STeamer - LIG
Spatial and Temporal Information Systems

Improving the search for victims in mountain environnements with geovisualization and competing hypotheses management

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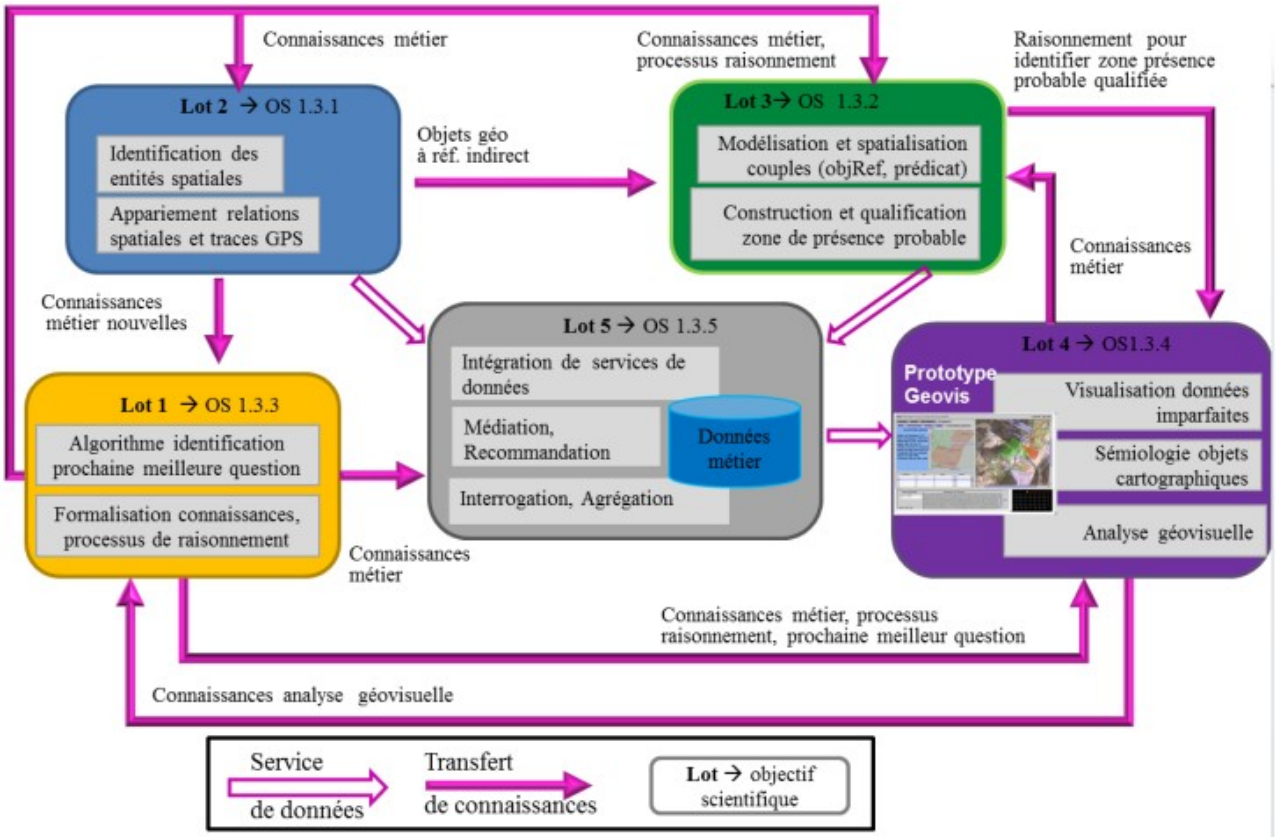
Context

- ANR Choucas : Heterogeneous data integration and spatial reasoning to help in locating mountain victims (Olteanu-Raimond et al., 2017)



Context – Example of call

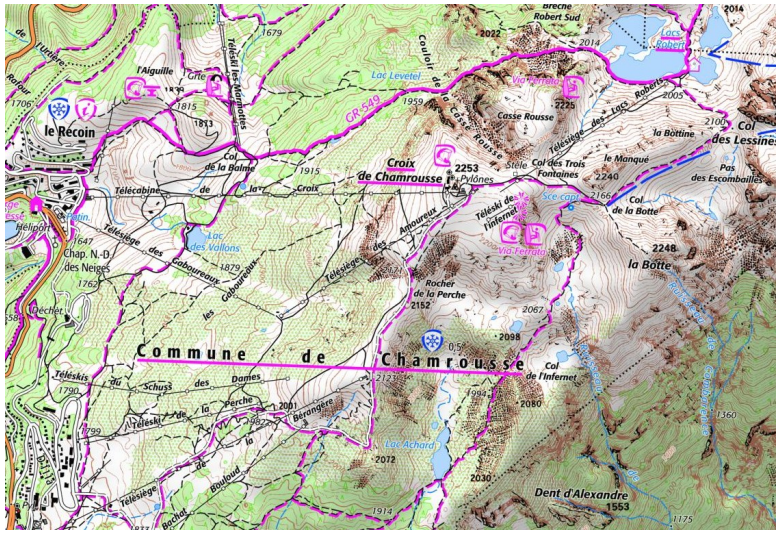
The victim:

- left *Le Bourg d'Oisans* on a pedestrian path.
- walked several hours towards a ski station.
- felt several meters.
- sees part of a body of water.
- is below a road and hears vehicles.
- is beneath an electric line.
- was in the sun but is now in the shade.

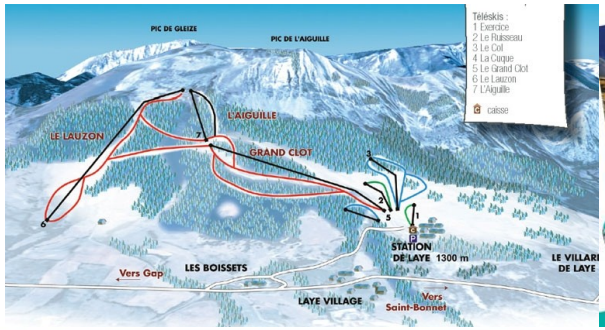
(real example from the project's red thread)

Tools used by rescuers

- Currently the rescuer who answers the phone uses a **digital topographical map** and the possibility to display business layers (hiking trails, ski slopes, etc.).



- S/he also refers to several **paper guides** (recommended hiking routes, touristic places, etc.).



Tools used by rescuers

→ Deducting the location is done manually by the rescuers

→ Conducting multiple competing hypotheses is difficult (nearly impossible ?) for the rescuers

The victim sees a lake…

What if it's the Lac Achard ?

What if it's any lake in the area ?

Did the victim walk towards the *Alpes d'Huez* ski station ?

…or towards the *Deux Alpes* ski station?

Objectives

- **supporting the rescuers' reasoning process** through a dedicated application interface
- **putting at their disposal various geospatial data** that will be useful to transform what the caller says in corresponding areas on the map
- helping to **lead several hypotheses simultaneously** on the same case of research
- **efficiently displaying the areas** corresponding to the caller clues.

→ *These are our requirements for a geovisualization approach that supports rescuers' reasoning process*

Scientific locks

- **Understand and model the reasoning of rescuers** (*a specific kind of user given their expert knowledge of the moutain environment*)
- **Translation** of **natural language clues** into some **computer-friendly formalism** taking uncertainty into account
- **Management and handling of theses clues in the UI**
- **Visual depiction of uncertainty** (on the map and on the various UI components)

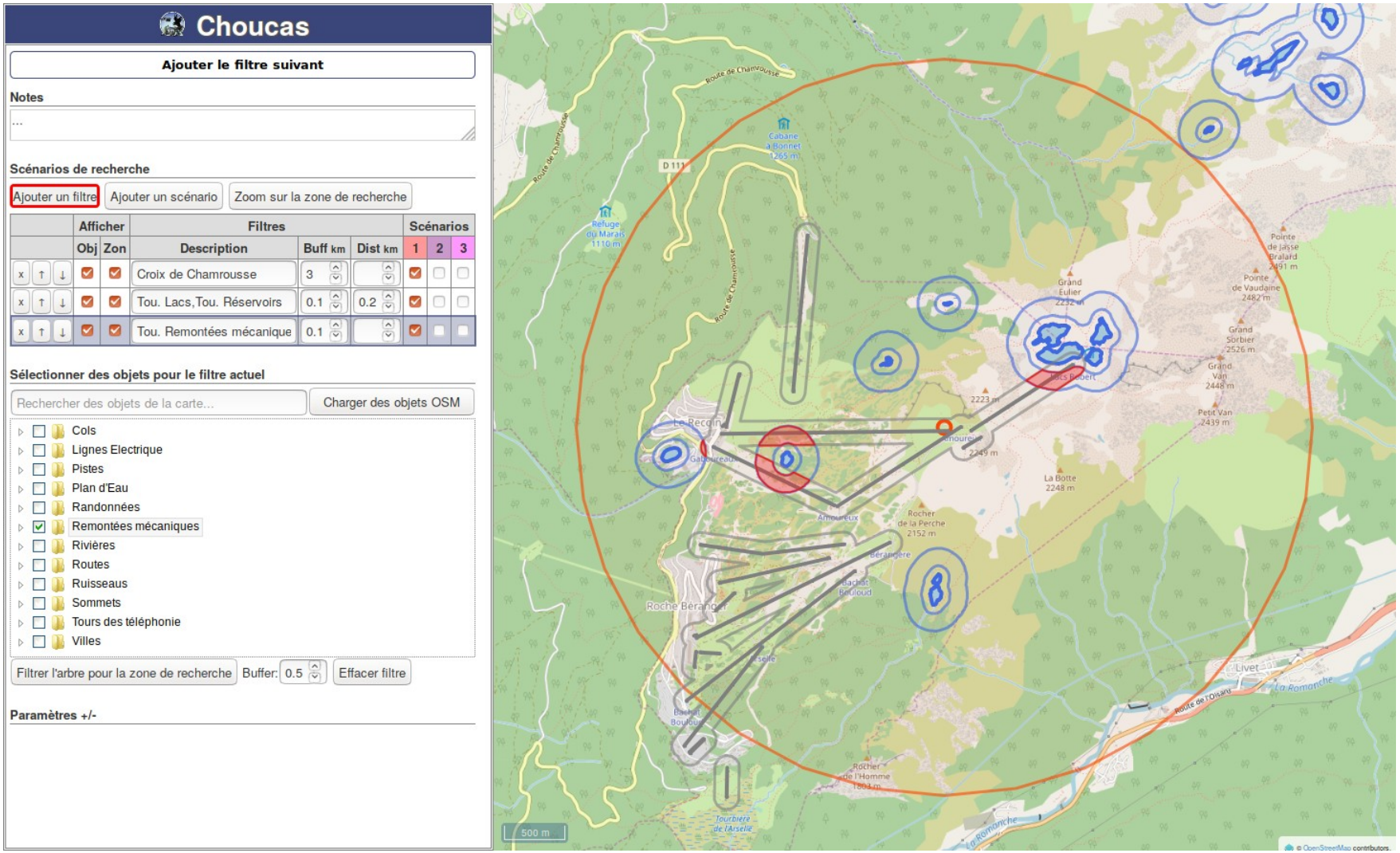
Our proposal - overview

- A prototype of victim location system combining:
  - the visualization of geospatial features
  - the creation of one or more search scenarios
  - the possibility of accounting for the imperfect nature of the information

Our proposal - overview

- **User-centered design**, notably based on **prototyping**
- Involves **frequent meeting with the referent rescuer**
- Having in mind that proposing new methods and UI components (visualization, clues management, etc.) could modify the reasoning of the rescuers in front of the application

Our proposal point by point



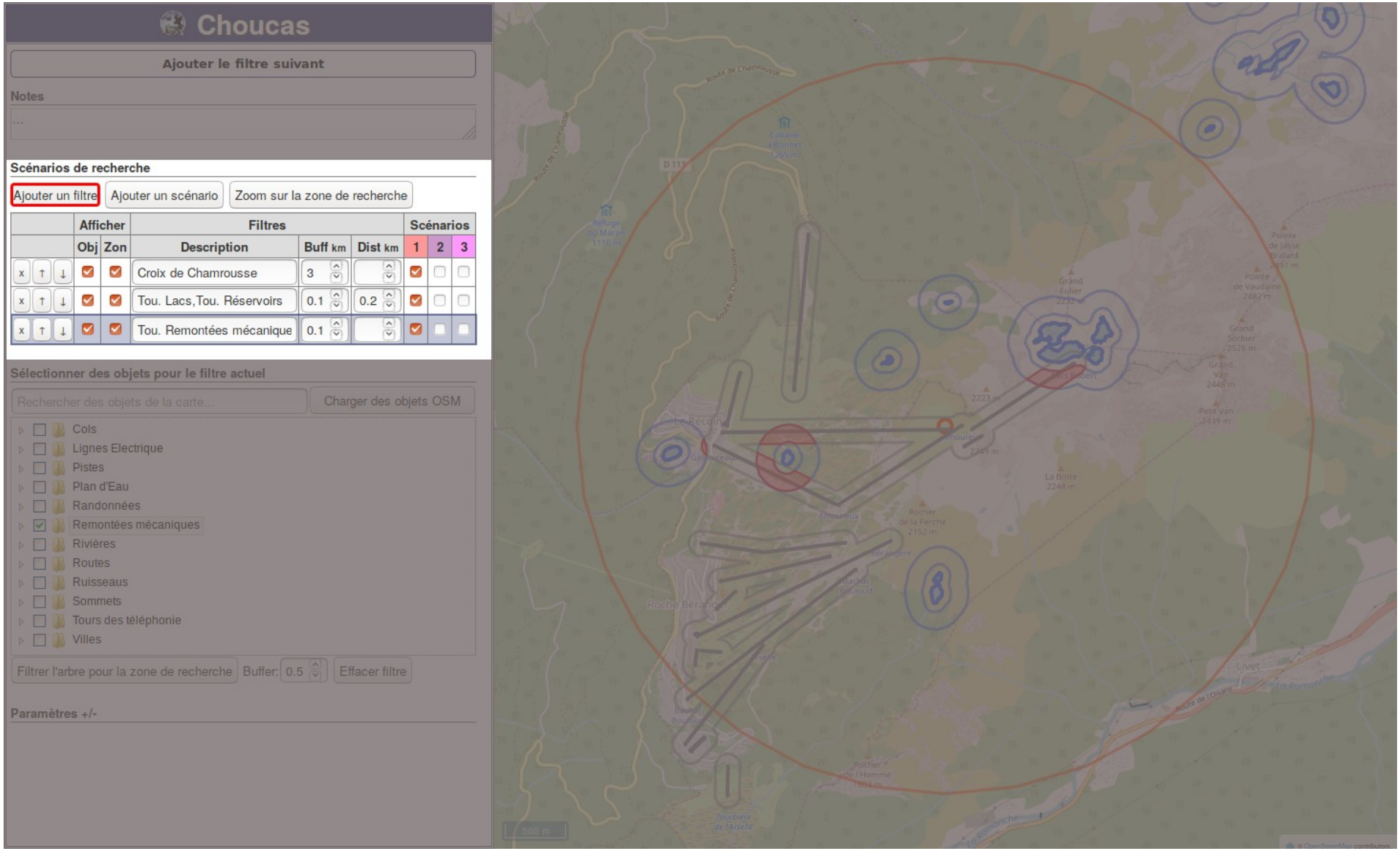

Choucas
Ajouter le filtre suivant
Notes
Scénarios de recherche
Ajouter un filtre
Ajouter un scénario
Zoom sur la zone de recherche
Afficher
Filtres
Scénarios
Obj
Zon
Description
Buff km
Dist km
1
2
3
Croix de Chamrousse
Tou. Lacs,Tou. Réservoirs
Tou. Remontées mécanique
Sélectionner des objets pour le filtre actuel
Rechercher des objets de la carte...
Charger des objets OSM
Cols
Lignes Electrique
Pistes
Plan d'Eau
Randonnées
Remontées mécaniques
Rivières
Routes
Ruisseaux
Sommets
Tours des téléphonie
Villes
Filtrer l'arbre pour la zone de recherche
Buffer:
Effacer filtre
Paramètres +/-

Table of filters and scenarios management

	Afficher		Filtres			Scénarios		
	Obj	Zon	Description	Buff km	Dist km	1	2	3
x ↑ ↓	☑	☑	Croix de Chamrousse	3		☑	☐	☐
x ↑ ↓	☑	☑	Tou. Lacs,Tou. Réservoirs	0.1	0.2	☑	☐	☐
x ↑ ↓	☑	☑	Tou. Remontées mécanique	0.1		☑	☐	☐

Clues

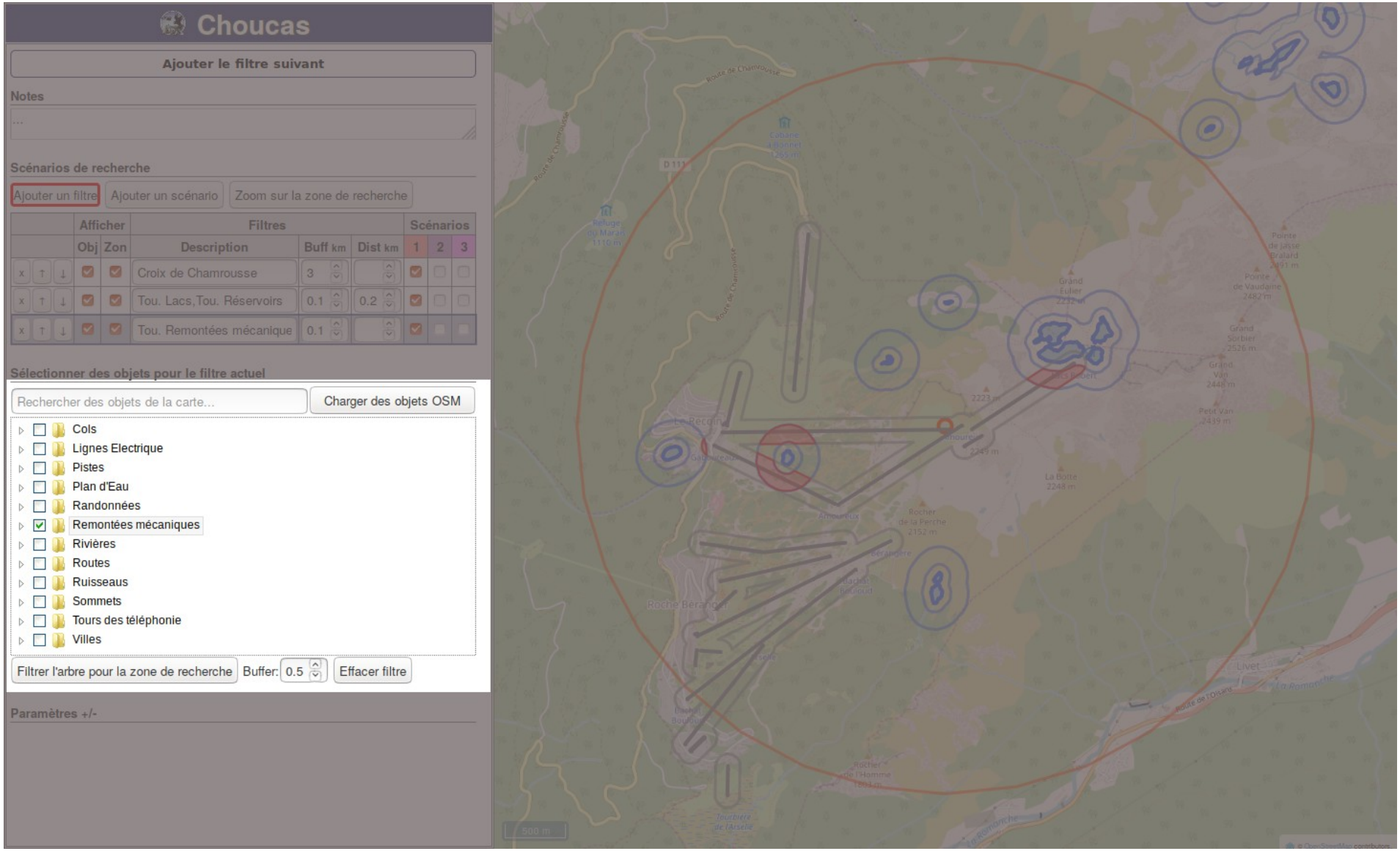
Item or category of items

Uncertainty parameters

Scenario construction

Table of filters and scenarios management

- Each row corresponds to a clue built from the caller's information.
- One or two distance information(s) can be entered for each clue to transcript uncertainty about distances.
- Each clue can be included in zero or more search scenarios.


Choucas
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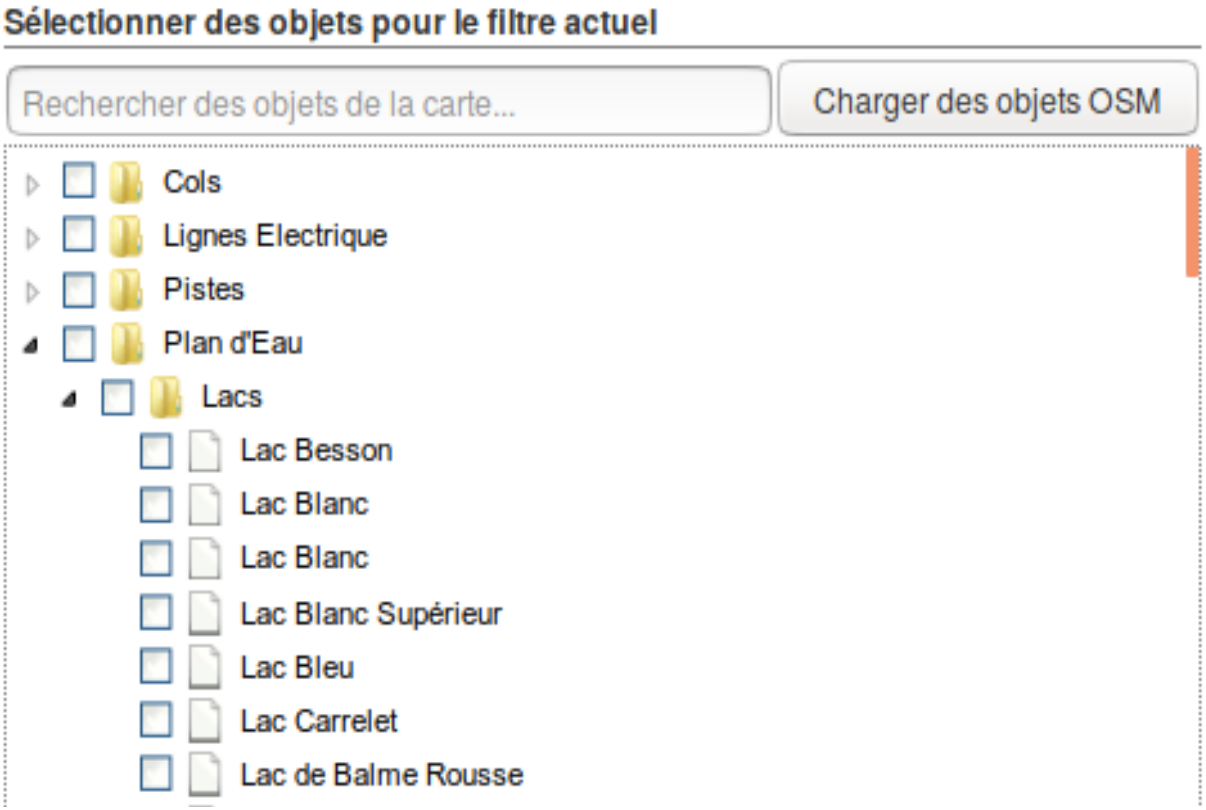
Sommets
Tours des téléphonie
Villes
Filtrer l'arbre pour la zone de recherche
Buffer:
0.5
Effacer filtre
Paramètres +/-

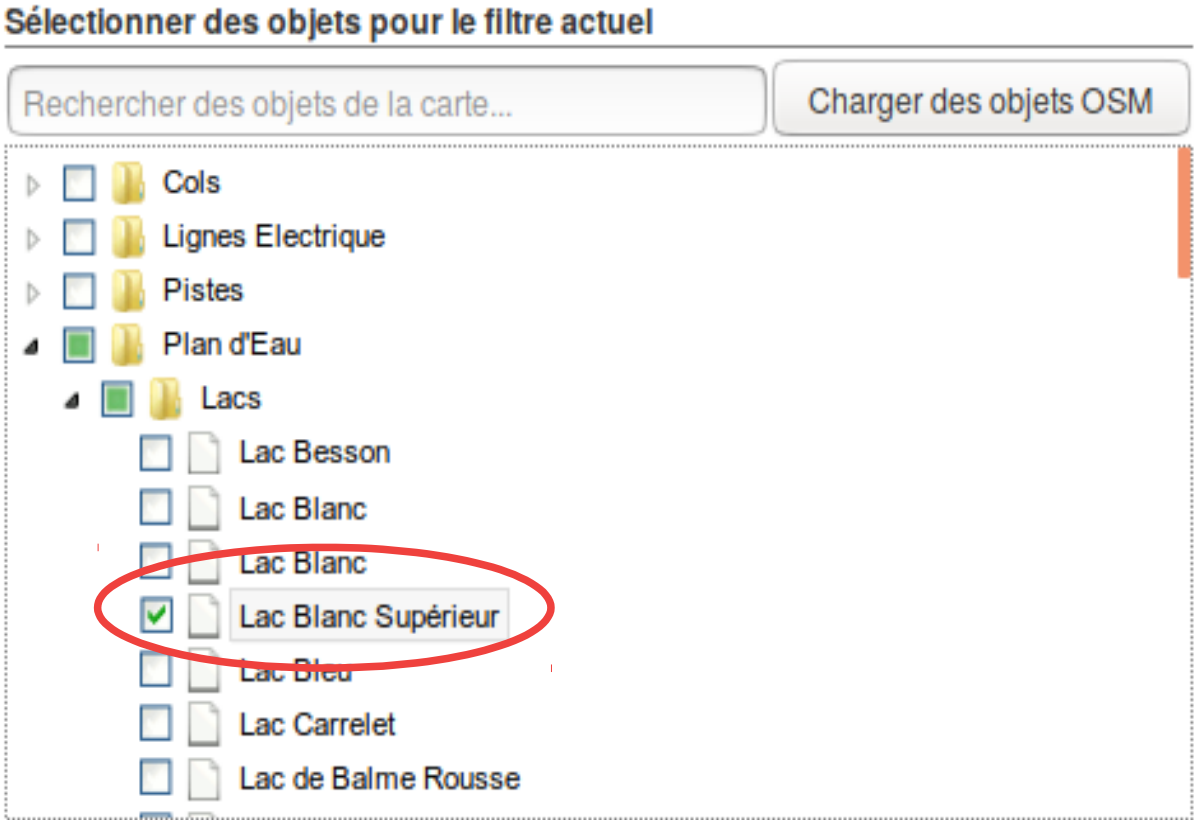
Searchable items tree

- Objects from the tree are extracted on-the-fly from *OpenStreetMap*



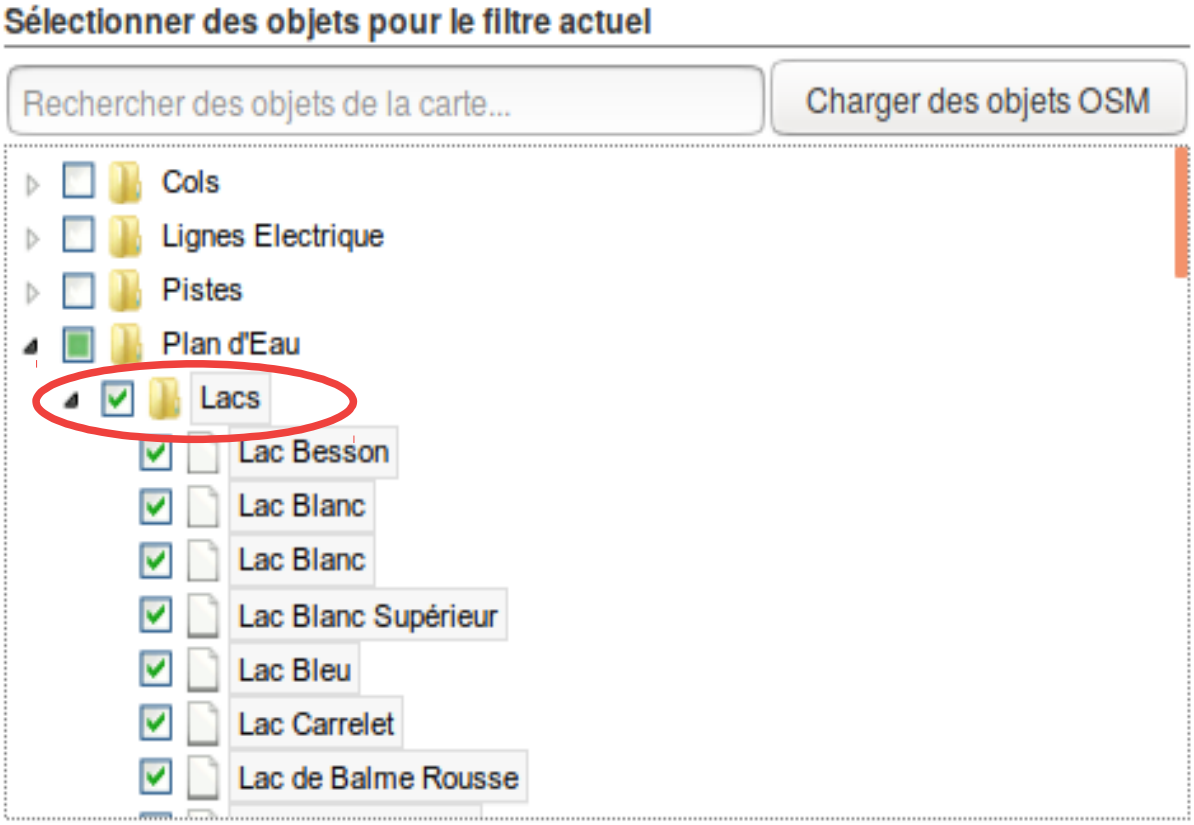
Searchable items tree

- Objects can be added individually (« Achard Lake ») ...



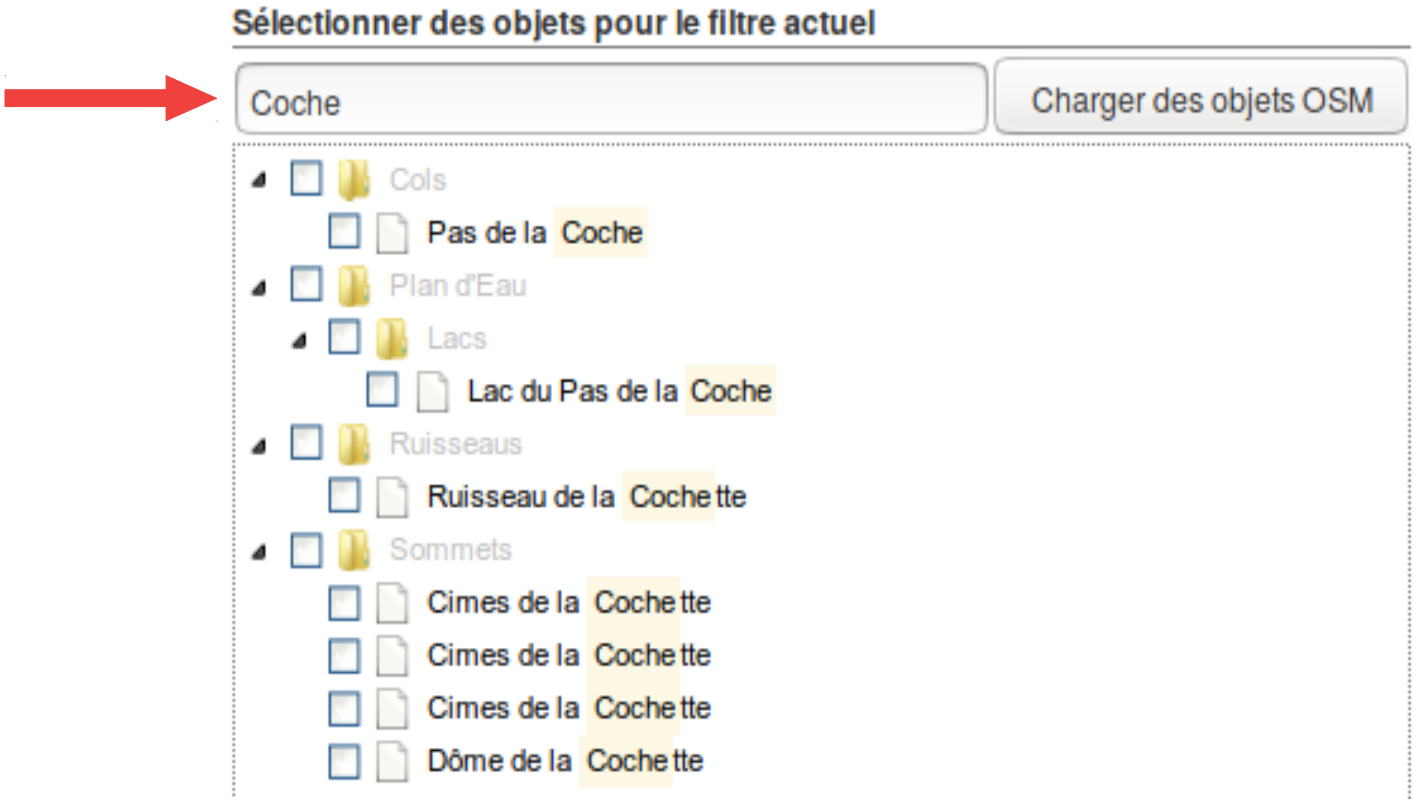
Searchable items tree

- … or by groups (« All the lakes »)



Searchable items tree

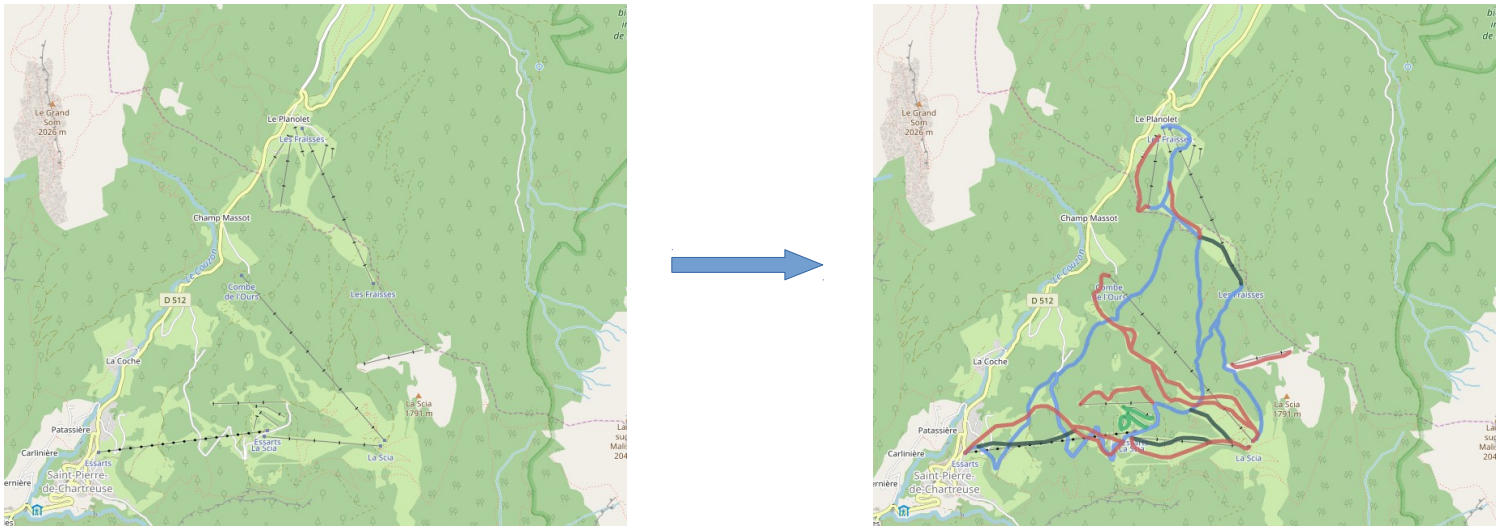
- A text search area allows to filter the list of objects.

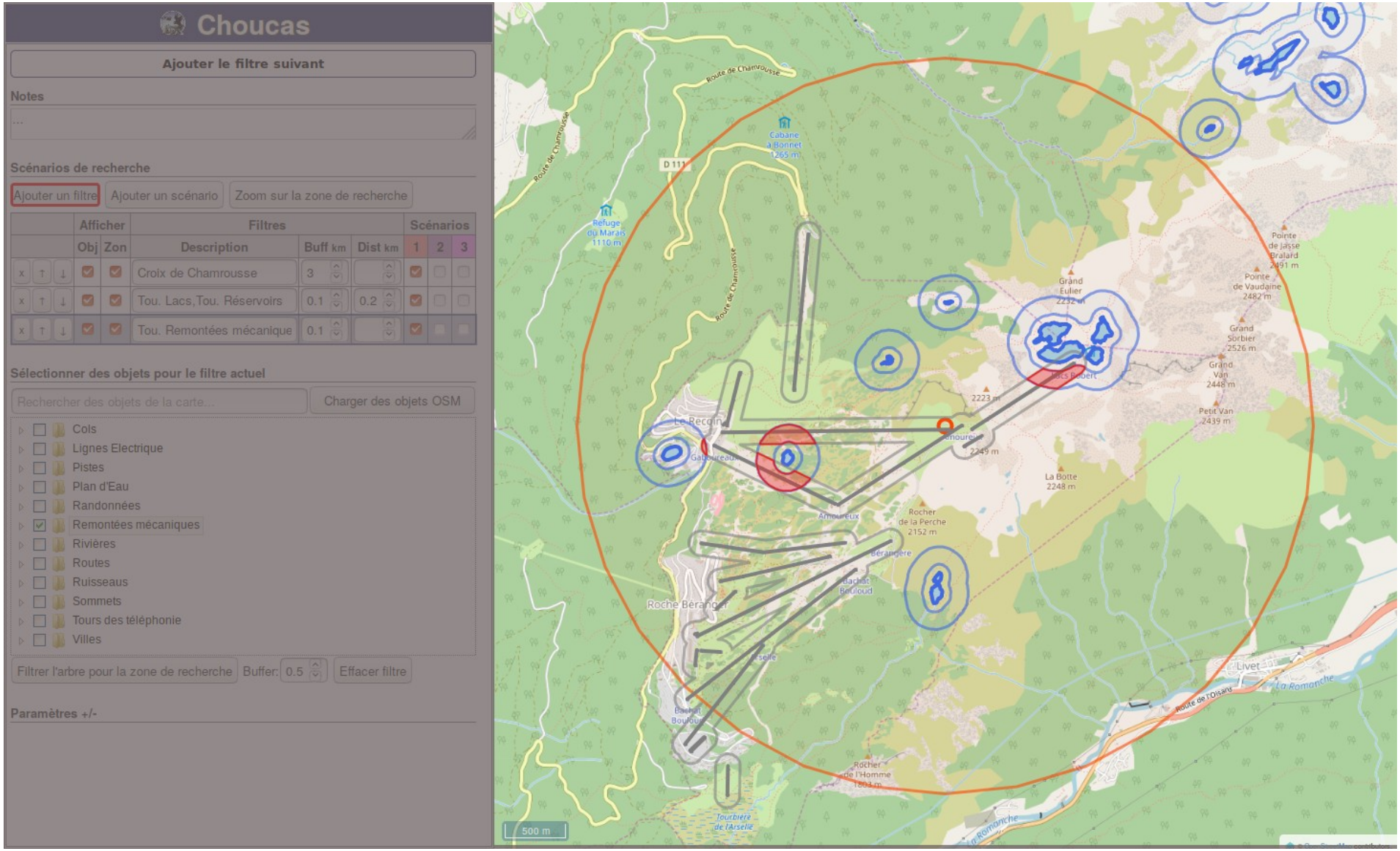


Searchable items tree

- Items selected from this tree are feeding the filter table.

- Items are highlighted on the map when hovering over the tree.

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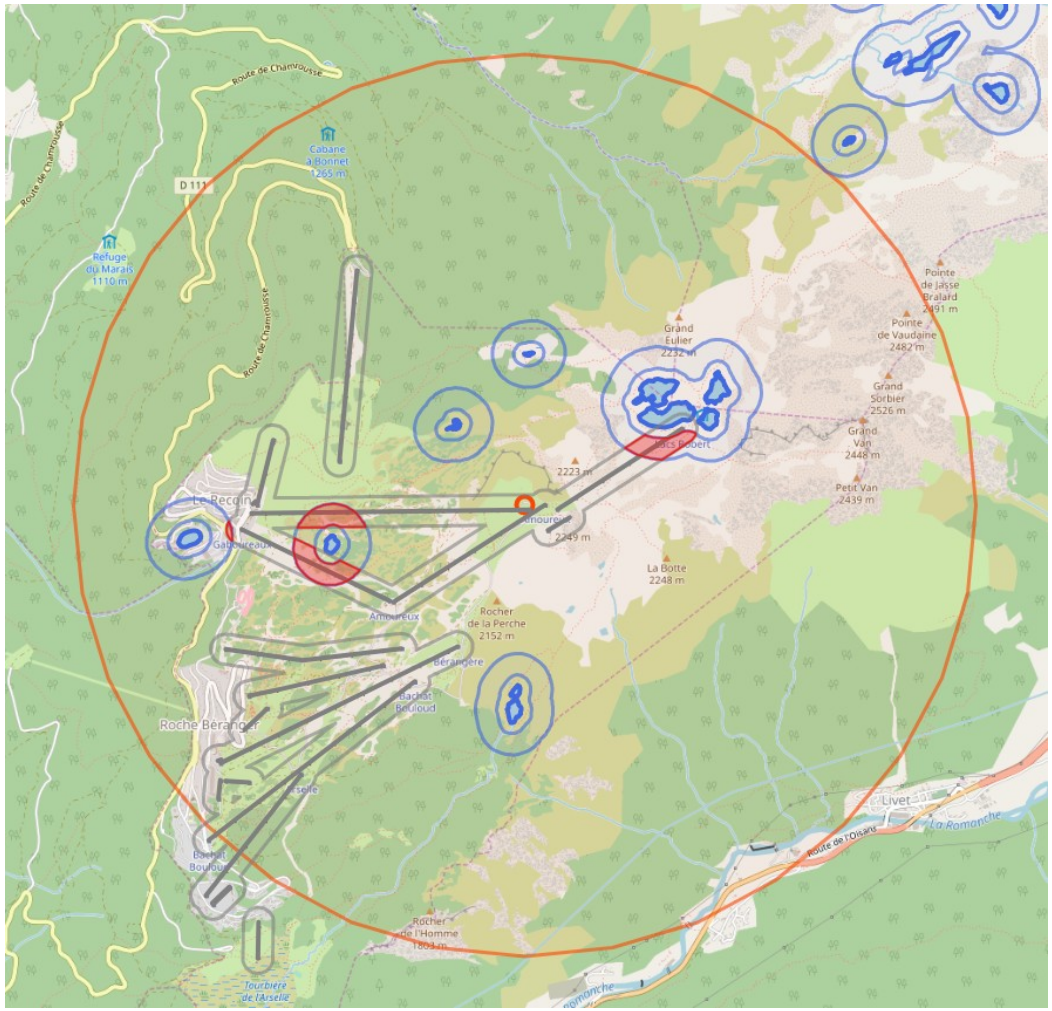
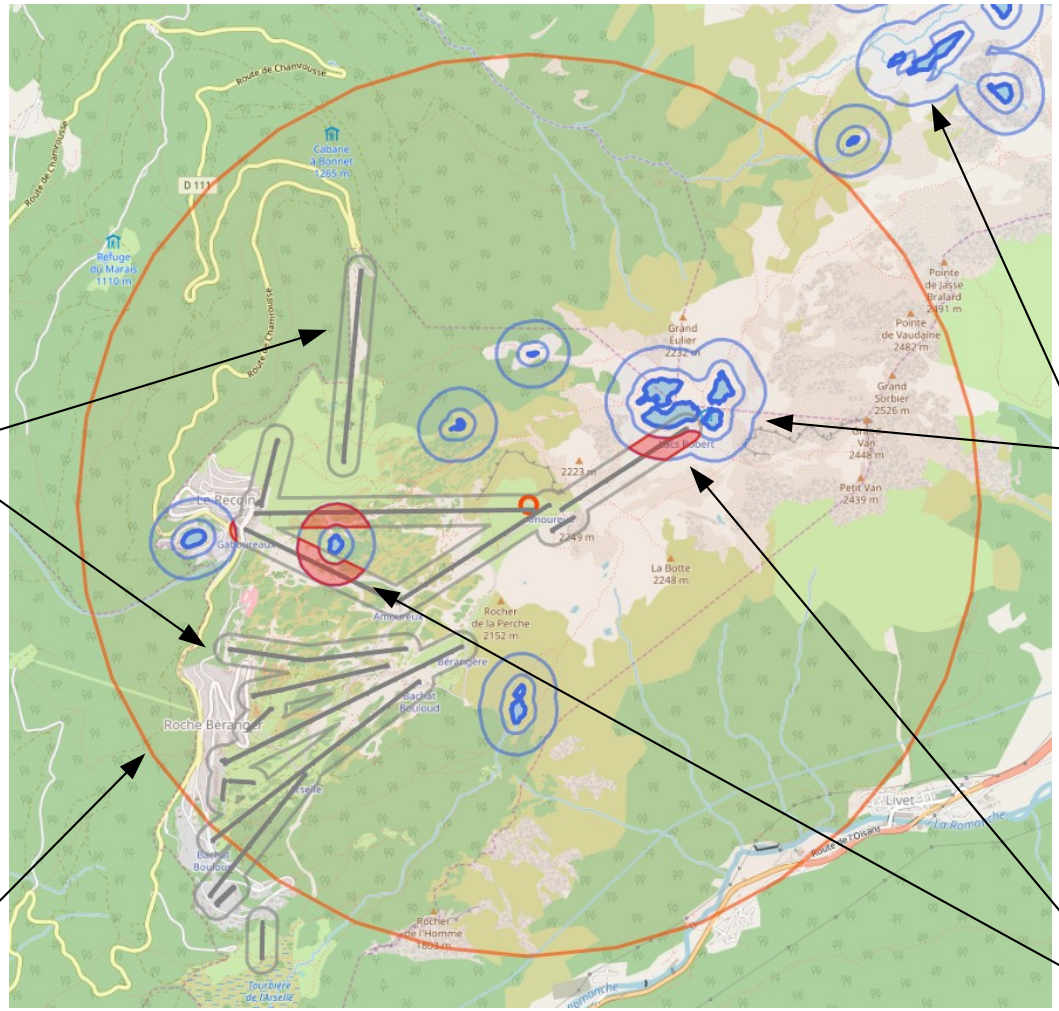
Sommets
Tours des téléphonie
Villes
Filtrer l'arbre pour la zone de recherche
Buffer:
Effacer filtre
Paramètres +/-
Route de Chamrousse
Cabane a Bonnet 1265 m
D 111
Refuge du Marais 1110 m
Pointe de Jasse Bralard 2491 m
Pointe de Vaudaine 2482 m
Grand Sorbier 2526 m
Grand Van 2448 m
Petit Van 2439 m
La Botte 2248 m
Rocher de la Perche 2152 m
Roche Bérangère
Livet
La Romanche
Route de l'Oisans
500 m

Map area : Displaying of clues and probable location areas



Map area

All the ski lifts



All the lakes

3km around *Croix de Chamrousse*

Victim probable locations areas

Map area

	Afficher		Filtres			Scénarios		
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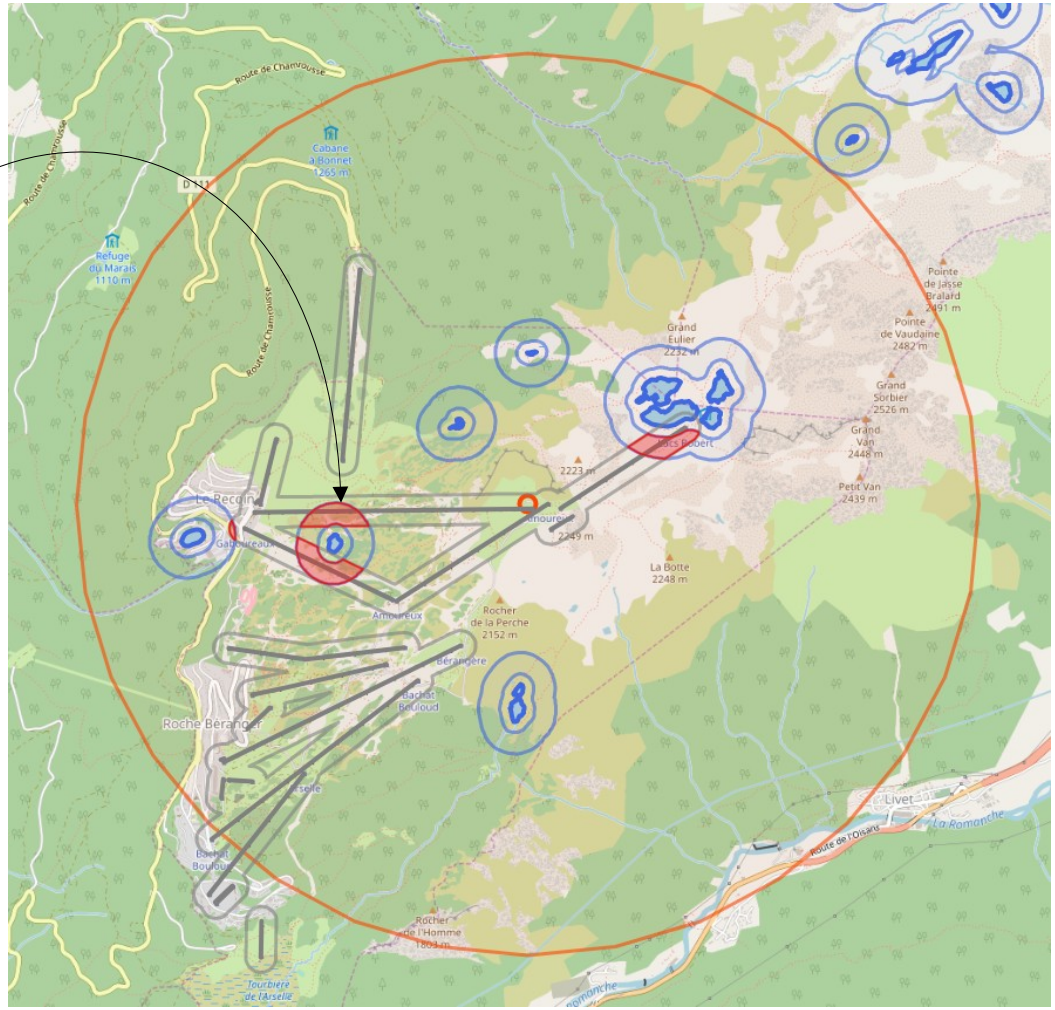
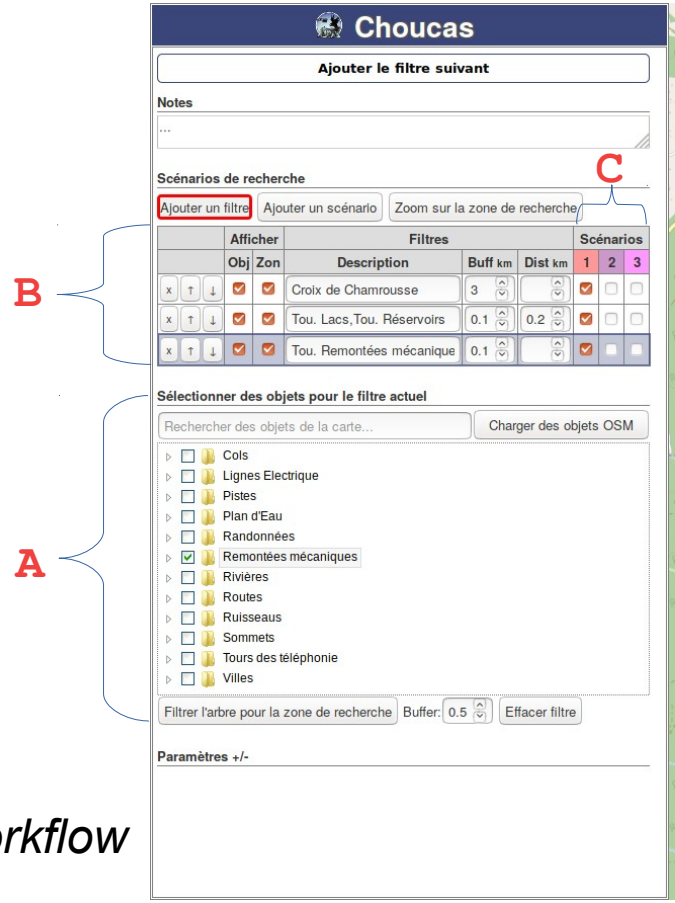
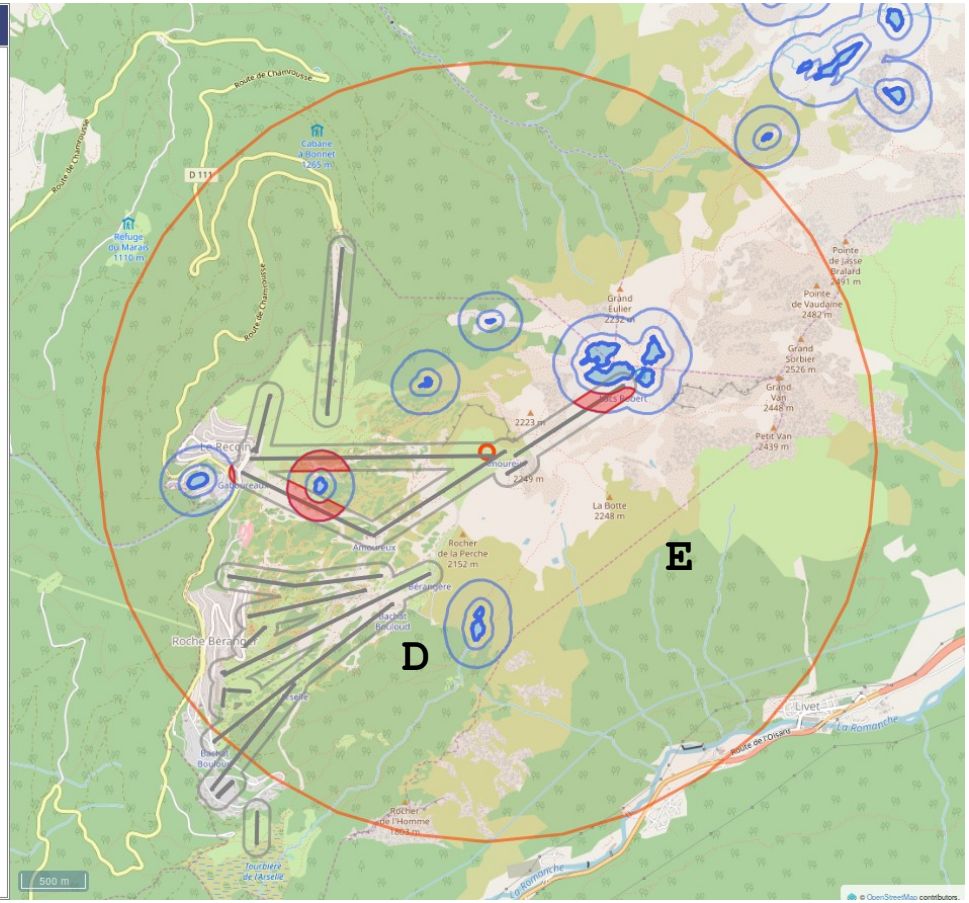
x ↑ ↓	☑	☑	Croix de Chamrousse	3		☑	☐	☐
x ↑ ↓	☑	☑	Tou. Lacs,Tou. Réservoirs	0.1	0.2	☑	☐	☐
x ↑ ↓	☑	☑	Tou. Remontées mécanique	0.1		☑	☐	☐



Map area

- Reacts instantly to interactions with other menus (when modifying uncertainty parameters, etc.)
- Allows to add free hand drawing at the end of the search process
- Basemap can be chosen from several options (standard topographical map, orthophoto, various OSM backgrounds)





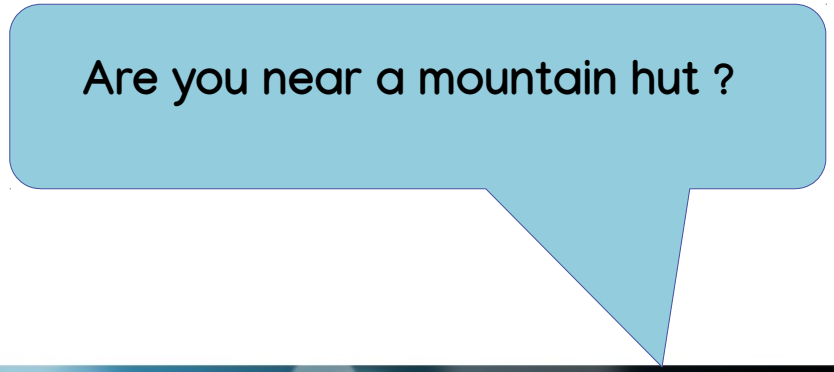
Intended workflow

[A] selection of an item (or a group of items) in the **tree** to build a **filter**
[B] selection of the related **uncertainty parameters**
[C] selection of the **scenario in which including the filter**
[D] **displaying of the corresponding zones**
[E] intersection between the various zone to display the **probable location areas**

Filtering of the items tree

- Once probable location areas have been computed, the user can filter the items tree to only display items within theses areas.

- It's a first step towards a **system that could suggest to the rescuer new questions to be asked to refine the probable location area**.



Current limitations and perspectives

- Notably :
  - User can't interact with the map to select a specific item for example
  - Temporal dimension is not taken into account
  - Querying OSM features is only bounded by the viewport (*needs to be explicited by some cartographic mean*)

- Perspectives and current work

- Thank you !

Video demonstration : https://steamer.imag.fr/?page_id=792

CHOUCAS project : http://choucas.ign.fr

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