

The phylogeny of Critical Zone Observatories, or how to better structure existing observation networks to match the whole system approach

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Outline of the presentation

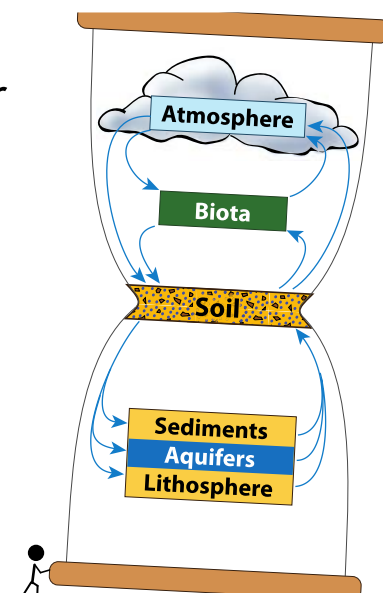
1. Context and objectives: the Whole System Approach and existing observation networks
2. A visualization of observatory networks rationale: the OZCAR Tree
3. More details on the proposed visualization
4. How to go beyond a nice visualization tool?
5. Conclusions and perspectives



On each slide, click on the arrow to come back to the presentation outline

Context of the Anthropocene

- Human beings have become geological agents and are modifying their life environment
- There is a urgent need to preserve the habitability of the Earth so that human beings can sustain their needs in terms of water, soil, food resources
- Ecosystems, critical zones and socio-ecological systems observatories are critical elements to understand the interplaying processes and build the models that can “earthcast” the trajectory of the territories in the Anthropocene.



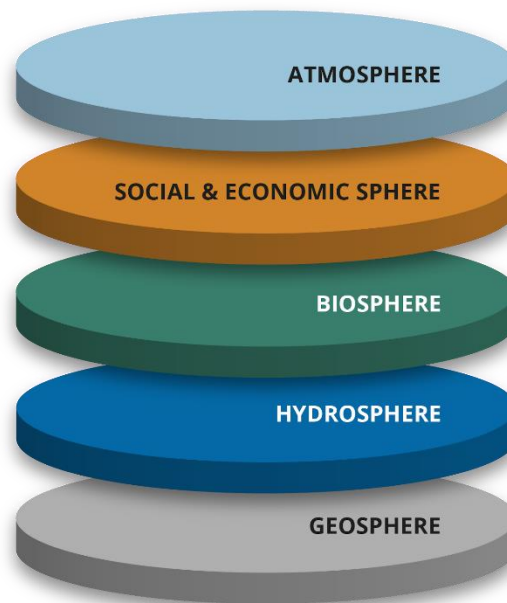
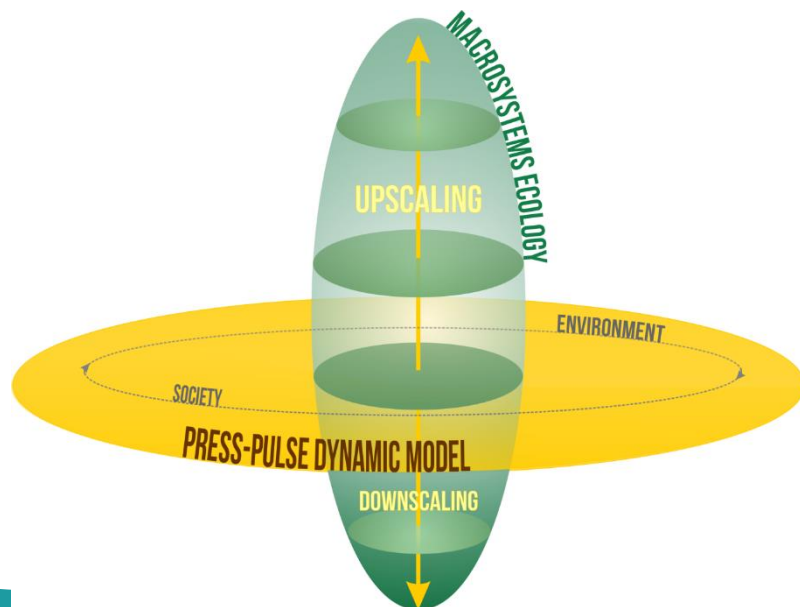
=> These observatories must rely on a systemic, multi-compartment approach: the Whole system Approach for In-situ & Long-term environmental System research on Life supporting Systems (WAILS)



The WAILS approach

- A **multi-scale** approach from local to regional scale
- A **multi-disciplinary** approach sampling the various compartments of the ecosystems, critical zone and socio-ecosystems

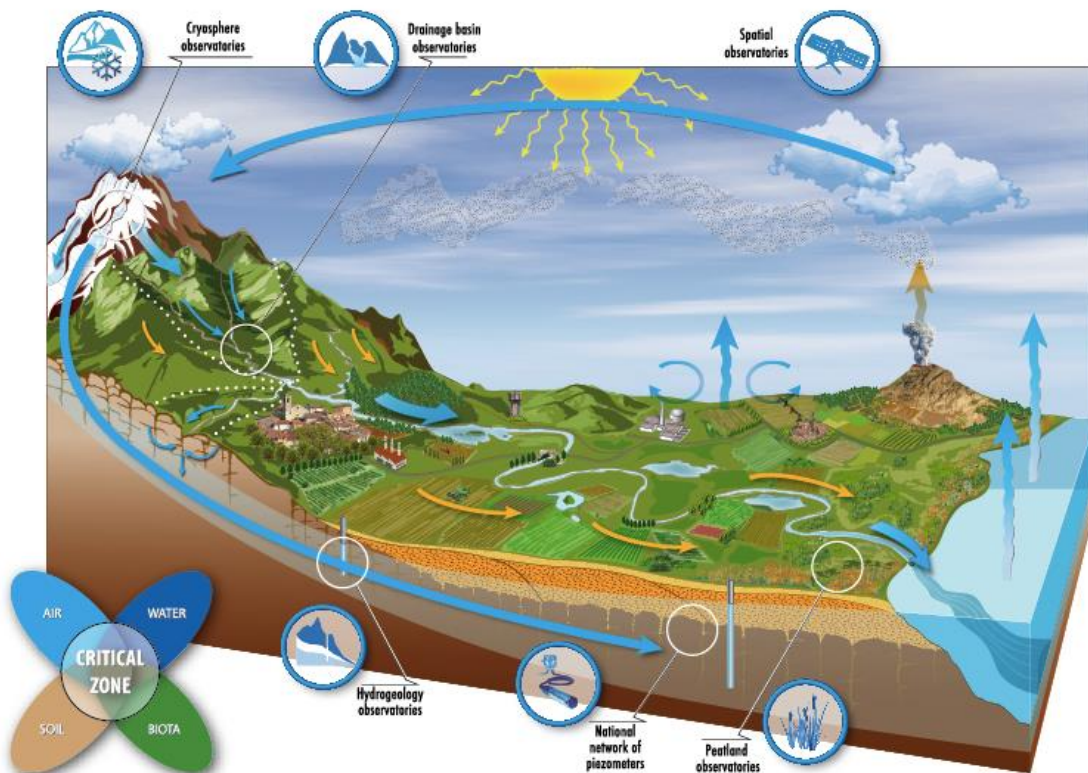
=> Need for dedicated observation networks



How to set up the WAILS approach?

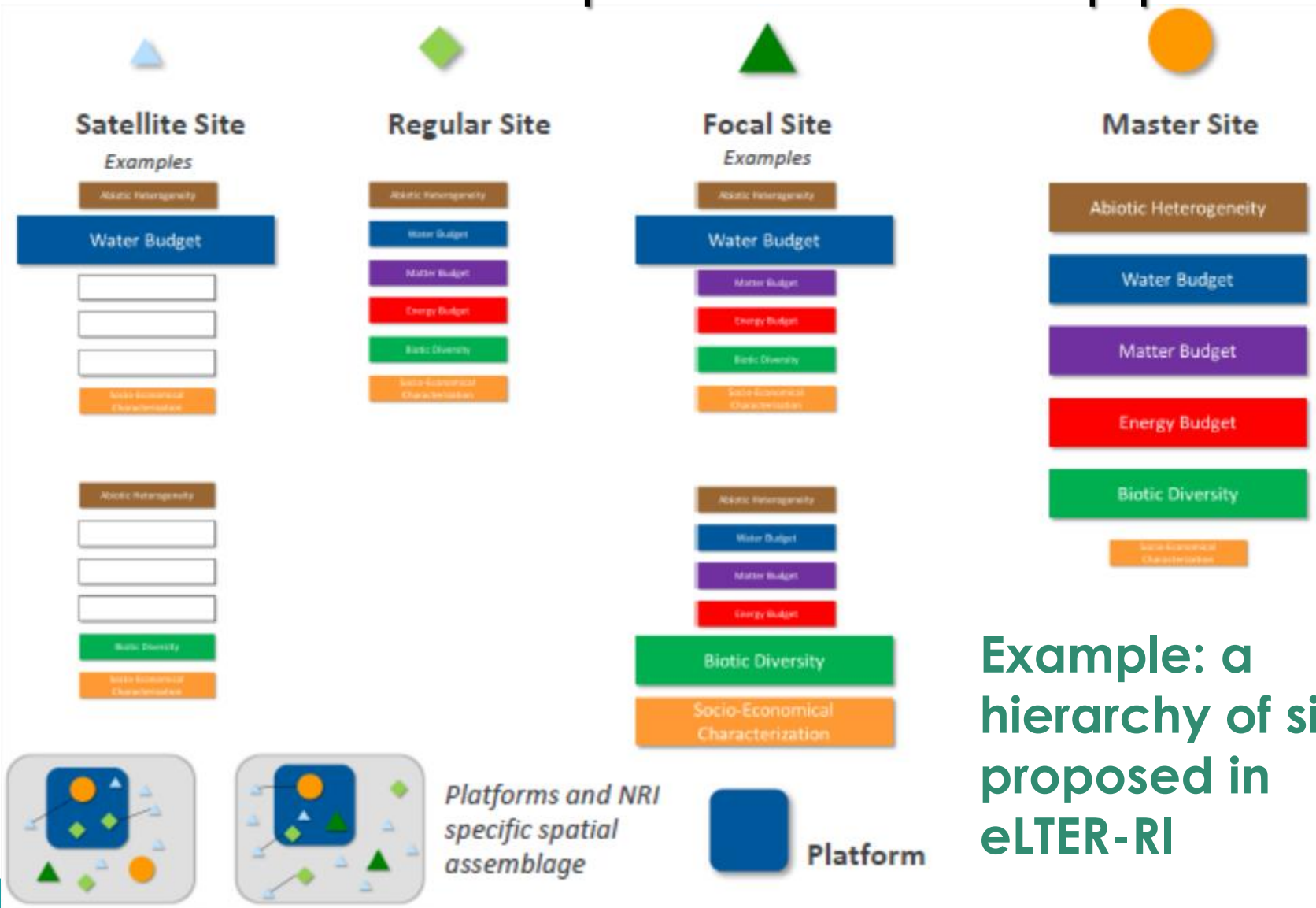
Diversity and heterogeneity of the targeted system

=> How to design the observation set up to fulfil the WAILS approach?





How to set up the WAALS approach?

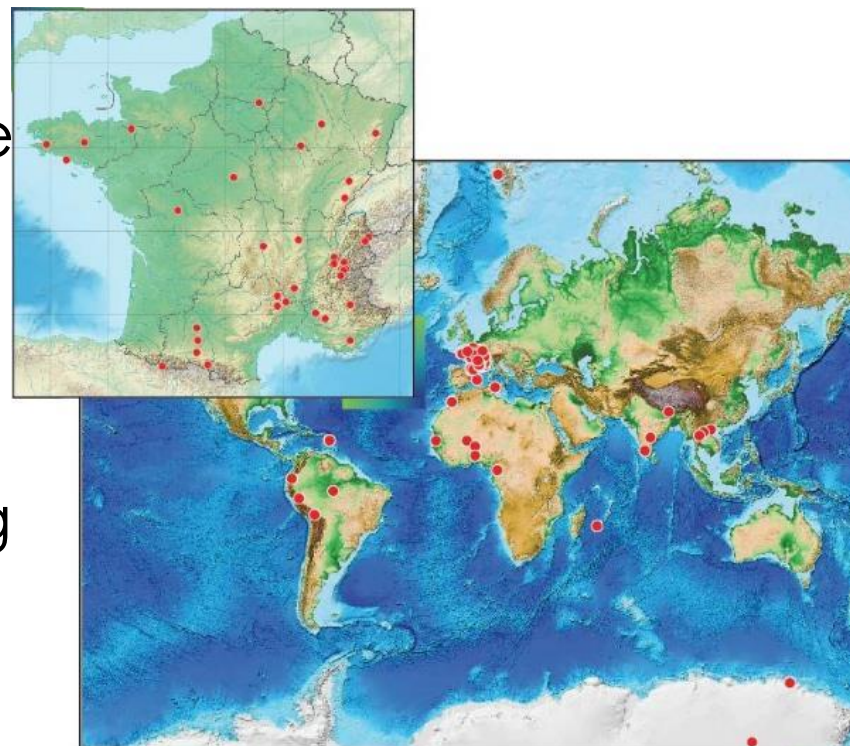


Example: a hierarchy of sites proposed in eLTER-RI



How to set up the WAILS approach?

- A large number of existing observation networks that were historically independently built on specific research questions with a large heterogeneity in object of interest, measured variables, organization, funding etc...



=> Need for diagnostic tools to identify where and how the WAILS could be deployed, how the hierarchy of sites could be defined

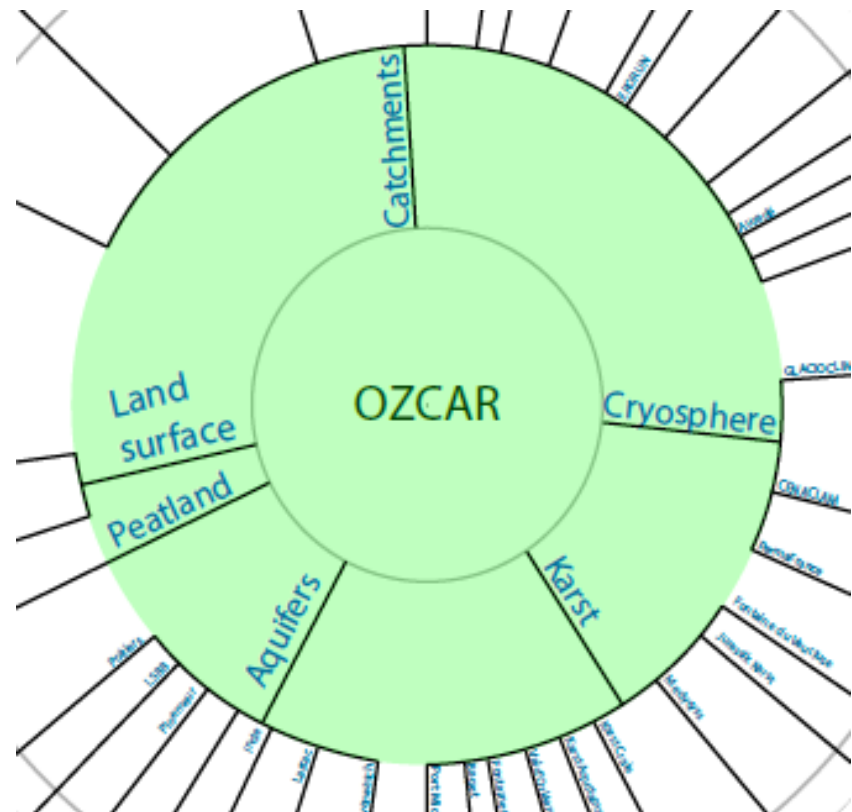
A typical example: the OZCAR RI observation network: about 60 historical observation sites with different objectives



Organization of the tree by objects in the landscape

- Identification of the **objects of interest**: catchments, cryosphere, karst, aquifer, peatland, land surface

=> Reflects the **discipline-oriented** creation of the observatories

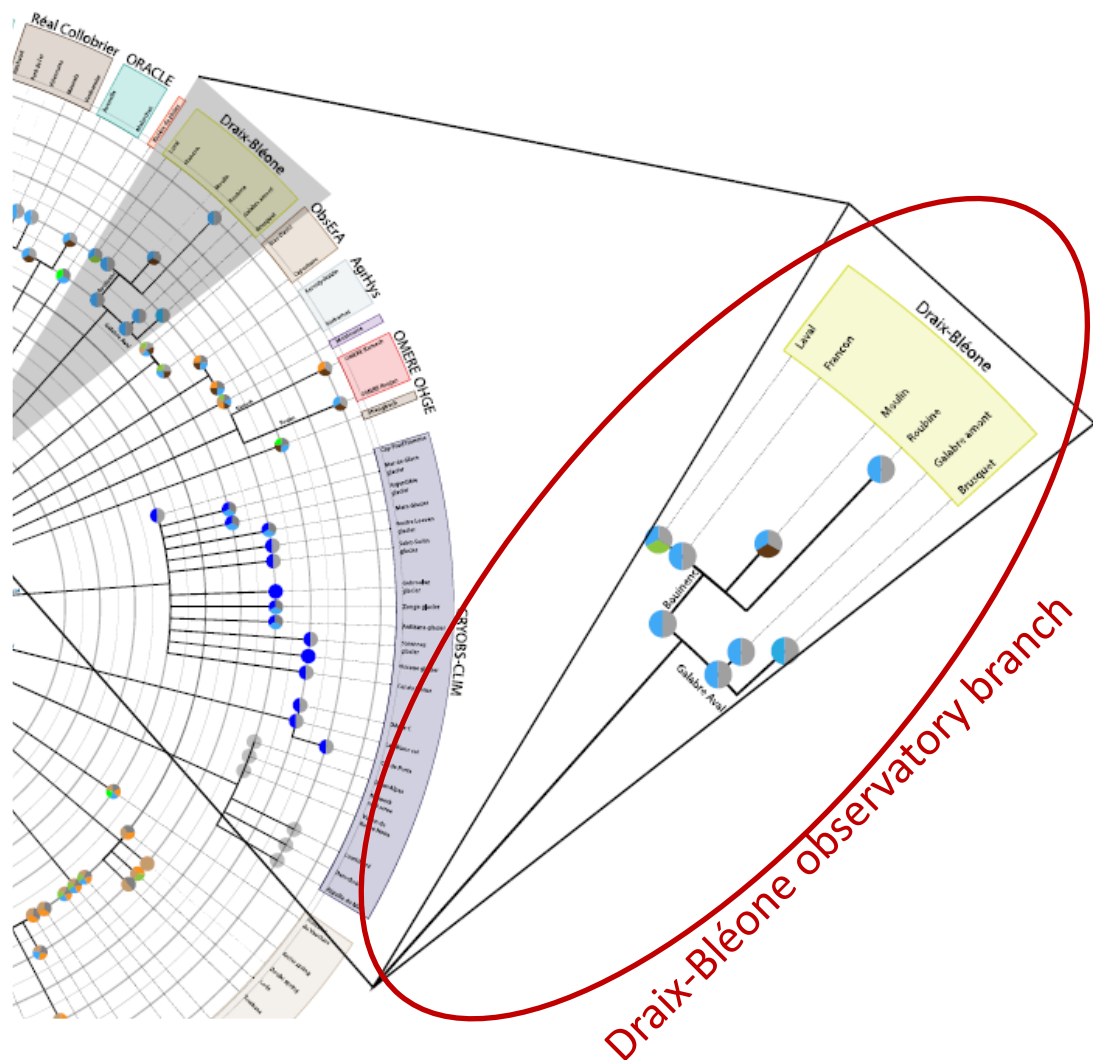




Main branches represent the observatories

- Observatories are labelled entities organized around common scientific questions and generally a common object of interest

=> Reflects the **institutional organization** of the network (funding, support, human resources)

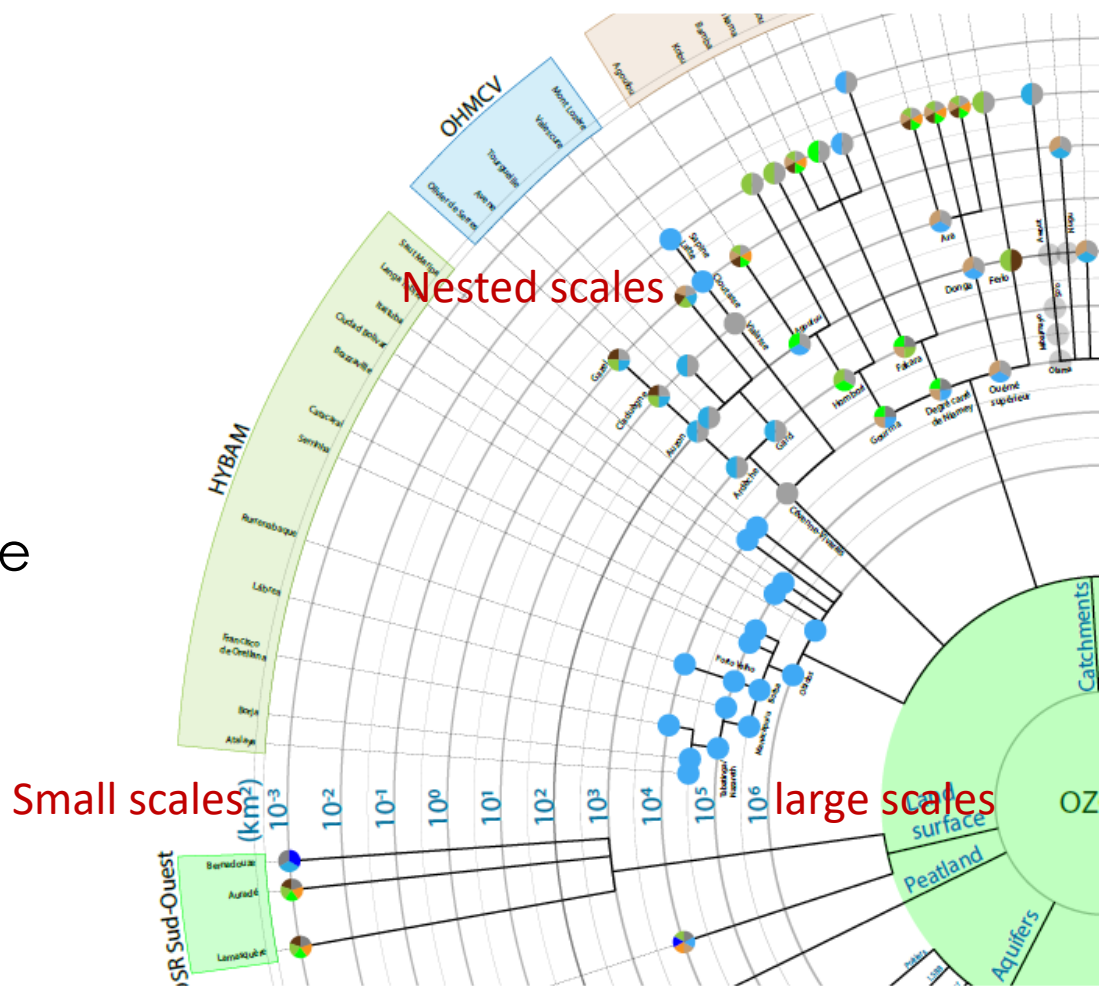




Representation of nested scales of observation

- The scale of observation is represented by circles: small/plot scales on the larger circle; continental scale close to the center
- The branches represent the nested scales (e.g. nested sub-catchments)

=> Reflects the **spatial organization** of the network





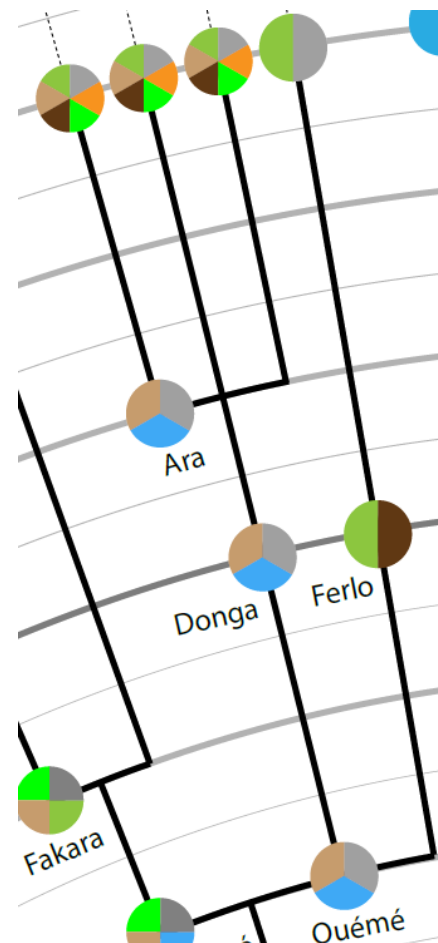
Representation of monitored compartments

Small scales

Studied compartments:

- Atmosphere ●
- Land use ●
- Biomass ●
- Ice - snow ●
- Soil ●
- Deep water ●
- Surface water ●
- Soil water ●

- The colors in the pies represent the sampled compartments (note that a compartment is listed at one scale if the collected data are representative at this scale)
- In general more compartments are monitored at small scales (process understanding), and are data collected to address change of scales at larger scales



large scales

=> Reflects the **completeness of the monitoring** to address the WAILS



How to go beyond a nice visualization?

- **A diagnostic tool of existing observation networks**
 - For OZCAR RI, a network mainly organized around disciplines/objects of interest but also institutional labelling and funding
 - The whole network covers most of the compartments identified for the WAILS approach, but none of the sites complies with it
- **Help in the identification of the site category:**
 - Master: the most colored pies
 - Focal site: a dominant color in the pie or a single object of interest
- **A tool to be complemented with maps to identify co-localized sites with other RIs and build LTSER platforms**

How to go beyond a nice visualization?



- To go a step further: complement the pies with a visualization of the collected variables and their frequency

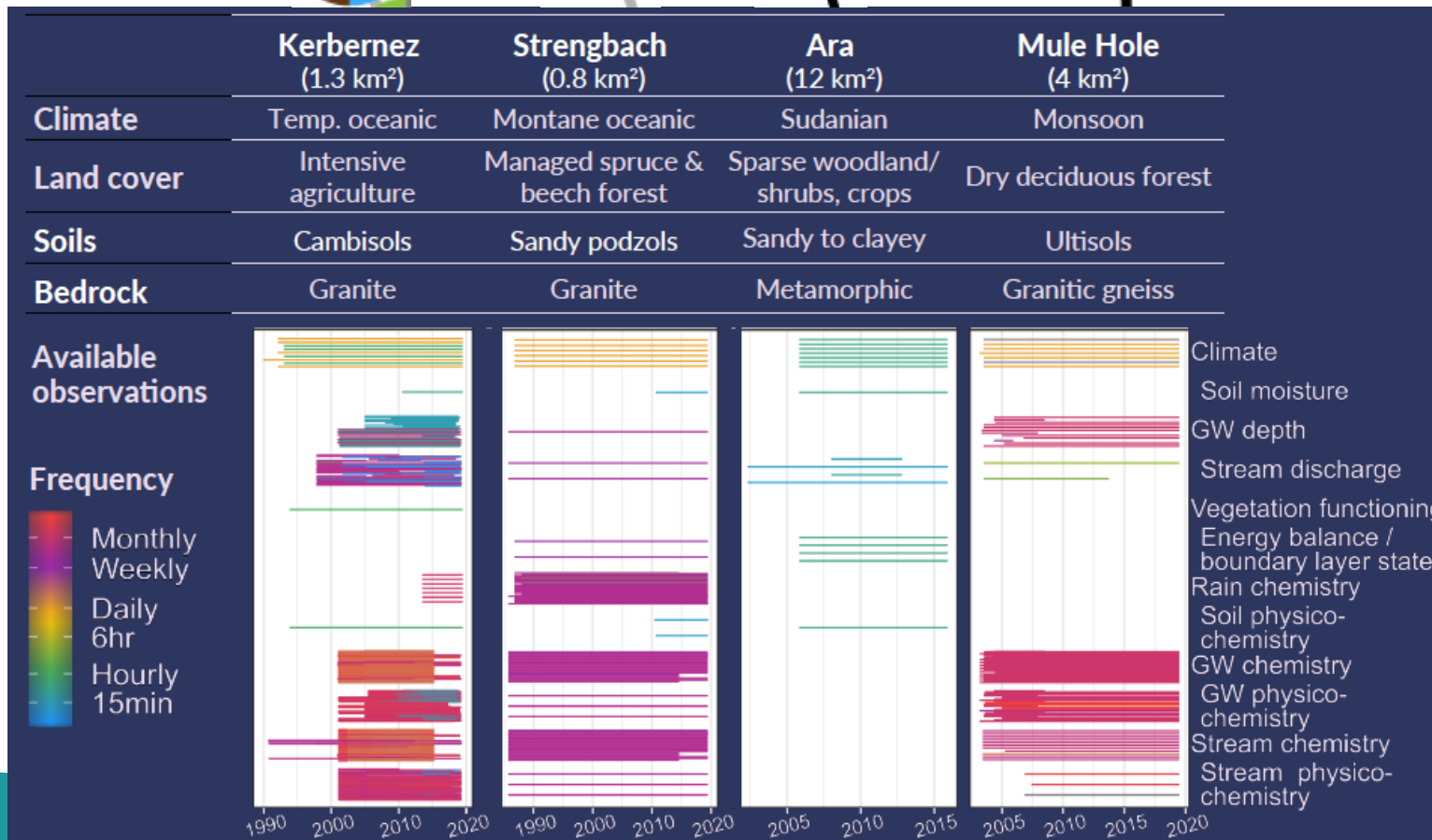
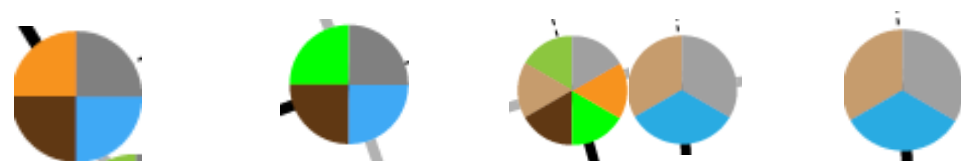


Figure from Kuppel et al., AGU, 2019



Conclusions and perspectives

- First steps towards a tool allowing to summarize the structure and organization of observation networks
- Combined with mapping, a tool that can help identifying and building potential sites category and LTSER platform
- A tool probably needing extensions to be applicable to socio-ecological networks



To learn more about OZCAR RI:

Gaillardet, J., Braud, I., Hankard, F., Anquetin, S., Bour, O., Dorfliger, N., de Dreuzy, J.R., Galle, S., Galy, C., Gogo, S., Gourcy, L., Habets, F., Laggoun, F., Longuevergne, L., Le Borgne, T., Naaim-Bouvet, F., Nord, G., Simonneaux, V., Six, D., Tallec, T., Valentin, C., Abril, G., Allemand, P., Arènes, A., Arfib, B., Arnaud, L., Arnaud, N., Arnaud, P., Audry, S., Comte, V.B., Batiot, C., Battais, A., Bellot, H., Bernard, E., Bertrand, C., Bessière, H., Binet, S., Bodin, J., Bodin, X., Boithias, L., Bouchez, J., Boudevillain, B., Moussa, I.B., Branger, F., Braun, J.J., Brunet, P., Caceres, B., Calmels, D., Cappelaere, B., Celle-Jeanton, H., Chabaux, F., Chalikakis, K., Champollion, C., Copard, Y., Cotel, C., Davy, P., Deline, P., Delrieu, G., Demarty, J., Dessert, C., Dumont, M., Emblanch, C., Ezzahar, J., Estèves, M., Favier, V., Faucheux, M., Filizola, N., Flammarion, P., Floury, P., Fovet, O., Fournier, M., Francez, A.J., Gandois, L., Gascuel, C., Gayer, E., Genthon, C., Gérard, M.F., Gilbert, D., Gouttevin, I., Grippa, M., Gruau, G., Jardani, A., Jeanneau, L., Join, J.L., Jourde, H., Karbou, F., Labat, D., Lagadeuc, Y., Lajeunesse, E., Lastennet, R., Lavado, W., Lawin, E., Lebel, T., Le Bouteiller, C., Legout, C., Lejeune, Y., Le Meur, E., Le Moigne, N., Lions, J., Lucas, A., Malet, J.P., Marais-Sicre, C., Maréchal, J.C., Marlin, C., Martin, P., Martins, J., Martinez, J.M., Massei, N., Mauclerc, A., Mazzilli, N., Molénat, J., Moreira-Turcq, P., Mougín, E., Morin, S., Ngoupayou, J.N., Panthou, G., Peugeot, C., Picard, G., Pierret, M.C., Porel, G., Probst, A., Probst, J.L., Rabatel, A., Raclot, D., Ravanel, L., Rejiba, F., René, P., Ribolzi, O., Riotte, J., Rivière, A., Robain, H., Ruiz, L., Sanchez-Perez, J.M., Santini, W., Sauvage, S., Schoeneich, P., Seidel, J.L., Sekhar, M., Sengtaheuanghoung, O., Silvera, N., Steinmann, M., Soruco, A., Tallec, G., Thibert, E., Lao, D.V., Vincent, C., Viville, D., Wagon, P., Zitouna, R., 2018. OZCAR: The French Network of Critical Zone Observatories. *Vadose Zone Journal*, 17(1).

<https://doi.org/10.2136/vzj2018.04.0067>

<https://www.ozcar-ri.org/fr/ozcar-observatoires-de-la-zone-critique-applications-et-recherche/>

Contacts:

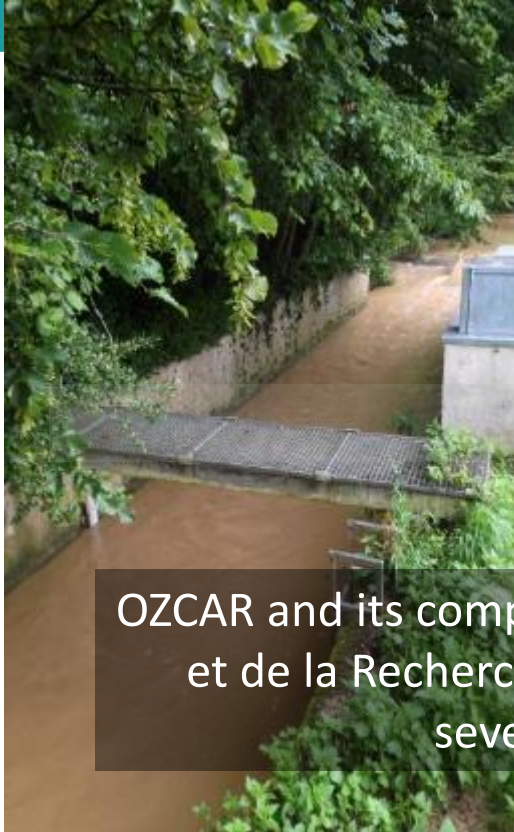
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