology:TropicalRainforest	geography:NorthAmericanRegion	*	false	193
landcover:BroadleafForest	ecology:TropicalRainforest	geography:SouthAmericanRegion	*	false	193
landcover:BroadleafForest	ecology:TropicalRainforest	geography:AsianRegion	*	false	180
landcover:BroadleafForest	ecology:TropicalRainforest	geography:InsularAsianRegion	*	false	225
landcover:BroadleafForest	ecology:TropicalRainforest	geography:AustralianRegion	*	false	199.5
landcover:BroadleafForest	ecology:TemperateContinentalForest	geography:AsianRegion	false	false	14
landcover:BroadleafForest	ecology:TemperateContinentalForest	geography:EuropeanRegion	false	false	14
landcover:Forest	ecology:BorealMountainSystem	*	false	true	4.5
landcover:BareArea	*	*	*	*	1
landcover:WaterBody	*	*	*	*	0
landcover:ArtificialSurface	*	*	*	*	0

Ecosystem accounts compilation

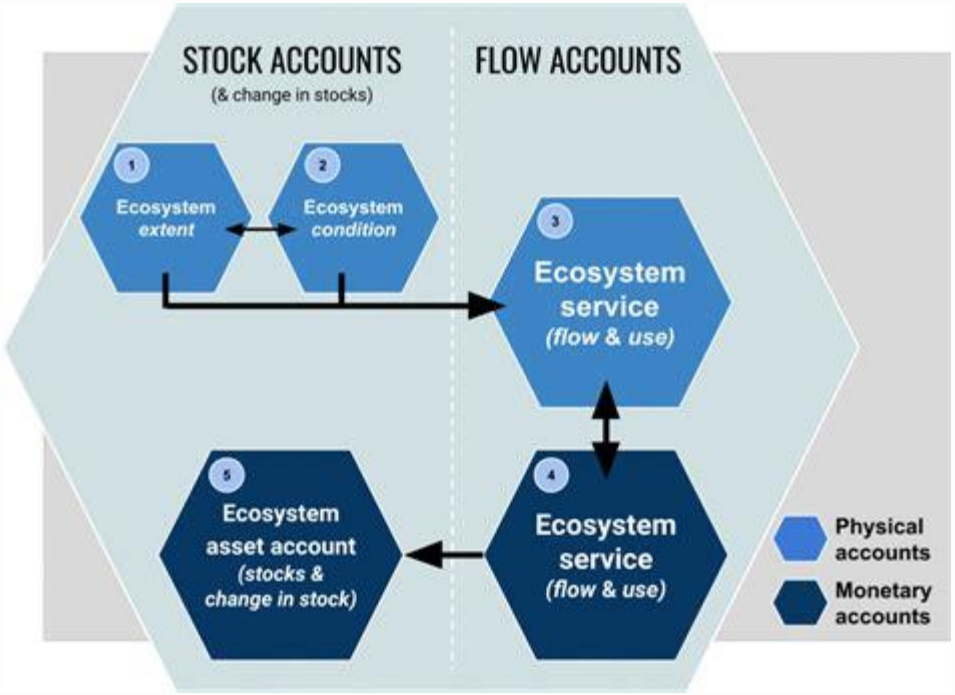
- Facing similar challenges comparable to compilation of energy accounts
- Potentially more challenging due to the need to **combine statistics with geospatial data**
- Challenges in **data collection and harmonization** of datasets across different areas (data may be already in-house but used for other goals) -> demand global production of **accounts-ready data**
- Biophysical modelling is even more complex due to the **uncertainty** added:

I. **Estimates** of biophysical output, a perfect model does not exist (geospatial vs statistics approach)
II. Learn **work-around** and find solutions when data is not perfect/available (be brave and smart!)

- Learn from one another / what's our role:

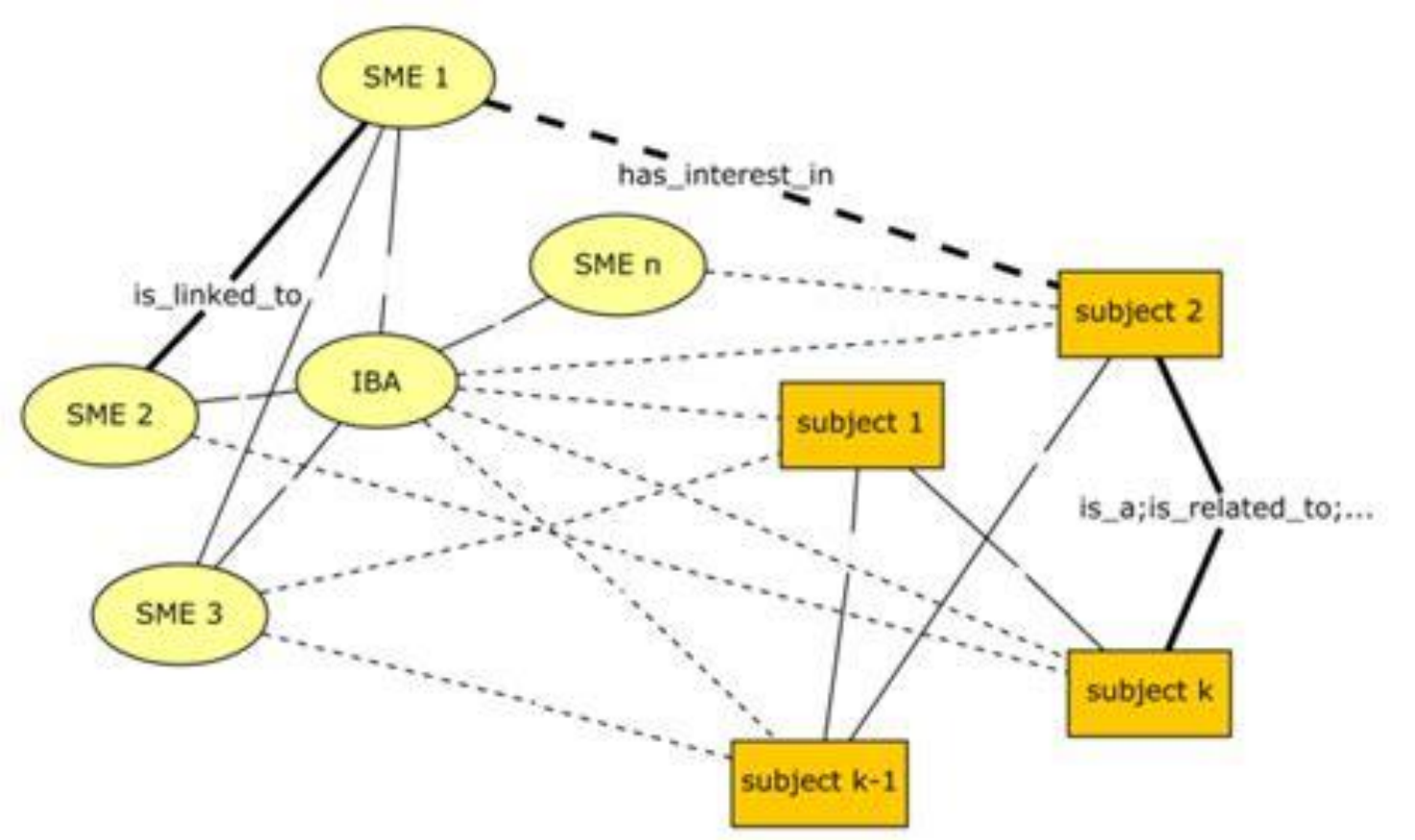
I. To **facilitate compilation** of accounts
II. **Integrating** national/local **(your) knowledge**
III. **Building capacity** together (in both ways)

- How to convince our government that EA is important? Tier1 demonstration



Let's work on an example

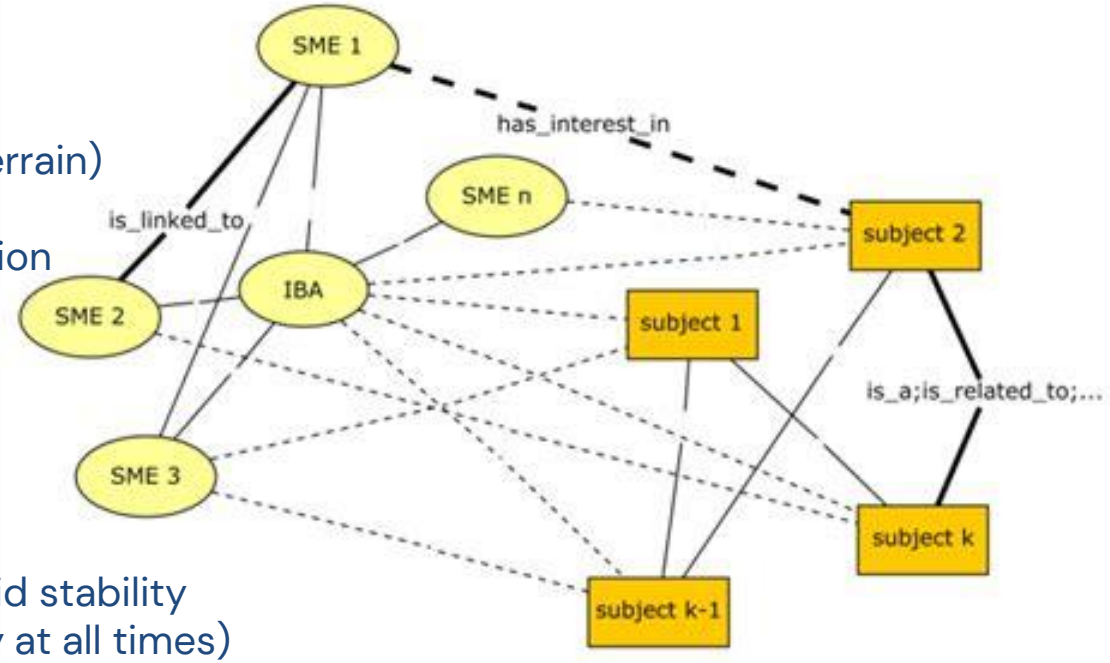
How to **model a network** to identify **most effective construction of grid connection. Any ideas?**



Let's work on an example

How to **model a network** to identify **most effective construction of grid connection. Any ideas?**

- Natural resources available: sun, inshore and offshore wind, geothermal, others?
- Existing infrastructure: power plants, gas-grid, electricity-grid
- Physical hindrances and landscape characteristics (rivers, mountain, terrain)
- Environmental obstacles (presence of protected areas or fauna migration corridors for fauna, issue related with a dam construction)
- Proximity to city and people
- Construction costs (engineering POV)
- Technology development and alternatives (energy storage strategy, grid stability as intermittent/renewable energy is added – meet demand and supply at all times)
- Match demand and supply to obtain more effective, timely and cost effective strategy



System of Environmental Economic Accounting

Thank you for your attention!

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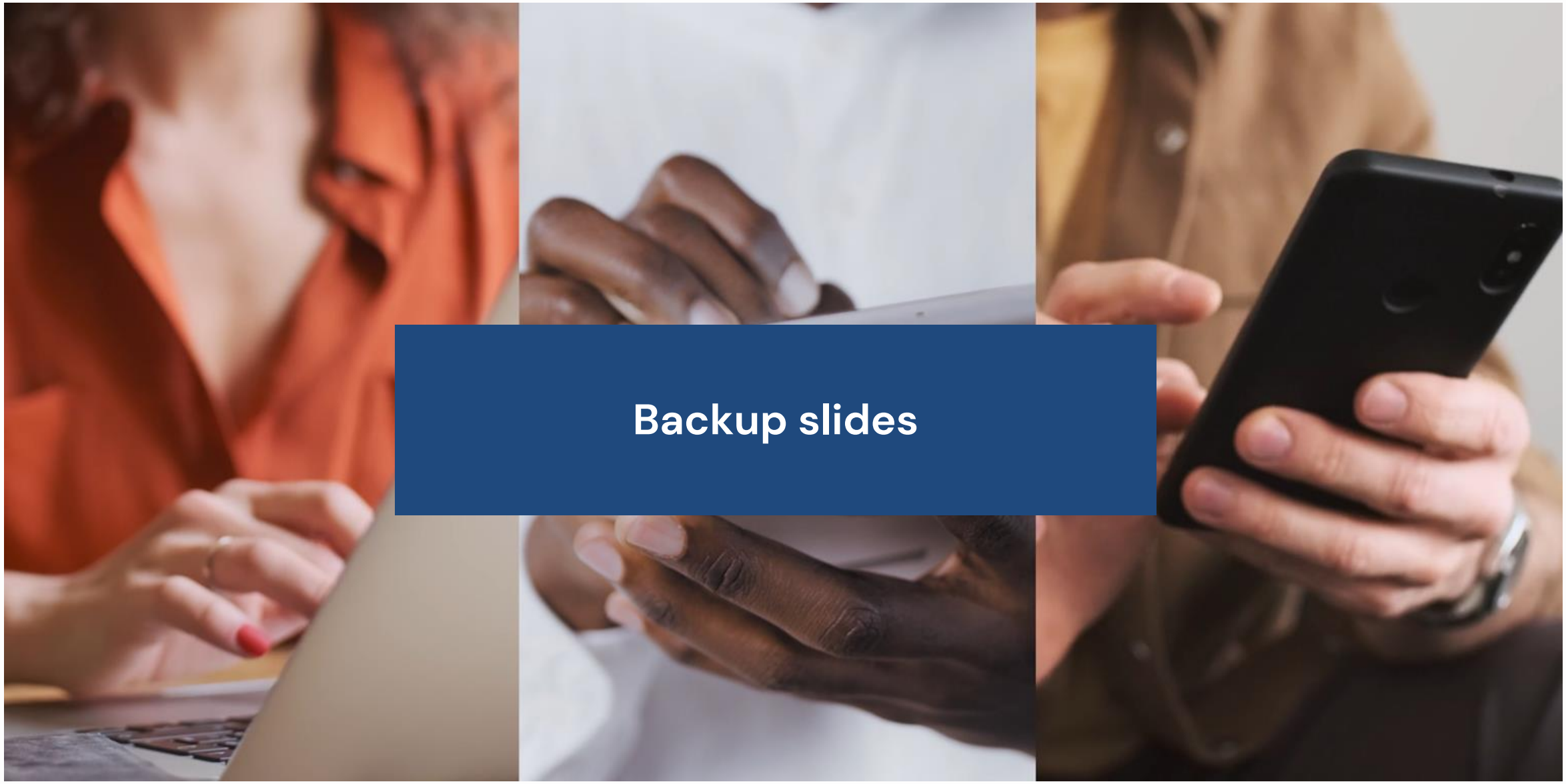


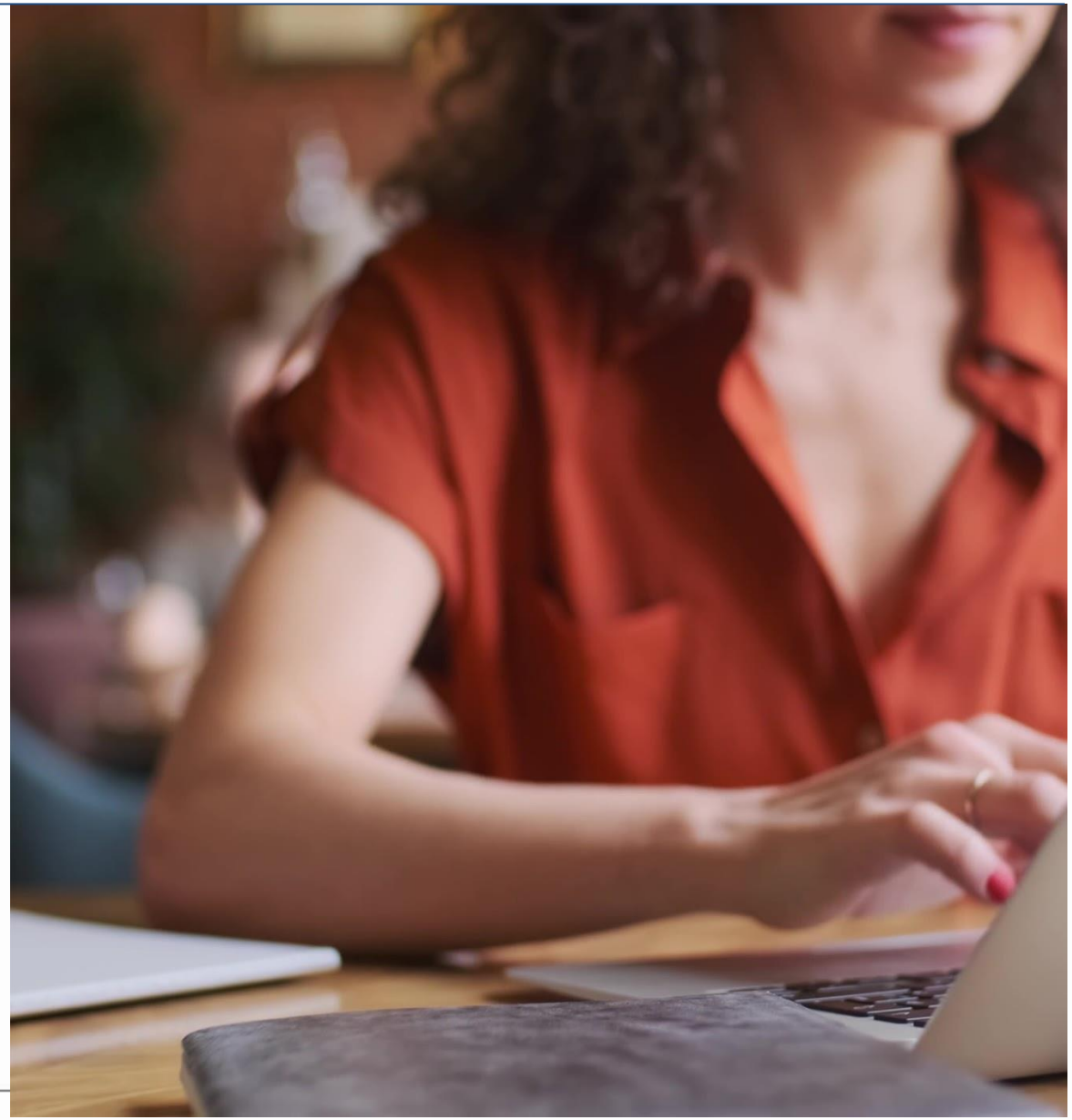
Backup slides

Access the application

1. The first step is to **register** in the Integrated Modelling hub
2. Once created a profile, **access the link** to launch the application from your browser (or download the Control Center – the software for modelers, and install it on your engine)
3. Use the intuitive user-interface to **compile account(s) everywhere on earth**

Useful links to explore

1. ARIES for SEEA explorer
2. Registration in the IM hub
3. Technical note
4. YouTube channel
5. Write us for support at support@integratedmodelling.org or for if you're interested to join our modelling journey at aries@integratedmodelling.org

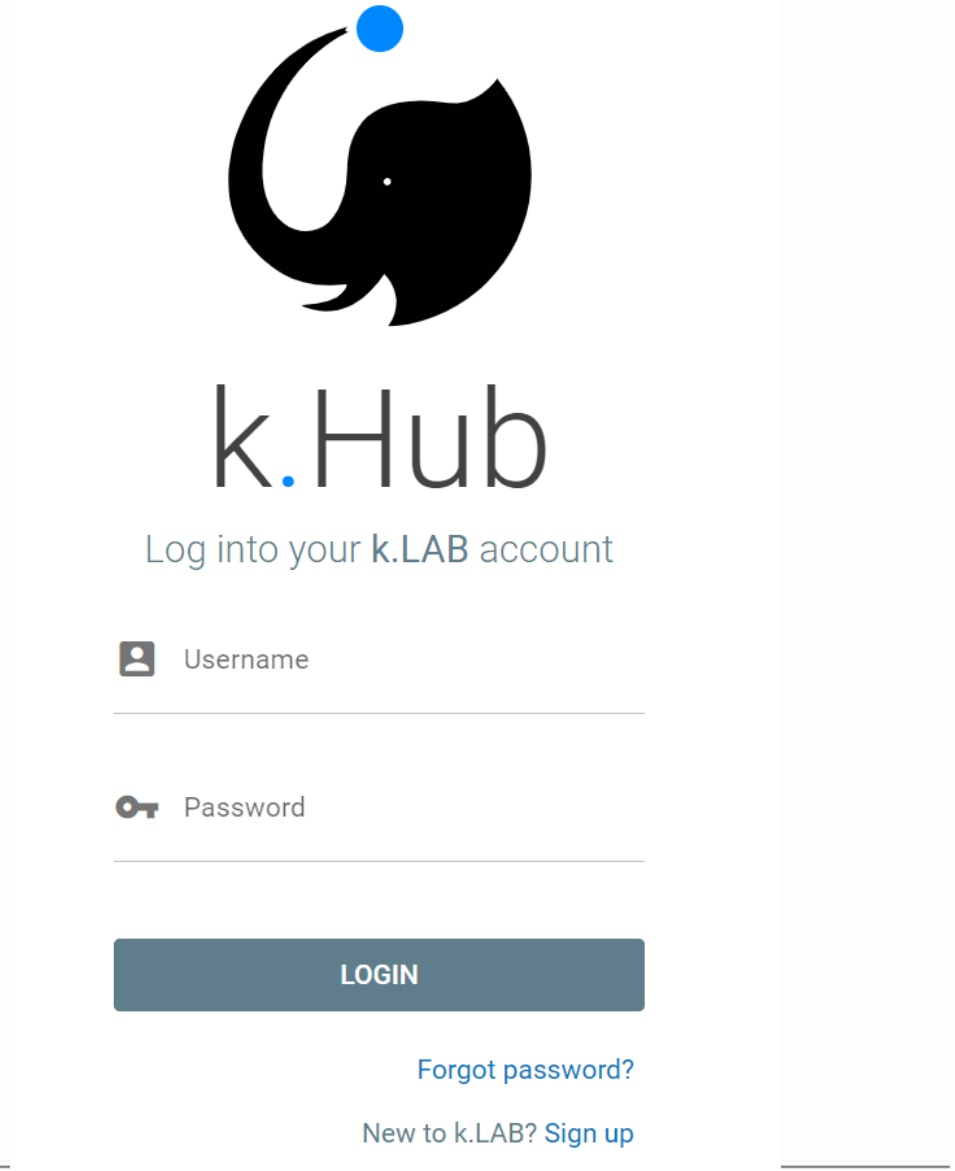


Sign up

A k.Hub account is needed to access the ARIES for SEEA functionalities.

The creation of an account only requires an email address, through which the signing up process will be confirmed.

video on the steps to sign up



Useful links

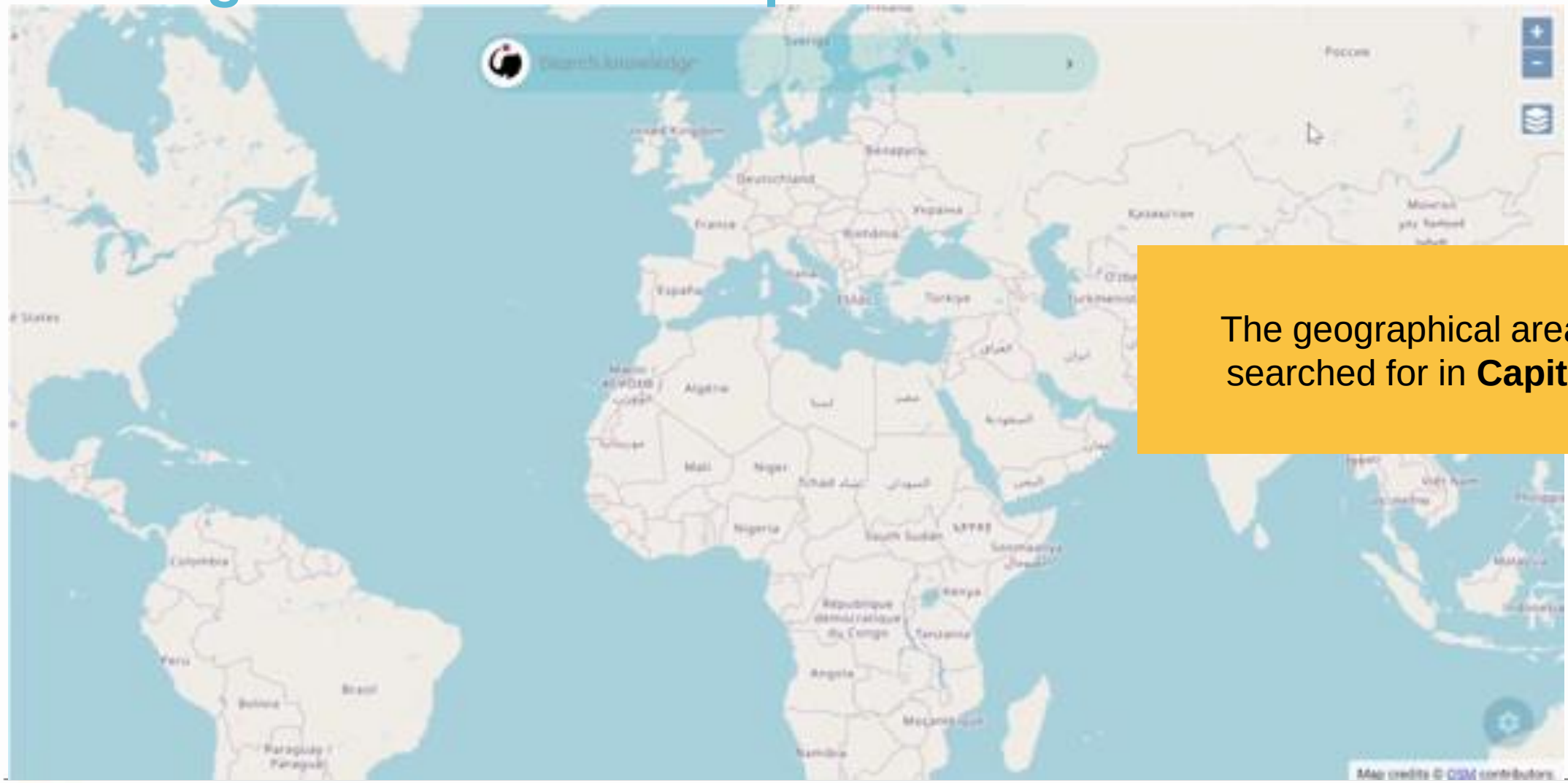
Guide to access ARIES for SEEA

The steps described in the previous slides are detailed in this guide.
In the first instance we've talked about connecting using an explorer but in the future we'll also (and mostly) be using the k.LAB software.

User guide of ARIES for SEEA

In this guide, the various functions of the ARIES for SEEA explorer can be found, allowing the user to make queries related to ecosystem accounting.

Defining the context: k.Explorer

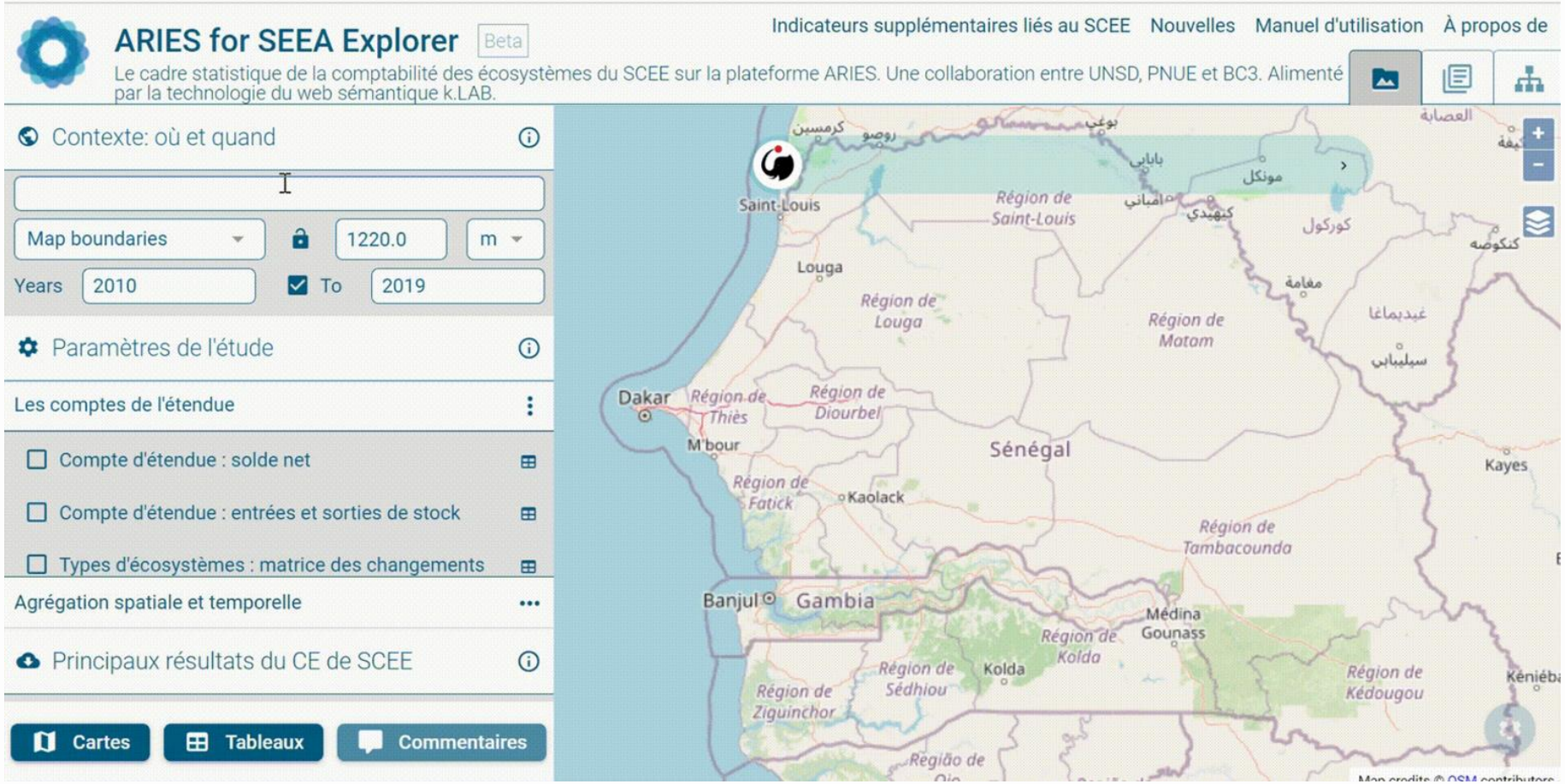


The geographical area must be searched for in **Capital letters**

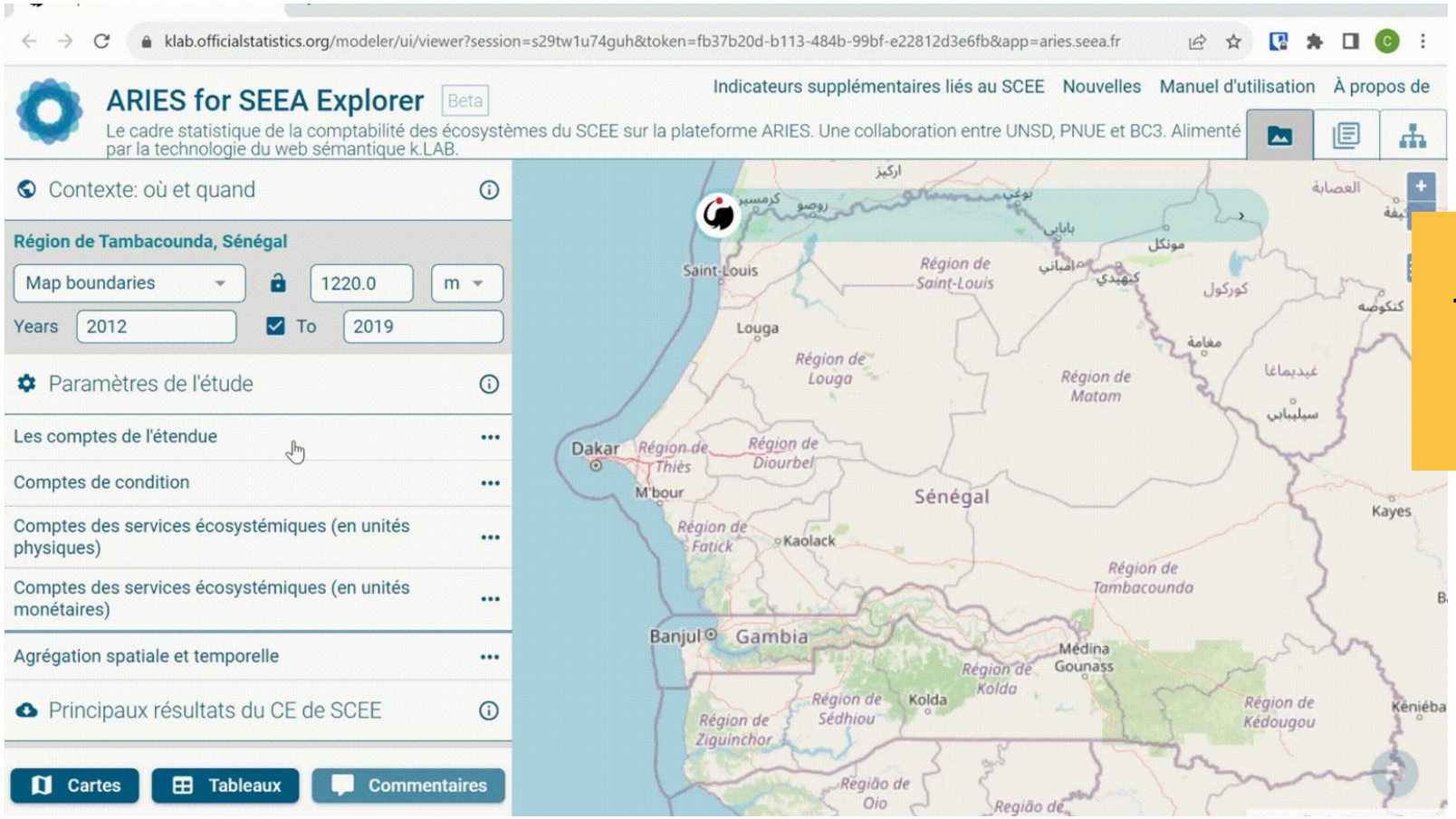
Defining the context: ARIES for SEEA Explorer

The geographic context can be defined in three different ways:

- map boundaries
- administrative entities
- watershed (river basin)



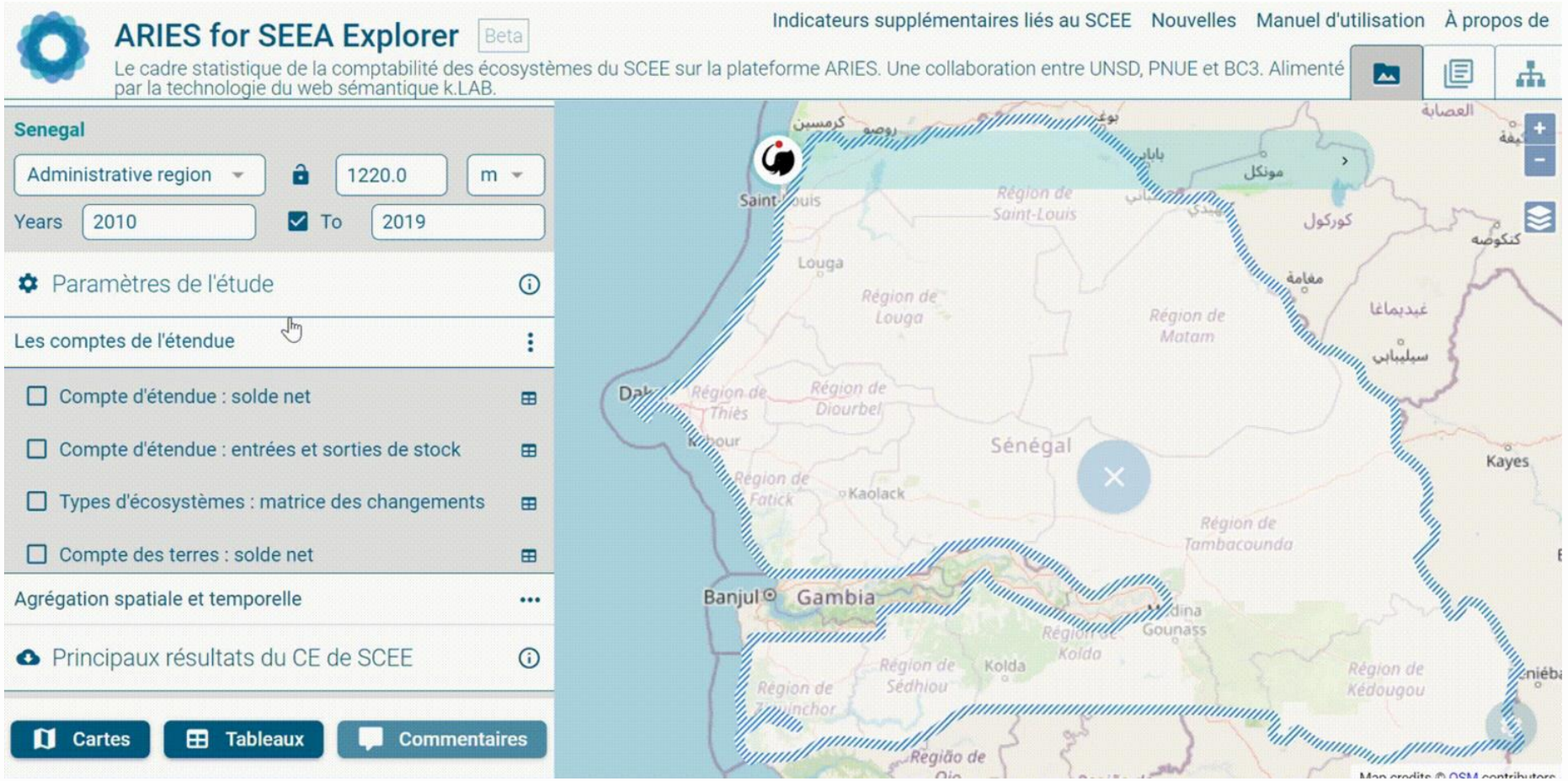
ARIES for SEEA Explorer: how to query the system



The “observations” must be searched for using **smaller-size letters**

Most common queries related to ecosystem accounting can be found directly in the drop-down menu by clicking the space bar in ARIES for SEEA Explorer search bar

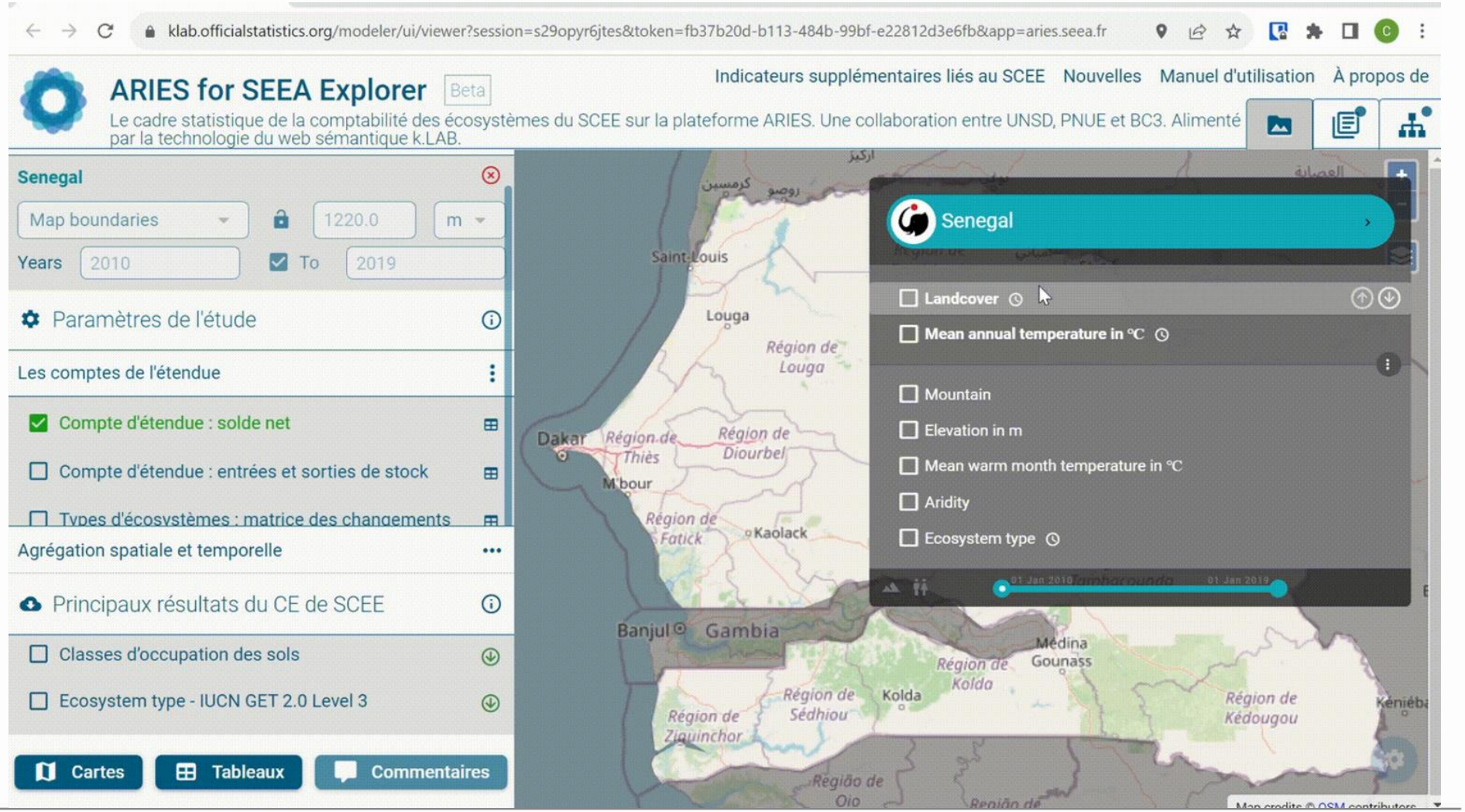
Resulting maps



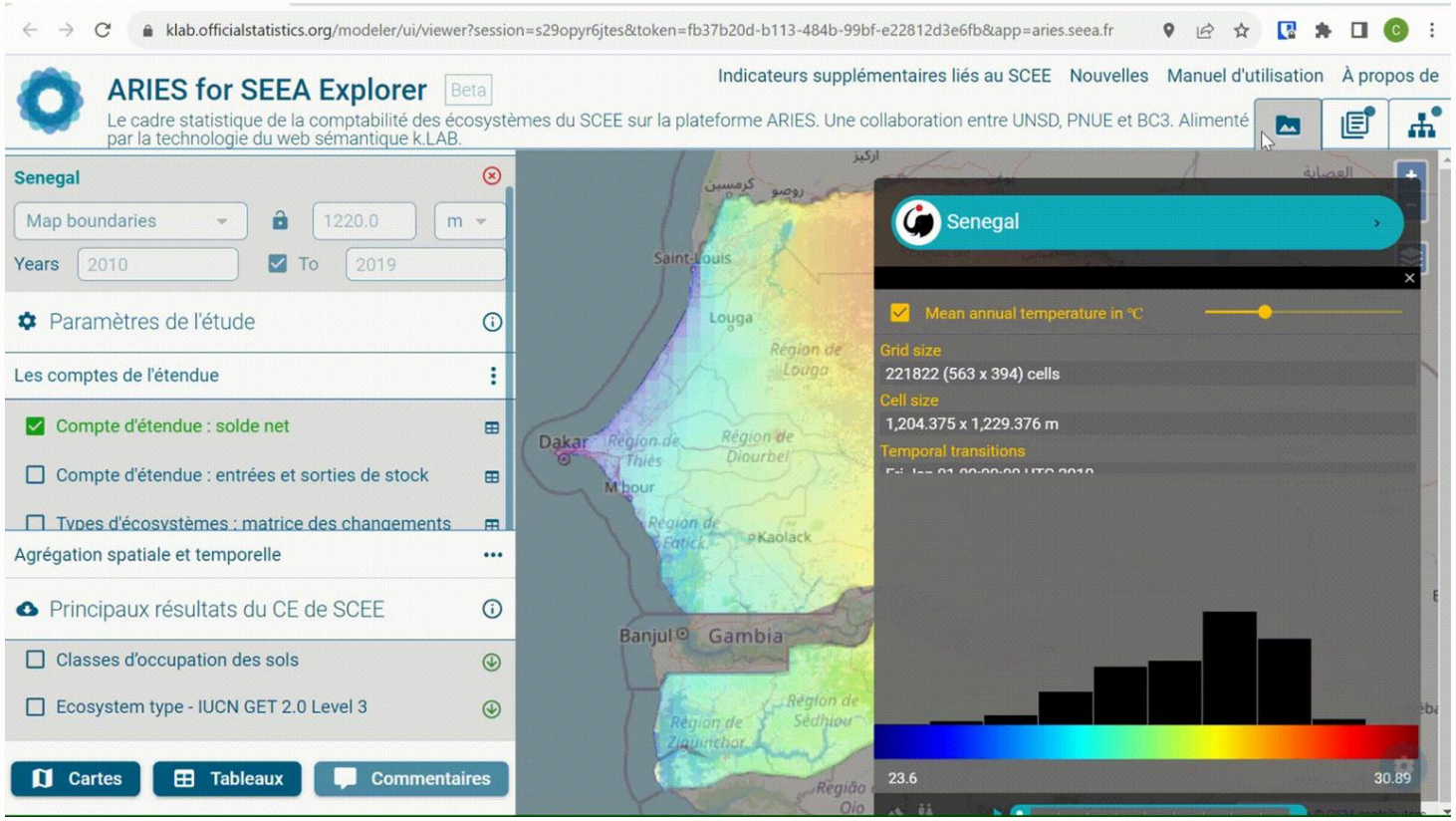
the intermediate outputs appear as they are computed

Resulting maps

the intermediateand final outputs appear as they are computed



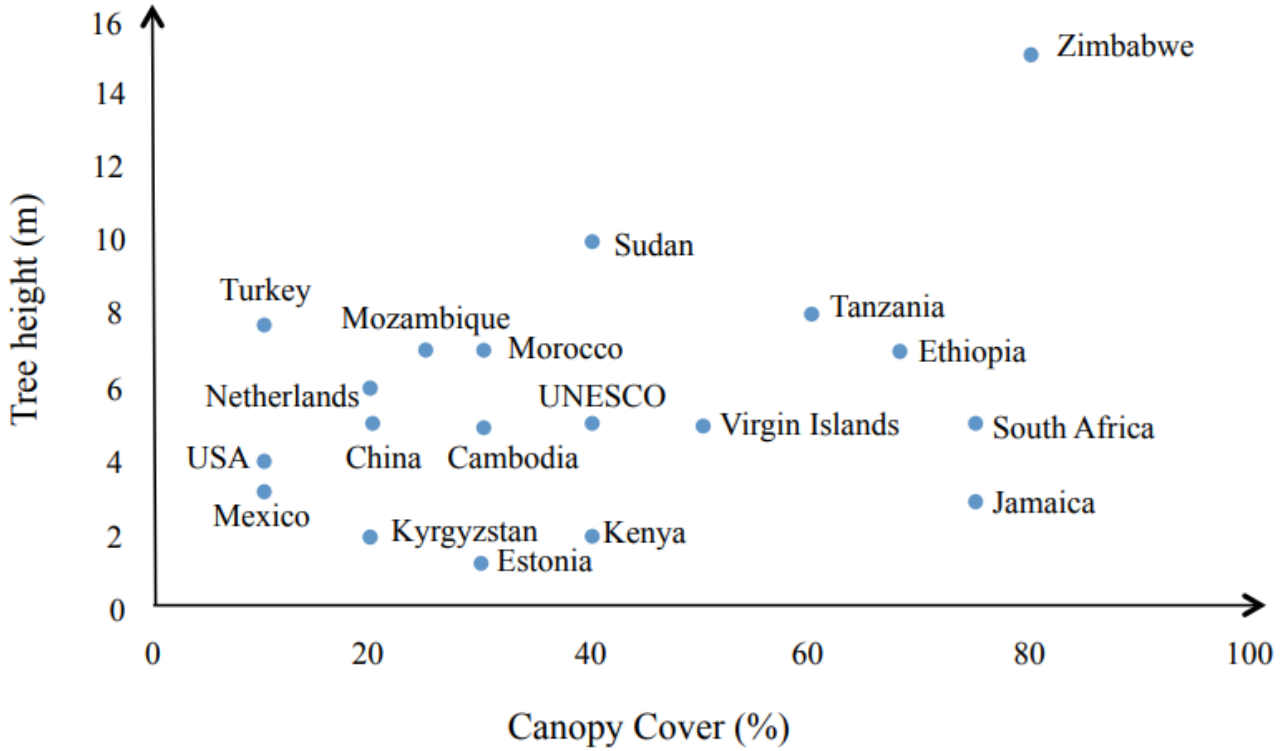
Other results



Besides the maps, the following results can be obtained:

- the **data flow** with the corresponding **documentation**.
- an automatic report summarizing all the information and the sources of data

Forest definition heterogeneity



Di Gregorio, A. (2016). *Land cover classification system* (Vol. 3). Food & Agriculture Org.

There are more than 350 definitions for *Forest*.

This graph shows some of the differences across countries in the definition of *Forest* based on two elements: tree height (in m) and canopy cover (in %).

Improvement to the above ground and below ground carbon vegetation model

- **Revisit the assumptions used to estimate carbon stock in Ruesch and Gibbs (2008)**
- **Update references** according to **IPCC 2019 reassessment** (allow comparison with 2006 IPCC ref.)
- Further refine **stratification inputs** were possible (i.e., Carbon fraction and Root:Shoot ratio)
- Revision of **forest age** assessment (Frontier Class/Frontier forest/Intact Forest Landscape)
- Development of **regrowth trajectories** after fire (Burned land)