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1) INTRODUCTION

PURPOSE OF OUR PROJECT

As technology advances, people have increasingly diverse ways of accessing information, and the volume of accessible information continues to grow. The inundation of information poses a challenge for ordinary citizens to discern accurate information, while experts encounter difficulties in efficiently utilizing those informations in their work.

During the XXV Winter Olympic Games, there is a significant need to provide high-quality information on landslide and floods to facilitate the safety and enjoyment of the event for tourists, citizens, and other general users. In response to this, we have developed a user-friendly data visualization and data querying functionality tailored to the specific needs and characteristics of the users. This streamlined system aims to ensure that individuals can easily access reliable information about potential hazards, enabling them to make informed decisions and navigate the Olympic environment safely.

For our expert users, we have further empowered them with the ability to visualize data and access data. Expert users have the opportunity to delve into datasets, extract valuable insights, and arrive at strategic conclusions with higher precision and efficiency. This approach not only streamlines their workflow but also provides them with the necessary resources to tackle the inherent complexities of their respective fields, enabling them to optimize decision-making processes and drive impactful outcomes.

SCOPE

The application is specifically tailored to offer various degrees of data visualization and data accessibility to diverse user groups, including non-registered users, general users, and experts. Its primary objective is to educate these users about the occurrences of floods and landslides in their locality. This is achieved through the integration of interactive maps and the comprehensive analysis of historical data. By employing these features, the application strives to enhance user comprehension of potential hazards and empower them to make well-informed decisions regarding precautionary measures for ensuring safety. For example, non-registered users may be provided with basic visualizations and general information, while experts could have access to more detailed and specialized data analysis tools. This differentiation in access levels ensures that the application caters to the specific needs and expertise levels of its user base.

2) SYSTEM OVERVIEW
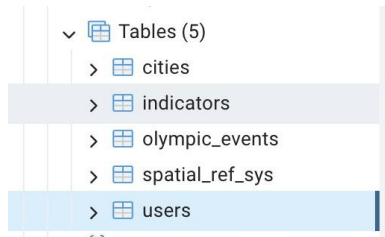
Selected indicators

The database is based on the use of various tables that contain information about the cities and the related events where the Milan and Cortina Winter Olympics will be held. In addition to this information, some of the indicators derived from IdrogeoAPI are considered useful in defining the hydrogeological risk of these cities.

Among the selected indicators are:

- **ar_kmq**: area of the city in km²
- **ar_id_p3**: surface area of high hydraulic hazard areas (km²)
- **ar_id_p2**: surface area of medium hydraulic hazard areas (km²)
- **ar_id_p1**: surface area of moderate hydraulic hazard areas (km²)
- **aridp3_p**: surface area of high hydraulic hazard areas (%)
- **aridp2_p**: surface area of medium hydraulic hazard areas (%)
- **aridp1_p**: surface area of moderate hydraulic hazard areas (%)
- **ar_fr_p4**: surface area of very high landslide hazard areas (km²)
- **ar_fr_p3**: surface area of high landslide hazard areas (km²)
- **ar_fr_p2**: surface area of medium landslide hazard areas (km²)
- **ar_fr_p1**: surface area of moderate landslide hazard areas (km²)
- **ar_fr_aa**: surface area of attention areas (km²)
- **ar_frp4_p**: surface area of very high landslide hazard areas (%)
- **ar_frp3_p**: surface area of high landslide hazard areas (%)
- **ar_frp2_p**: surface area of medium landslide hazard areas (%)
- **ar_frp1_p**: surface area of moderate landslide hazard areas (%)
- **ar_fraa_p**: surface area of attention areas (%)
- **pop_res011**: resident population
- **pop_idr_p3**: resident population in high hydraulic hazard areas
- **pop_idr_p2**: resident population in medium hydraulic hazard areas
- **pop_idr_p1**: resident population in moderate hydraulic hazard areas
- **popidp3_p**: resident population in high hydraulic hazard areas (%)
- **popidp2_p**: resident population in medium hydraulic hazard areas (%)
- **popidp1_p**: resident population in moderate hydraulic hazard areas (%)
- **pop_fr_p4**: resident population in very high landslide hazard areas
- **pop_fr_p3**: resident population in high landslide hazard areas
- **pop_fr_p2**: resident population in medium landslide hazard areas

- **pop_fr_p1**: resident population in moderate landslide hazard areas
- **pop_fr_aa**: resident population in attention areas
- **popfr_p3p4**: resident population in high and very high landslide hazard areas
- **popfrp4_p**: resident population in very high landslide hazard areas (%)
- **popfrp3_p**: resident population in high landslide hazard areas (%)
- **popfrp2_p**: resident population in medium landslide hazard areas (%)
- **popfrp1_p**: resident population in moderate landslide hazard areas (%)
- **popfraa_p**: resident population in attention areas (%)
- **ed_tot**: buildings
- **ed_idr_p3**: buildings at risk in high hydraulic hazard areas
- **ed_idr_p2**: buildings at risk in medium hydraulic hazard areas
- **ed_idr_p1**: buildings at risk in moderate hydraulic hazard areas
- **edidp3_p**: buildings at risk in high hydraulic hazard areas (%)
- **edidp2_p**: buildings at risk in medium hydraulic hazard areas (%)
- **edidp1_p**: buildings at risk in moderate hydraulic hazard areas (%)

3) TABLES

In the project, we set up a database to store selected city location and other historical flood situations, landslide data and so on. The database employs PostgreSQL for managing relational data and PostGIS for handling geospatial data.

Table	Usage
Cities	Stores coordinates for cities
Olympic events	Stores information about Olympic events
Users	Storing registered user information

- **CITIES TABLE**

The table is designed to store comprehensive information about cities within Italy, including their geographical identifiers, location, and various indicators. The table leverages parameters provided by the IDROGEOapi portal, ensuring standardized identification and consistent data integration.

The table's columns are as follows:
- Cod_rip: identifies the zone in Italy (example: 1 means North-west)
- Cod_prov: identifies the selected province.
- Cod_reg: identifies the selected region.
- geometry
- uid
- name: name of the city
- ar_id_p3

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- ar_id_p2
- ar_id_p1
- pop_idr_p3
- pop_idr_p2
- pop_idr_p1
- fam_idr_p3
- fam_idr_p2
- fam_idr_p1
- ed_idr_p3
- ed_idr_p2
- ed_idr_p1
- im_idr_p3
- im_idr_p2
- im_idr_p1
- centroid_x
- centroid_y
- lat: latitude
- lon: longitude

Data Output | Messages | Notifications

	cod_rip bigint	cod_reg bigint	cod_prov bigint	geometry geometry
1	1	3	14	0103000020787F0000010000007B000000809ECD2A349E2241441CEB6E18AA534170E7FB29D49E22410612146FF2

	uid bigint	name text	ar_id_p3 double precision	ar_id_p2 double precision	ar_id_p1 double precision	pop_idr_p3 double precision	pop_idr_p2 double precision	pop_idr_p1 double prec
1	14009	Bormio	3.135	3.148	4.974	120	120	

	pop_idr_p1 double precision	fam_idr_p3 double precision	fam_idr_p2 double precision	fam_idr_p1 double precision	ed_idr_p3 double precision	ed_idr_p2 double precision	ed_idr_p1 double precision	im_idr_p double p
1	2213	50	50	966	36	36	778	

	idr_p3 ble precision	im_idr_p2 double precision	im_idr_p1 double precision	centroid_x double precision	centroid_y double precision	lat double precision	lon double precision
1	15	15	341	608008.3752722313	5150384.194010381	46.49836570917458	10.407572450261835
2	38	52	166	587194.0034532342	5152967.62151969	46.52462701792213	10.136863636045662
3	3552	6361	11440	513541.6011320142	5035004.2686184235	45.468434468095694	9.173231733138067
4	279	439	923	503899.5139270645	5041966.605121543	45.531223844997434	9.049940238723188
5	0	203	203	703504.7982249977	5132148.826181379	46.31235629824849	11.643117718882323
6	0	21	21	694094.9620770843	5129053.843121725	46.28728773820943	11.519748297476628
7	1502	1555	2080	656559.7810768323	5034710.811771544	45.44837512013979	11.002095985223068
8	22	30	30	739340.1862171293	5160691.089838553	46.5571485763325	12.122530388180746

- **OLYMPIC EVENTS**

This table provides information about the events' venues and games.

  o game_id is the code that identifies the SPORT.
  o CITY is the municipality where the venue takes place.
  o SPORT is the game of the event
  o city_uid is the unique identifier of the municipality

	game_id bigint	CITY text	VENUE text	SPORT text	city_uid bigint
1	1	Milano	Stadio Giuseppe Meazza/San Siro	Opening Ceremony	15146
2	2	Milano	PalaItalia	Ice Hockey	15146
3	3	Assago	Mediolanum Forum	Figure Skating	15011
4	4	Assago	Mediolanum Forum	Short Track	15011
5	5	Rho	Rho Fiera Milano	Speed Skating	15182
6	6	Rho	Rho Fiera Milano	Ice Hockey	15182
7	7	Bormio	Stelvio	Men's Alpine Skiing	14009
8	8	Bormio	To be defined	Ski Mountaineering	14009
9	9	Livigno	Mottolini/Sitas, Tagliede/Carosello 3000	Freestyle	14037
10	10	Livigno	Mottolini/Sitas, Tagliede/Carosello 3000	Snowboarding	14037
11	11	Predazzo	Stadio del salto Giuseppe Del Ben	Ski Jumping	22147
12	12	Predazzo	Stadio del salto Giuseppe Del Ben	Nordic Combined	22147
13	13	Tesero	Centro del fondo e del biathlon Fabio Canal	Cross-Country Skiing	22196
14	14	Tesero	Centro del fondo e del biathlon Fabio Canal	Nordic Combined	22196
15	16	Cortina d'Ampezzo	Olimpia delle Tofane	Women's Alpine Skiing	25016
16	17	Cortina d'Ampezzo	Stadio olimpico del ghiaccio	Curling	25016
17	18	Cortina d'Ampezzo	To be defined	Bobsleigh	25016
18	19	Cortina d'Ampezzo	To be defined	Skeleton	25016
19	20	Cortina d'Ampezzo	To be defined	Luge	25016
20	21	Verona	Arena di Verona	Closing Ceremony	23091

- **USERS**

The table below provides information about the user. In particular, the user_type column specifies if the user is an expert or a general user.

	userid text	name text	last_name text	email text	user_type text	password text
1	1	amir	donyadide	amir@example.com	general	1234
2	2	john	dohn	john@example.com	expert	1234
3	3	Amirhossein	Donyadidegan	donyadideganamir@gmail.com	expert	7777

4) WEBSITE INTERFACE AND STRUCTURE

Home page for a non-registered user:
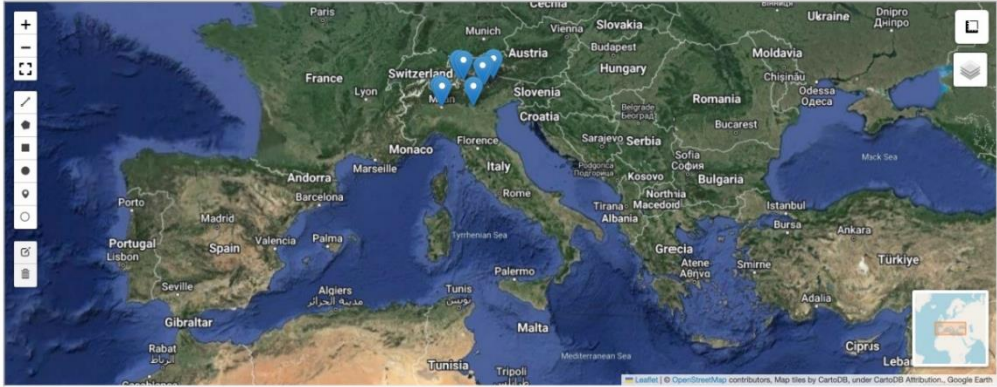
DESCRIPTION:

Top left Section: User Interaction Panel

- **Login Section:**
    - **Position:** Top-left of the screen.
    - **Components:**
        - **Username Field:** A text input field where users can enter their username.
        - **Password Field:** A password input field to ensure secure entry of user passwords.
- **Search Bar:**
    - **Position:** Below the login section.
    - **Components:**
        - City selection field.
        - Parameters selection field**.**
        - Plot type field

Top right Section: Interactive Map

- **Position:** Occupies the majority of the screen to the right.
- **Components:**
    - **Interactive Map:** A dynamic map interface that displays geographical data about cities in Italy.
        - **Zoom Controls:** Buttons to zoom in and out of the map for better navigation.
        - **Pan Controls:** Allows users to move the map view to different areas.
        - **Markers/Highlights:** Visual indicators on the map showing specific cities or points of interest.

Mid left: unavailable options because the user is not logged in.

Bottom: Registering section

Home page for a registered user after a city selection:

- On the map it pops up a label with the selected city

- in the mid-section there are the events of the selected city with the venues.

Home page for a registered user after a city selection and a parameter selection:

- after the parameter selection in the mid-section it pops up a table related to the selected parameter with the indicators (code and description) and the corresponding values.

Home page for a registered user after a city selection, a parameter selection and a plot type selection (Pie chart):
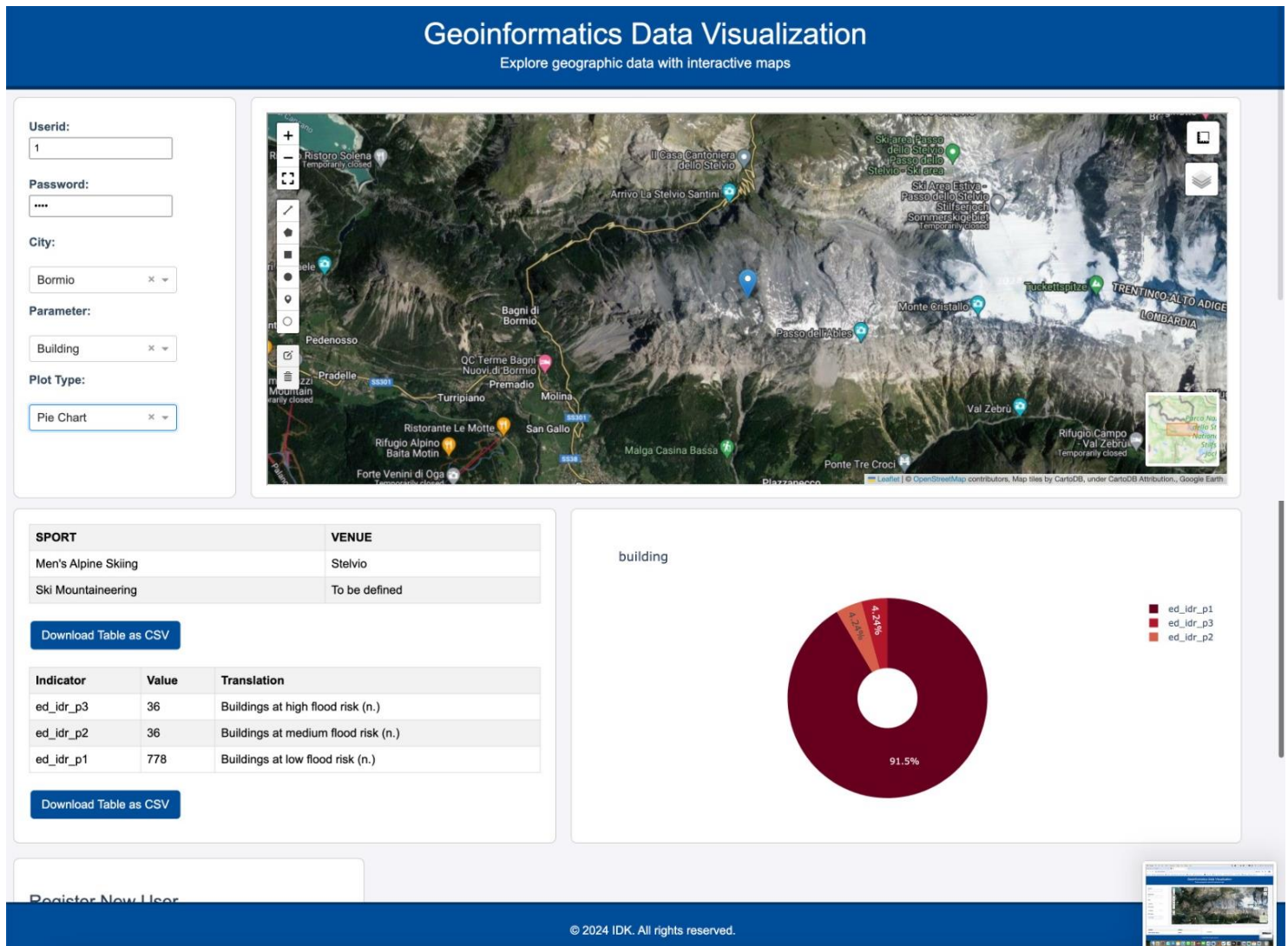
- the selected plot type gives a picture of the indicators: in the example the pie-chart describes what's the distribution of flood risk and it suggests that buildings of Bormio are more at high flood risk instead of medium/low.

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Home page for a registered user after a city selection, a parameter selection and another plot type selection (Bar plot):
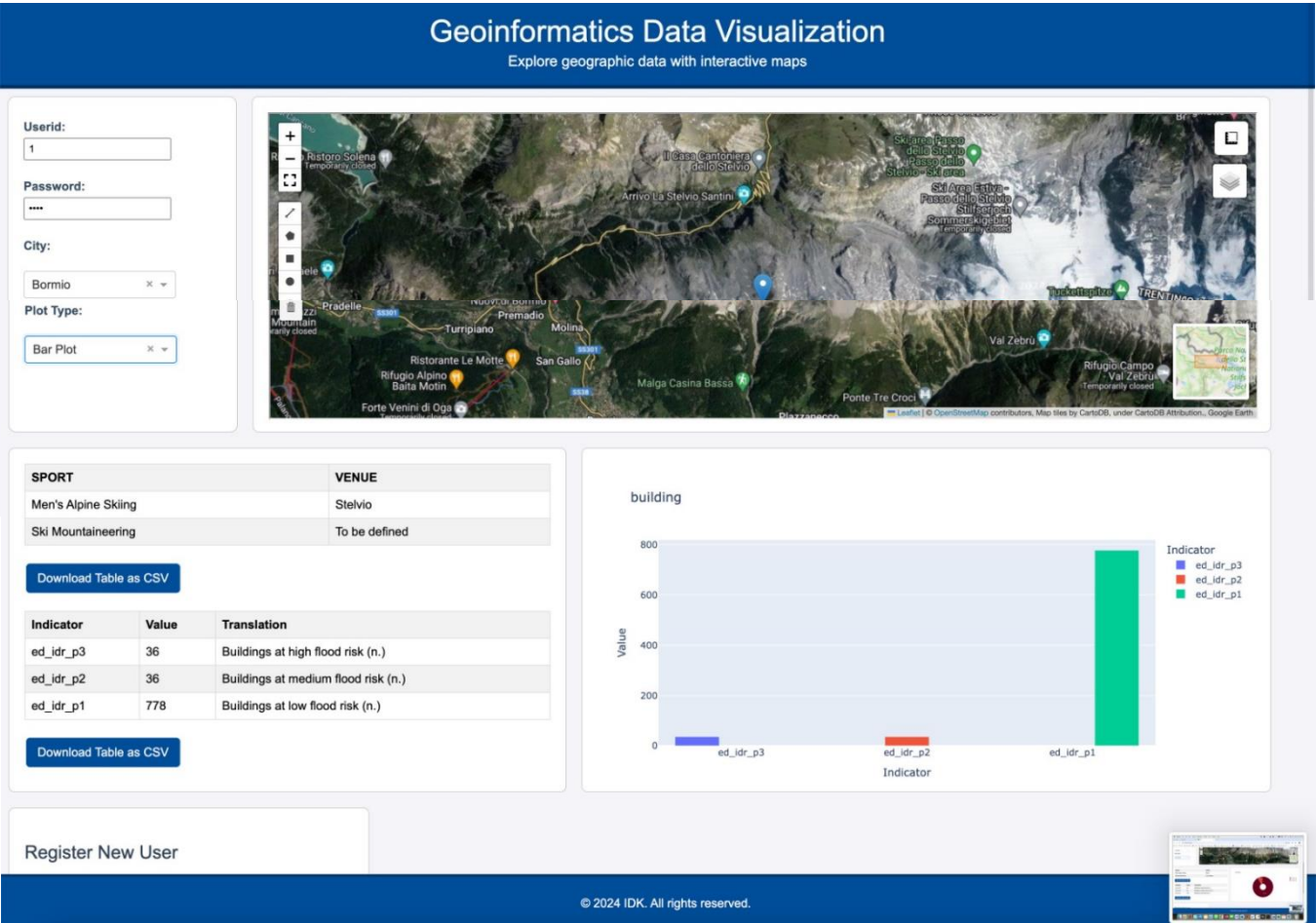
5) USER CASES

1. **Register**
   - **ID Name:** DD1
   - **User:** Anyone who has not yet registered
   - **Input:** Go to the Home Page, click on Register, and follow the instructions
   - **Actions:** Enter first and last name, e-mail, password and select the type of user you want to be (generic or expert), click on Register and you will be redirected to the Log In page

2. **Log In**
   - **ID Name:** DD2
   - **User:** Anyone who is already registered
   - **Input:** Click on Log In
   - **Actions:** Enter your name and password and click on Log In; you will be redirected to the Home Page. If the password is incorrect, you will remain on the Log In page.

3. **Log Out**
   - **ID Name:** DD3
   - **User:** Anyone who has logged in
   - **Input:** Click on Log Out
   - **Actions:** Clicking on Log Out will exit the personal section and return you to the Home Page.

4. **Query Data**
   - **ID Name:** DD4
   - **User:** Anyone who is registered
   - **Input:**
     - **Cities:** The user can choose one or more cities from those hosting the XXVI Winter Olympics by selecting flags on the map or from the Selection Section.
     - **Indicators:** The user decides which data to analyze: landslide data, flood risk area data and population data.
   - **Actions:** After choosing the data to view, the user can display it in two different ways: through specific maps concerning the selected cities or through tables presenting the basic statistics of the searched data.

5. **Data Visualization**
   - **ID Name:** DD5
   - **User:** Anyone who has logged in
   - **Input:** By selecting one or more items from the Selection Section, the user can view the data of interest through an interactive map or an attribute table.
   - **Actions:** The user can decide on which information to focus regarding landslide and flood events in the cities hosting the Winter Olympics 2026 through the Selection Section.

6. **Hazard Report**
   - **ID Name:** DD6

- o **User:** Anyone who is logged in
- o **Input:** The user must click on the Report button to download a table containing the selected indicators.
- o **Actions:** After clicking the "Report" button, the user will have the opportunity to view the attribute table containing the most significant indicators related to the selected cities; it will also be possible to download the file.

7. **Advanced Actions**
   - o **ID Name:** DD7
   - o **User:** Anyone registered as an expert
   - o **Input:** The user must register as an "expert"
   - o **Actions:** The user will have access to more functionalities in the Query Data, Data Visualization and Hazard Report fields, such as the ability to use more indicators or perform more complex queries