A mobile application for collecting snow data in support to satellite remote sensing

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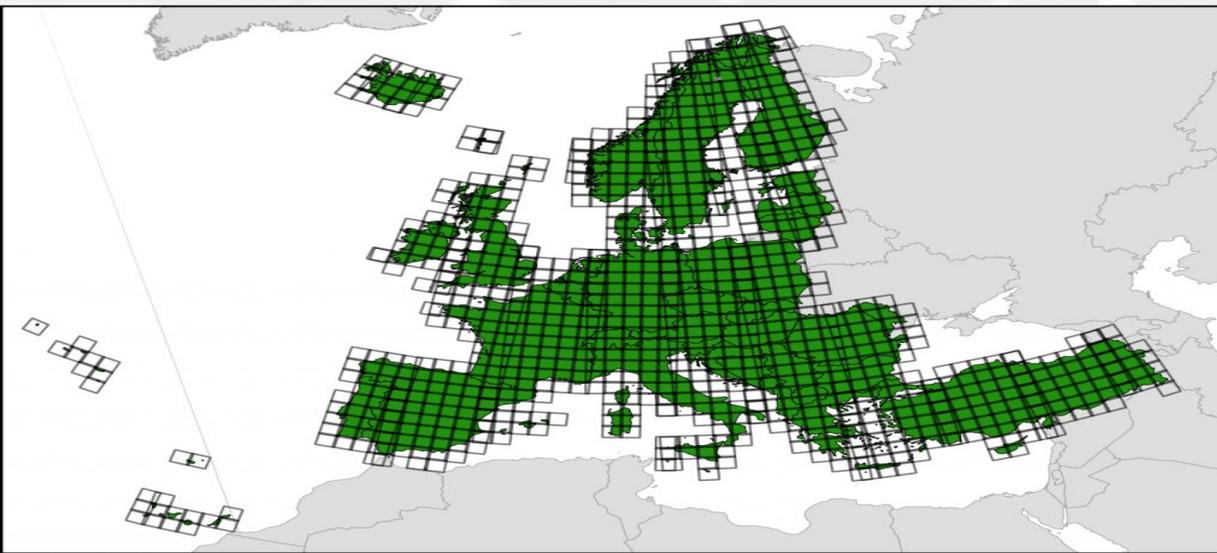*Center for the study of the biosphere from space - France*

Center for the Study of the BIOsphere from Space (CESBIO)

The CESBIO studies continental surfaces and their interactions with climate and humans.

Introduction

- Copernicus Snow & Ice Monitoring Service

- Aims to provide operational snow cover maps at Pan European scale from Sentinel-2 data.
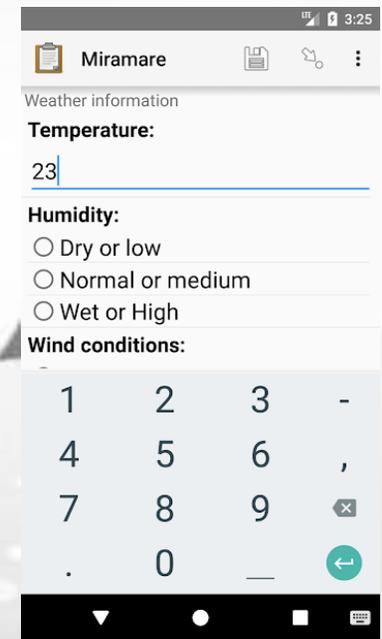
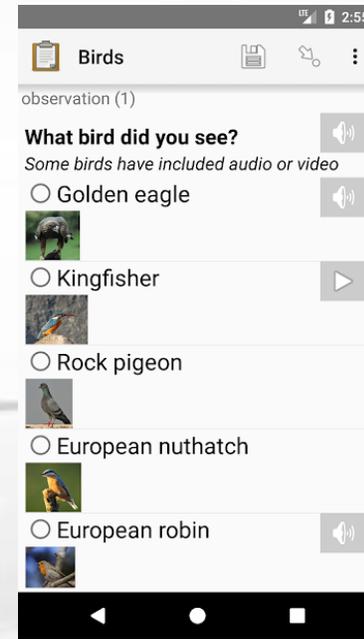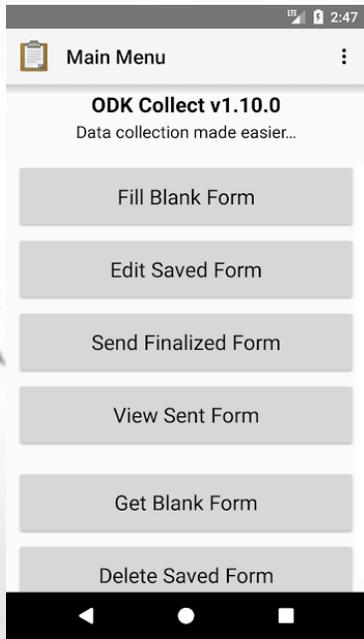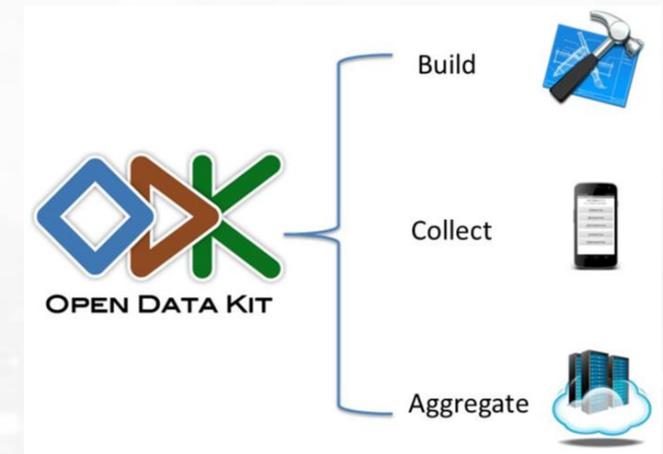- Snow cover maps include Fractional Snow Cover (FSC) values.

- Ground-truth observations of FSC are scarce.

- Solution: Get volunteer ground snow data from the general public with a mobile app.

- First experiment: Open Data Kit (ODK)
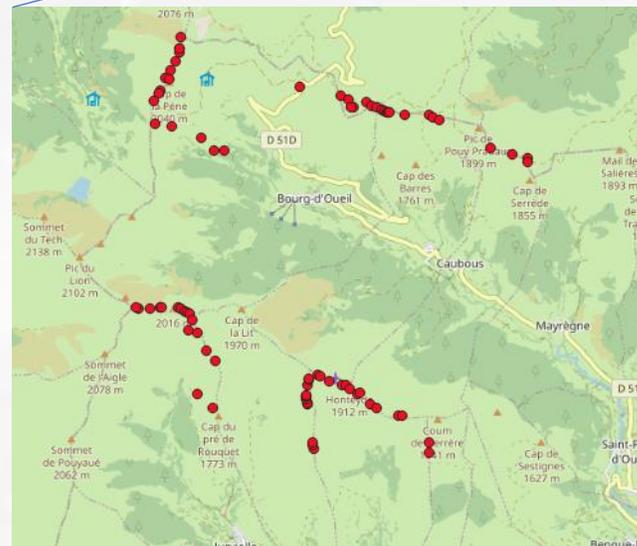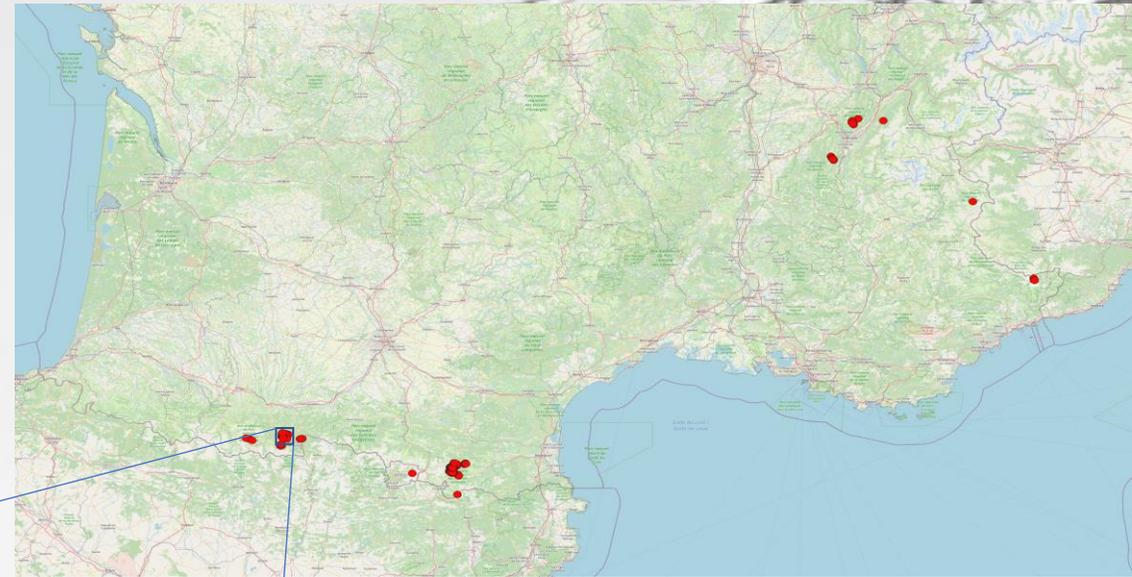
- New experiment: **Snow Data Kit**

ODK

- Open-source application developed by Get ODK Inc.
- Custom data collection forms including geolocation.
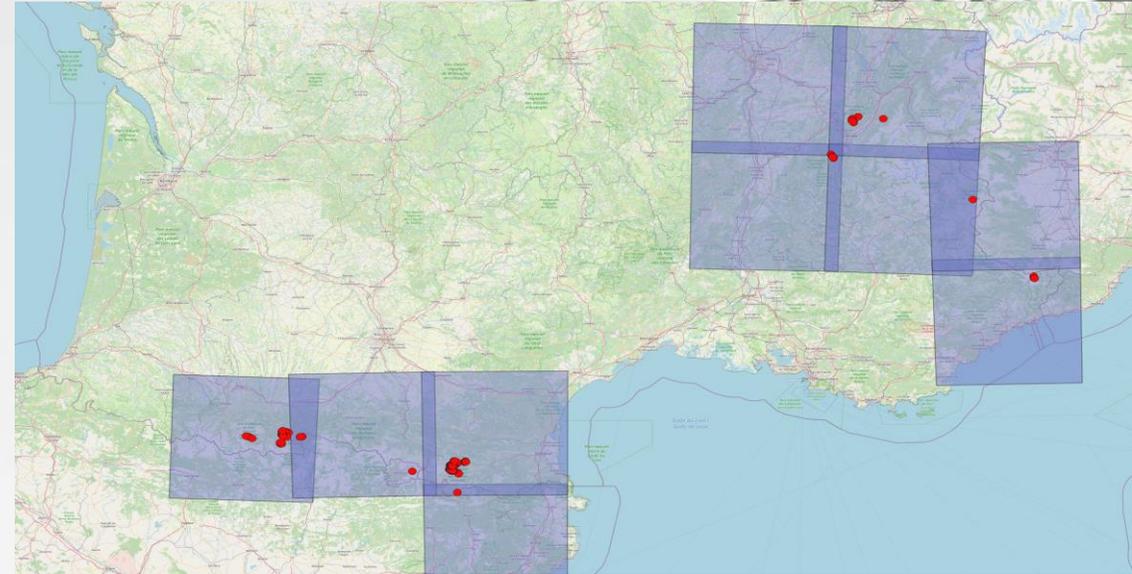- Forms can be saved on the phone and sent to a server.

Using ODK to get snow data

- Users were asked to indicate the fractional snow cover around them in a 10m radius.

- 337 snow measurements obtained mainly in French mountain ranges.

- Position accuracy <= 5m.

- 21 contributors (mostly from our colleagues)

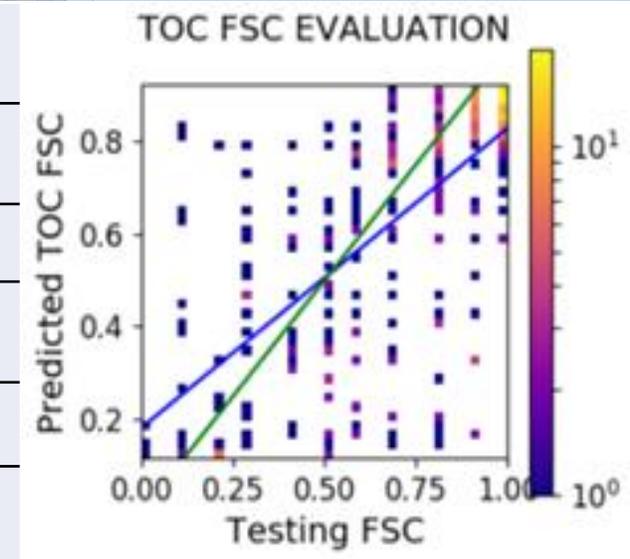# Evaluation with ODK data

- Data set distributed between 10 Sentinel-2 tiles.

- Evaluation of Top Of Canopy (TOC) fractional snow cover maps.

- Good correlation despite the uncertainties.

- Next: Evaluation of On Ground (OG) fractional snow cover maps.

Sample size	337
In forest	141
RMSE	23%
Mean error	-7.2%
STD	21%
Correlation	0.67

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ODK feedbacks

User experience:

- Complex to configure at the start.

- Users had to register in a website.

- They use it while outside.

Communication:

- Communication made only in French.

- Snow data collection form only available in French.

- We wish to broaden the user base to other European countries.
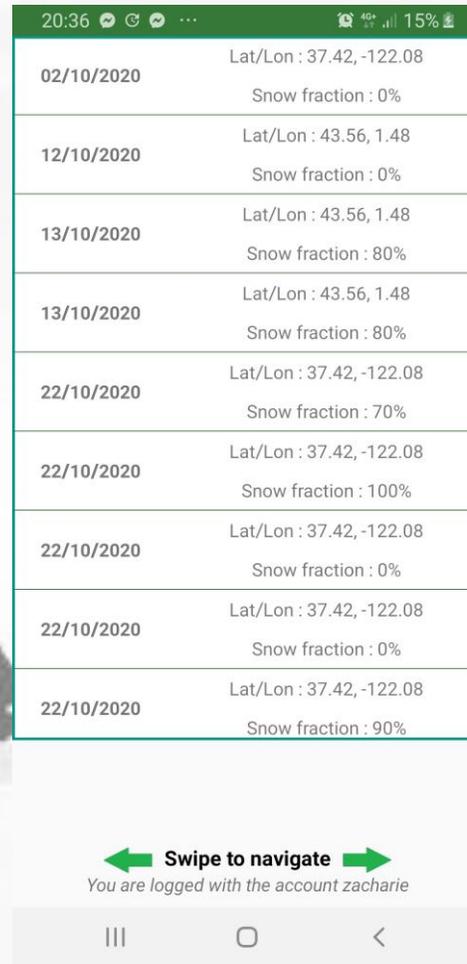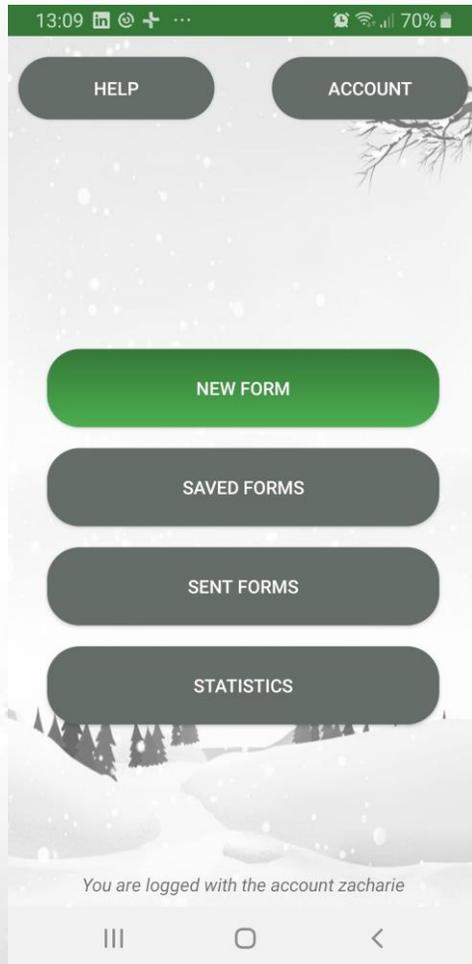
Solution: Snow Data Kit.

Snow Data Kit

Developers:

- Salah-Eddine Et-Taleby

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- Zacharie Barrou Dumont

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Snow Data Kit
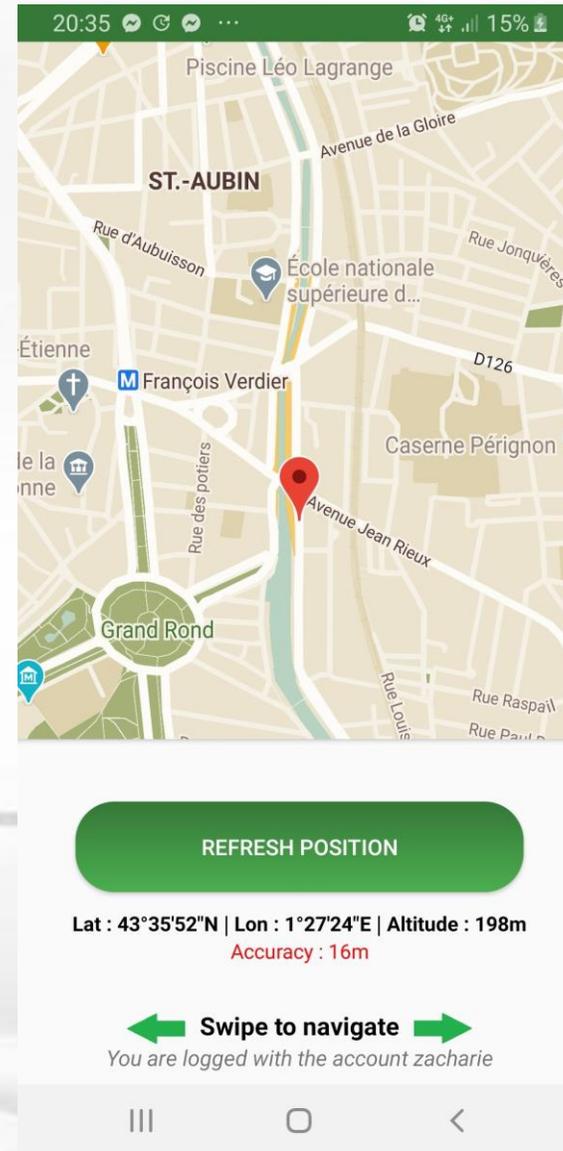

- Fill, save and send snow data forms.

- Both in French and English.

- Snow cover data form.

Snow Data Kit

Step 1:

- Get Latitude, Longitude, Altitude.

- The geolocation must have an accuracy below 5m!

Snow Data Kit

Step 2:

- Indicate the observed snow cover in a 10m radius.

Step 3:

- Save or send.

(a) Picture to explain the measurements protocol

(b) Examples of visually estimated snow fraction

Snow fraction
Snow fraction in 10m radius.

- ○ 0%
- ○ 10%
- ○ 20%
- ○ 30%
- ○ 40%
- ○ 50%
- ○ 60%
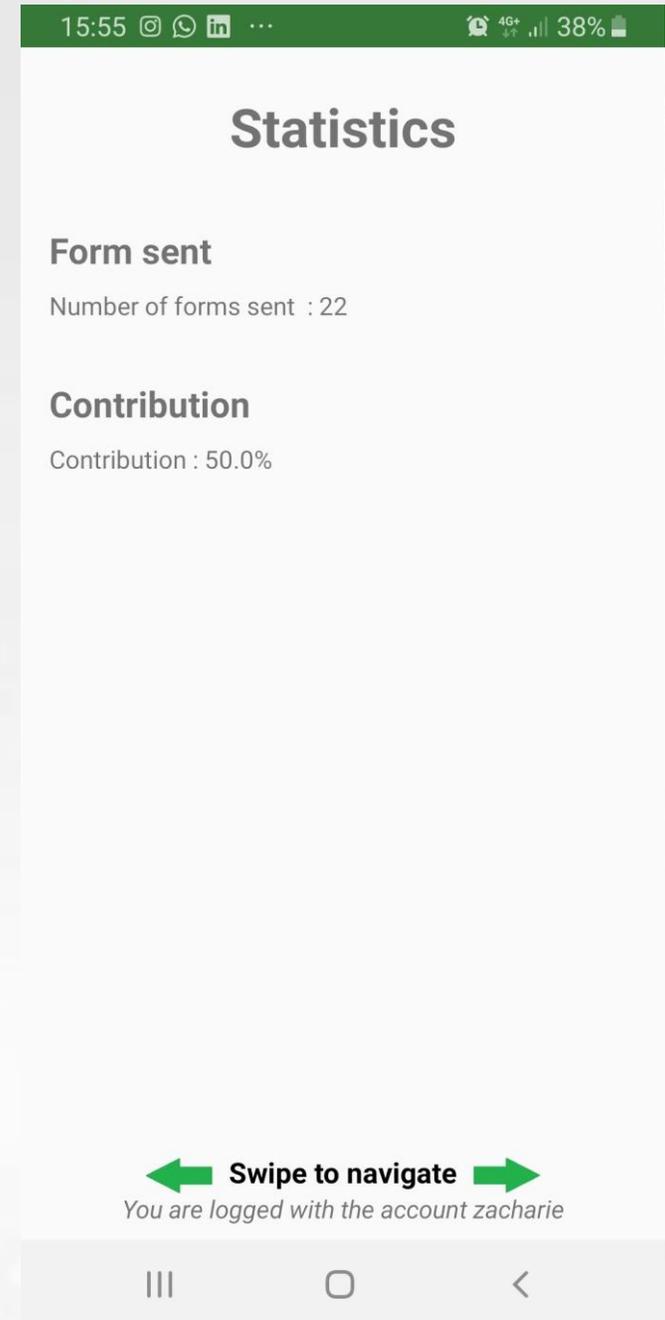- ○ 70%
- ○ 80%
- ○ 90%
- ○ 100%

Swipe to navigate
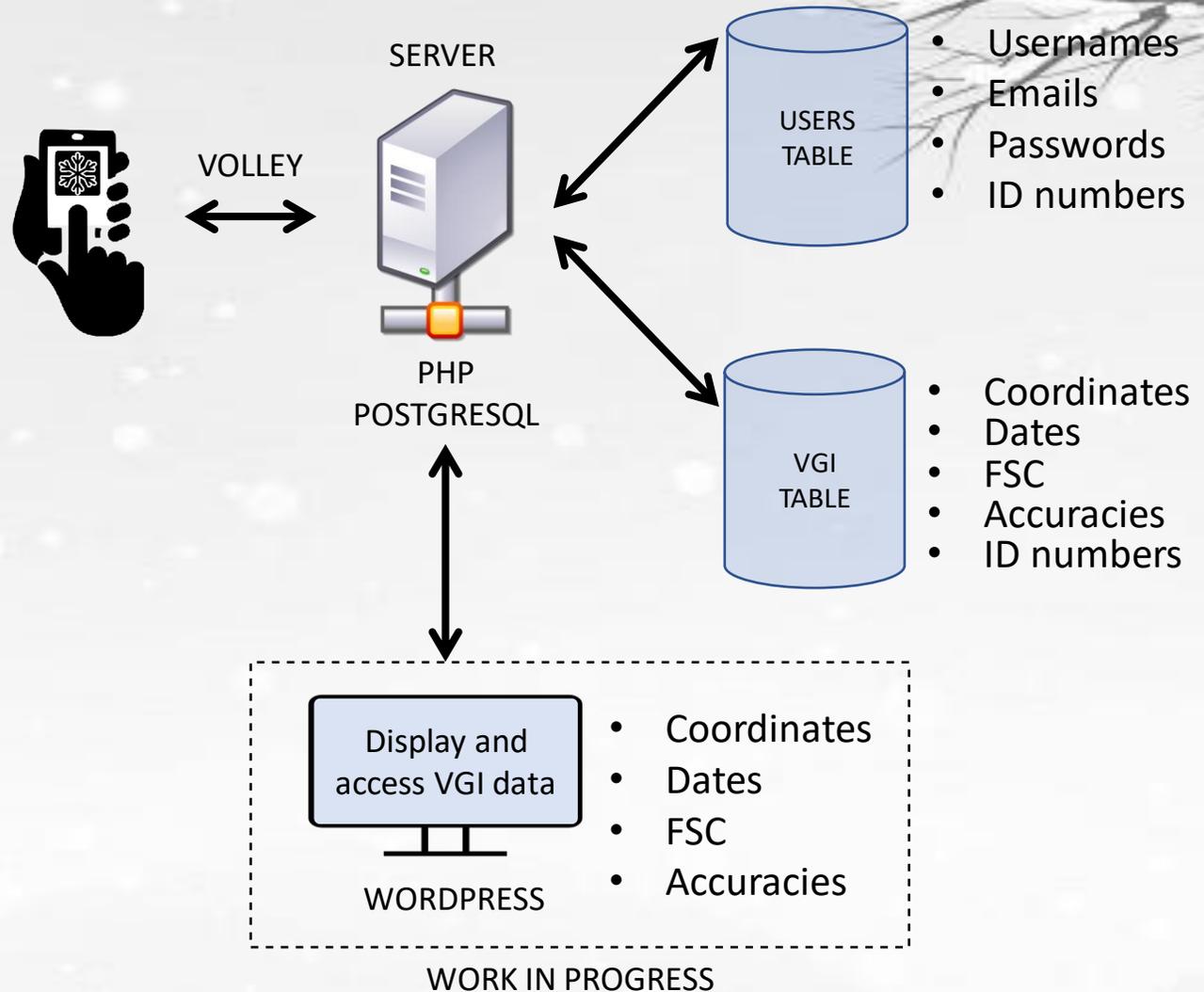*You are logged with the account zacharie*

Fostering user interest

- Number of necessary actions kept to a minimum.

- In-app registration and automatic account management.

- Display of user's contribution to the data set (other metrics could be added in next updates).

- Prizes for best contributors.

Architecture

- Mobile application:
  - Developed in Java with AndroidStudio.
- Server:
  - PHP with PostgreSQL database.
- Next:
  - Display downloadable VGI data on CESBIO website.
  - Developed with Wordpress.

SERVER

VOLLEY

PHP
POSTGRESQL

USERS
TABLE

- Usernames
- Emails
- Passwords
- ID numbers

VGI
TABLE

- Coordinates
- Dates
- FSC
- Accuracies
- ID numbers

Display and access VGI data

- Coordinates
- Dates
- FSC
- Accuracies

WORDPRESS

WORK IN PROGRESS

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Conclusion

- Potential ground-truth data source.

- Involve the general public with land cover data research.

- Easily editable.
    - Can be used as template for other thematics: Hydrology, Geology, Botany, etc...

- Open-source code available on "https://github.com/zachariebd2/SnowDataKit".

Thank you.

Snow Data Kit available on Google Play :

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