



HEV-E

Hazards, Exposures and Vulnerabilities Explorer

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About Us

- Around since 2006
- Expertise
 - GeoSpatial Data Fusion, Web Mashups, Mobile Apps
 - OGC, ISO, INSPIRE Standards
- Supporting/Developing FOSS4G projects
 - MapStore, GeoServer, GeoNetwork, CKAN, GeoNode
- Offer
 - Enterprise Support Services
 - Deployment Warranty
 - Professional Training
 - End-To-End Projects (Integration)
- Clients
 - UN FAO (CIOK, FIGIS, NRL, FORESTRY, ESTG), UN WFP, World Bank, DLR, EUMETSAT, JRC, ARPAT, NATO CMRE, UNESCO, IGAD, UNEP, etc..
 - Private Companies all over the world like TOTAL, CGI, BAYER, BASF, DigitalGlobe, MDA, e-GEOS, Halliburton, etc..



The Challenge Fund

- **Initiators**
 - Global Facility for Disaster Reduction and Recovery (GFDRR)
 - UK's Department for International Development (DFID)
- **Objectives**
 - innovation to local contexts
 - identify climate threats and disaster risk
 - support effective decision-making
 - **build resilience**



The Challenge Fund

- **Problem**
 - Unavailable risk data in developing countries
 - Generates non-effective risk-reducing policies
- **Response**
 - **Challenge Fund** took action
 - (by launching an initiative to) **develop a framework for multi-hazard view of risk.**



The Challenge Fund

- 3 teams working on the data framework
 1. Data schema and data for multi-hazard database – **British Geological Survey (BGS)**
 2. Data schema and data for global exposure database – **Global Earthquake Model Foundation (GEM)**
 3. Data schema and data for a global database of vulnerability functions – **University College London Consultants (UCL)**



The Challenge Fund

- **GeoSolutions** contribution
 - design and implement an **exploration platform**
 - provide a dedicated set of tools for
 - *Searching*
 - *Exploring*
 - *Extracting*
- data of interest

Hazards, Exposures and Vulnerabilities Explorer → **HEV-E**



HEV-E | Challenges

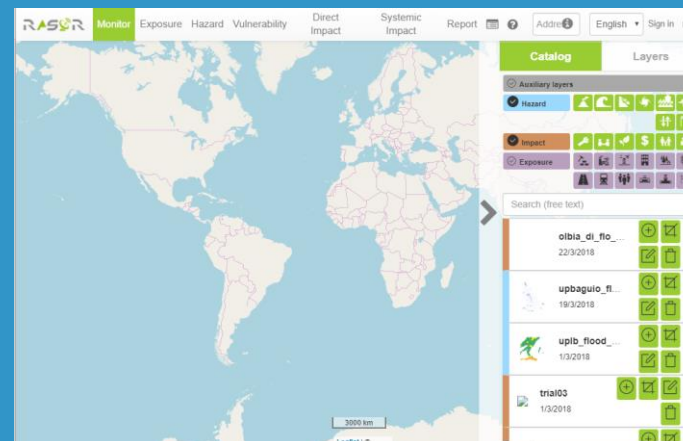
- **Unified exploration/exploitation platform**
- **Data Types**
 - **Hazards**
 - **Exposures**
 - **Vulnerabilities**
- **User friendly web frontend**
 - Broad range of stakeholders
 - Explore, inspect and download such diverse data
 - User friendly also for the uninitiated



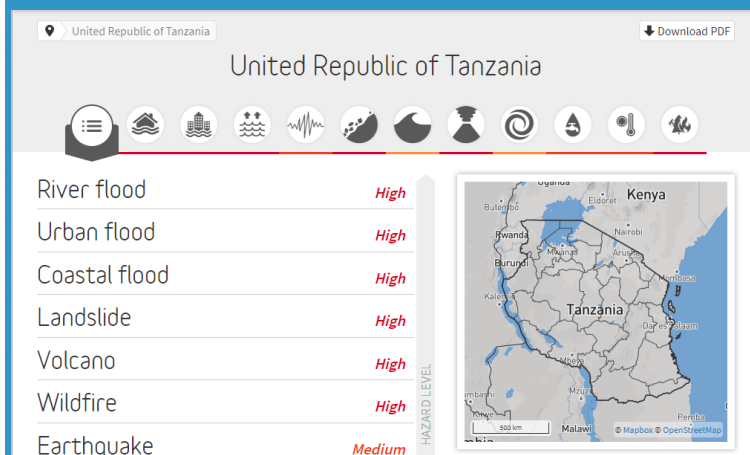
Previous work - Others



GeoSAFE



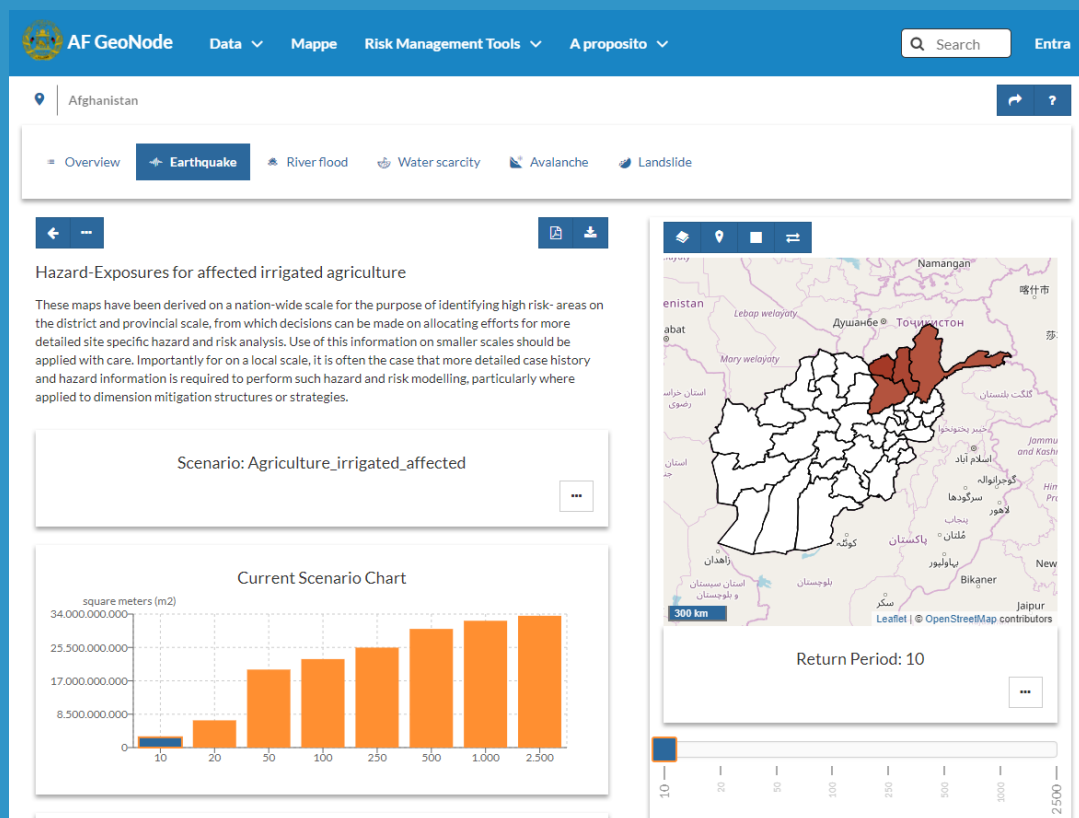
Rasor



ThinkHazard!

Previous work - GeoSolutions

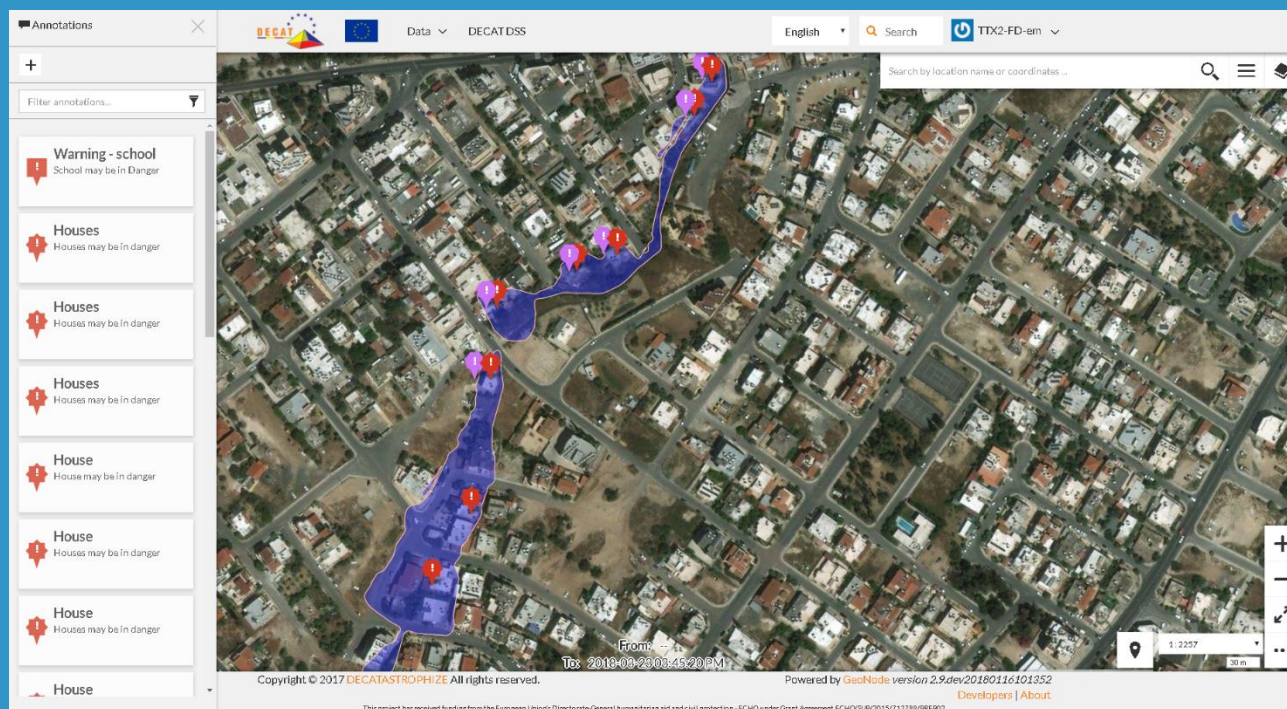
Afghanistan Disaster Risk <http://disasterrisk.af/>



Risk Assessment and Cost/Benefit Analysis

Previous work - GeoSolutions

DECATastrophize <http://decat.geo-solutions.it/>



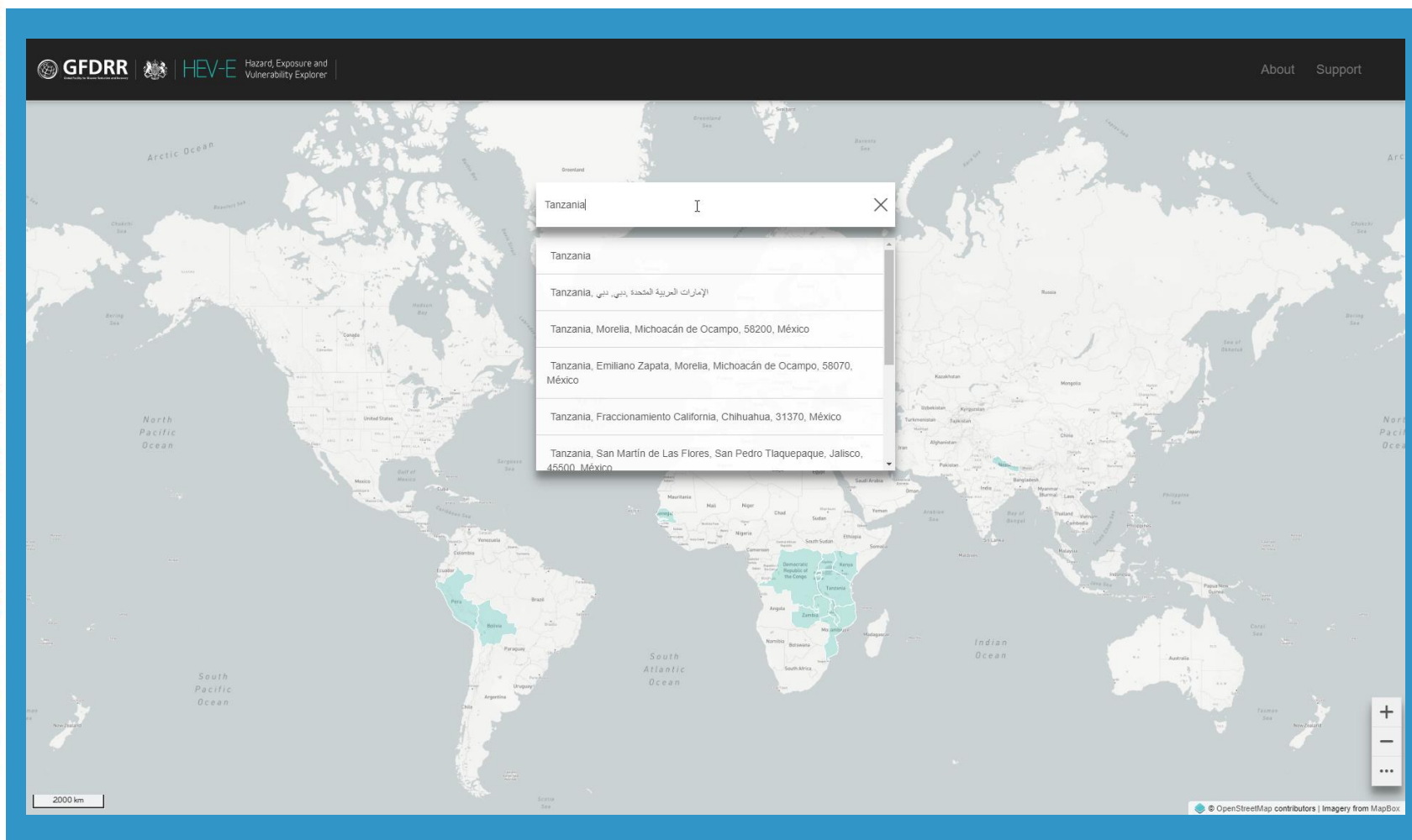
Early warning + Impact Assessment + Emergency Management

HEV-E | main functionalities

- **Discover** hazards, exposures and vulnerabilities
 - By Type
 - By Category
 - By Geographical area
- **Preview and Explore**
 - On a map
 - On a Dashboard (summaries and charts)
- **Download** content of interest (**Exploit**)



HEV-E | landing page



The screenshot displays the HEV-E (Hazard, Exposure and Vulnerability Explorer) landing page. The page features a world map with a search overlay. The search overlay is a white box with a search bar containing the text "Tanzania". Below the search bar is a list of search results:

- Tanzania
- Tanzania, الإمارات العربية المتحدة, دبي, دبي
- Tanzania, Morelia, Michoacán de Ocampo, 58200, México
- Tanzania, Emiliano Zapata, Morelia, Michoacán de Ocampo, 58070, México
- Tanzania, Fraccionamiento California, Chihuahua, 31370, México
- Tanzania, San Martín de Las Flores, San Pedro Tlaquepaque, Jalisco, 45500, México

The map shows the world with various countries highlighted in green. The search overlay is positioned over the map. The page includes a header with the GFDRI logo and the text "HEV-E Hazard, Exposure and Vulnerability Explorer". The footer includes the text "© OpenStreetMap contributors | Imagery from MapBox".

HEV-E | the 'e-store' approach

Data Discovery

- Narrow the matches using data specific contextual filters
 - Sort according to various criteria
 - Preview location and contents on map
 - Suggest related content (*prototype*)
- *Guided and simplified data discovery*



HEV-E in action








GFDRR Hazard, Exposure and Vulnerability Explorer

About Support United Republic of Tanzania

Hazards Exposures Vulnerabilities

Filter title, description or category

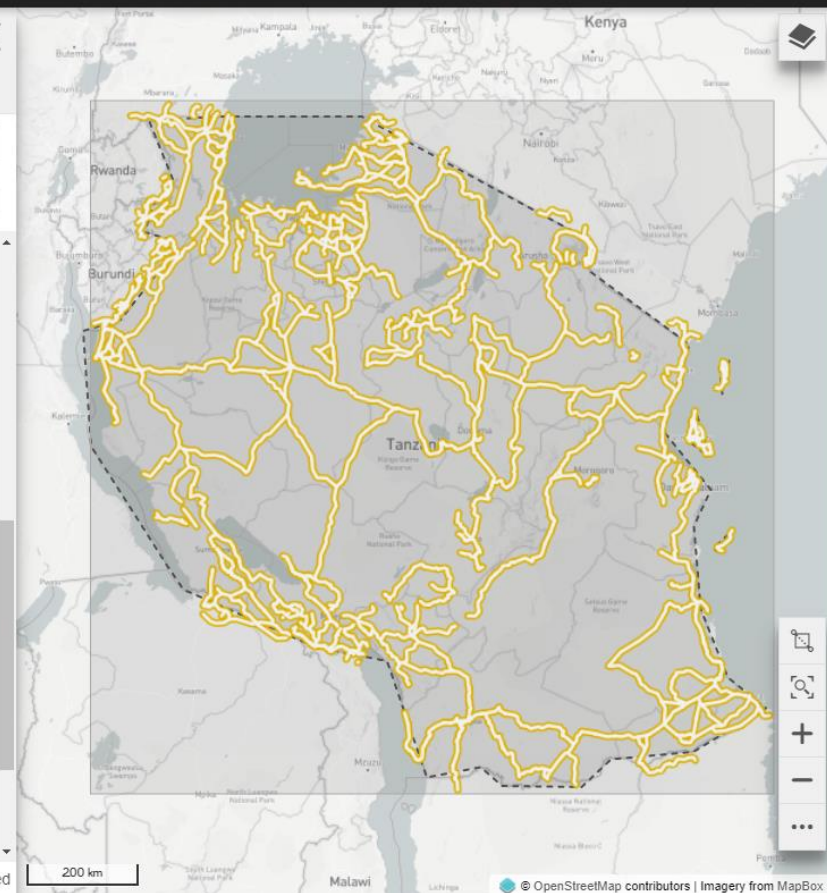
Sort by: alphabetical: A to Z

-  **moz_v10_buildings_137**
Mozambique exposure v10 by ImageCat
buildings
-  **osm_test_ph_buildings_65**
Zanzibar OSM Data with GEM taxonomy
buildings
-  **osm_tnz_main_roads_road_network_115**
Tanzania main roads, imported from OpenStreetMap.
road_network
-  **tanzania_arusha_exposure_buildings_76**
Tanzania Gridded Building Exposure for Admin Arusha
buildings
-  **tanzania_dar_es_salaam_exposure_buildings_77**
Tanzania Gridded Building Exposure for Admin Dar es Salaam
buildings

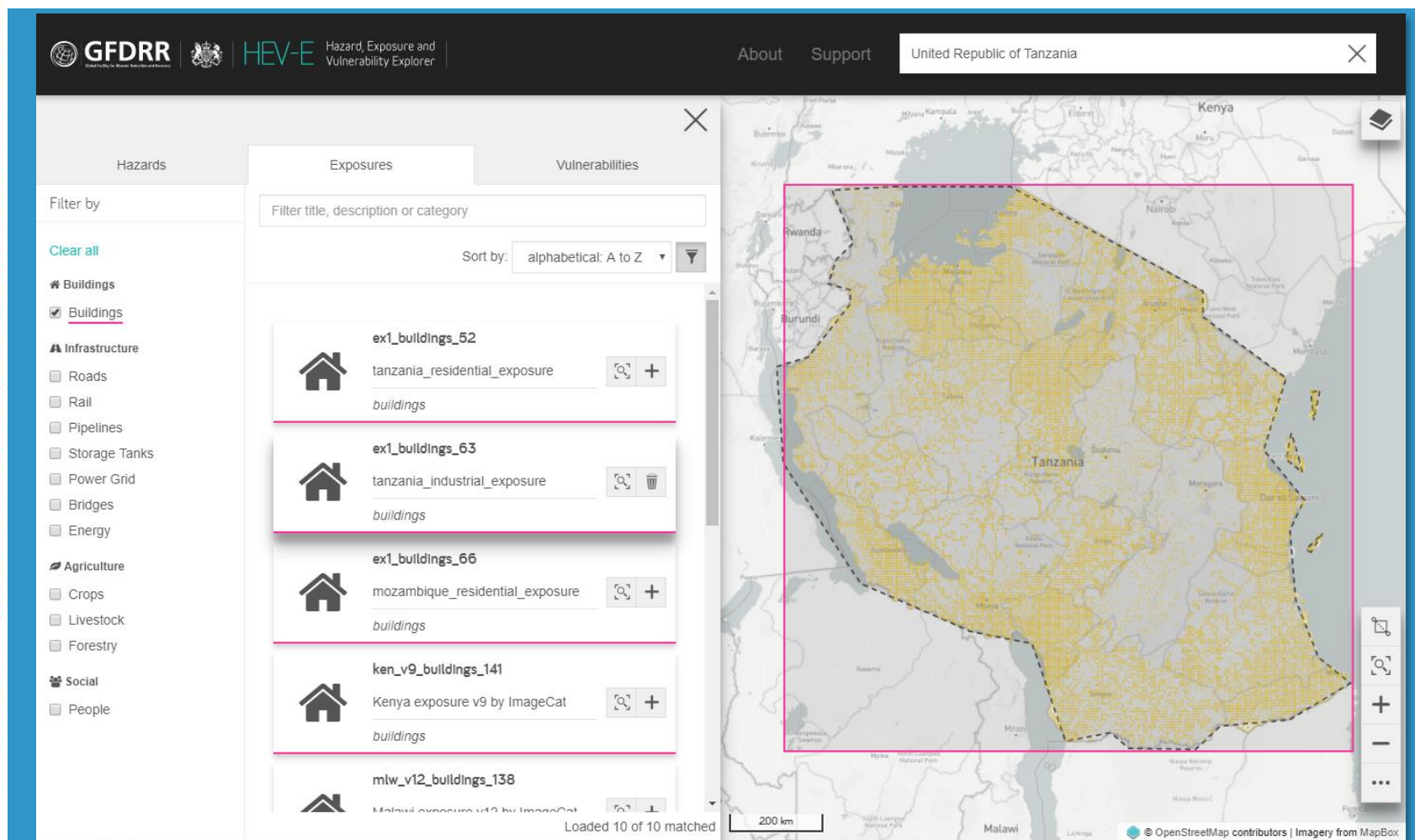
Loaded 11 of 11 matched

200 km

© OpenStreetMap contributors | Imagery from MapBox


















HEV-E in action



The screenshot displays the HEV-E (Hazard, Exposure and Vulnerability Explorer) web application interface. The top navigation bar includes the GFDRR logo, the HEV-E title, and links for 'About' and 'Support'. A search bar at the top right is set to 'United Republic of Tanzania'.

The main interface is divided into three tabs: 'Hazards', 'Exposures', and 'Vulnerabilities'. The 'Exposures' tab is active, showing a list of exposure data. The left sidebar under 'Filter by' includes categories like Buildings, Infrastructure, Agriculture, and Social. The 'Buildings' category is selected, and a list of exposure items is displayed, each with a house icon, a title, a description, and a category.

Icon	ID	Exposure Name	Category	Actions
	ex1_buildings_52	tanzania_residential_exposure	buildings	 
	ex1_buildings_63	tanzania_industrial_exposure	buildings	 
	ex1_buildings_66	mozambique_residential_exposure	buildings	 
	ken_v9_buildings_141	Kenya exposure v9 by ImageCat	buildings	 
	mlw_v12_buildings_138	Malawi exposure v12 by ImageCat	buildings	 

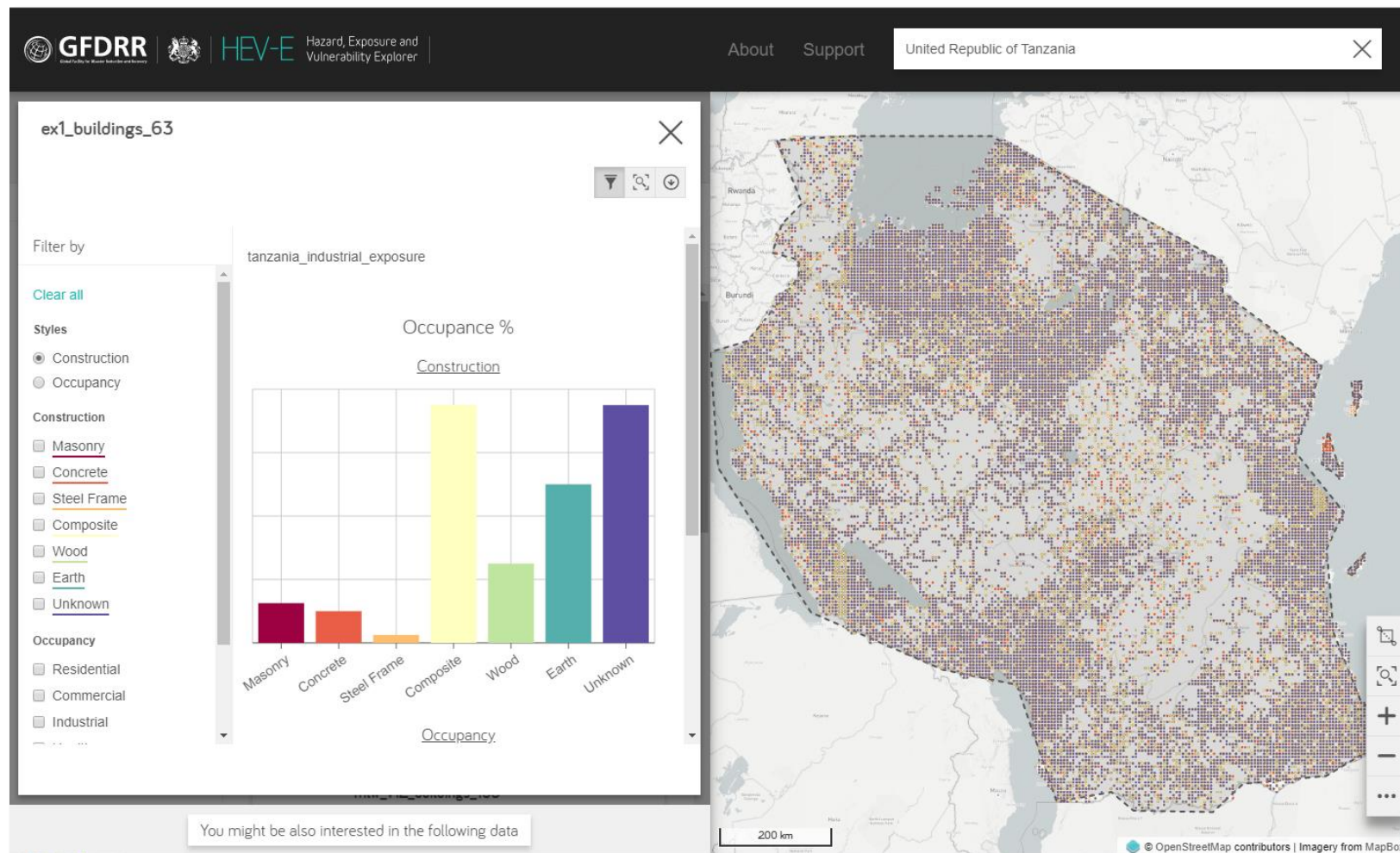
The right side of the interface shows a map of Tanzania with a yellow grid overlay representing the exposure data. The map includes a scale bar (200 km) and a copyright notice: '© OpenStreetMap contributors | Imagery from MapBox'.

HEV-E | the 'e-store' approach

- **Data Exploitation**
- Dashboard view for data contents
 - Charts
 - Metadata
 - Textual Summaries
- Additional Filter on contents
- Multiple detailed stylings on map



HEV-E in action

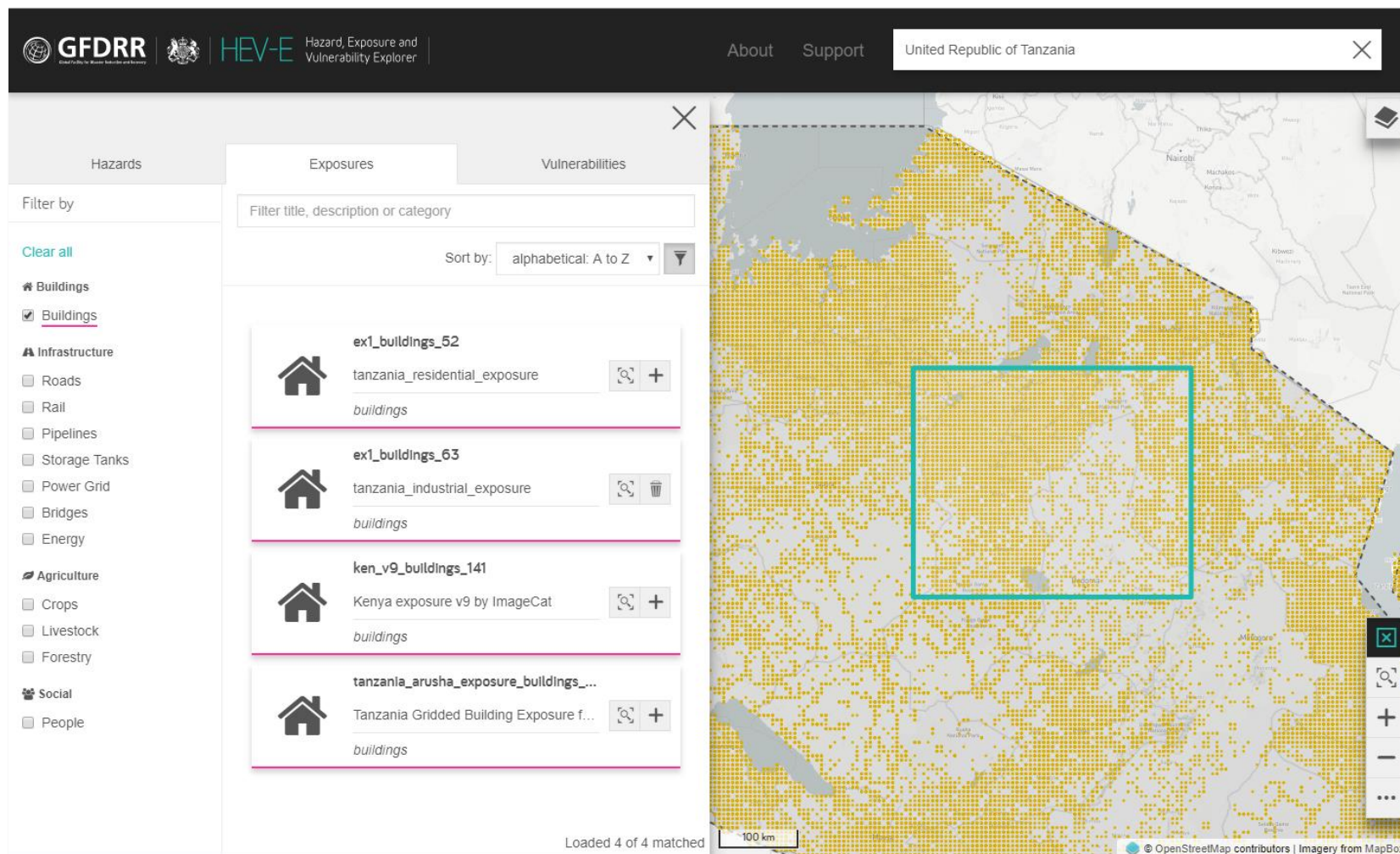


HEV-E

- **Data Download**
- Spatial filters to fix the area of interest
 - exploration
 - download
- Download subsets of data
 - ESRI Shapefile
 - GeoPackage dumps (according to the original schema structure)



HEV-E in action



The screenshot displays the HEV-E (Hazard, Exposure and Vulnerability Explorer) web application interface. The top navigation bar includes the GFDRR logo, the HEV-E title, and a search bar set to "United Republic of Tanzania". The main interface is divided into three tabs: Hazards, Exposures, and Vulnerabilities. The Exposures tab is active, showing a list of exposure data on the left and a map on the right. The map displays a yellow gridded exposure layer over the United Republic of Tanzania, with a red rectangle highlighting a specific area. The left sidebar contains a "Filter by" section with categories: Buildings (checked), Infrastructure (Roads, Rail, Pipelines, Storage Tanks, Power Grid, Bridges, Energy), Agriculture (Crops, Livestock, Forestry), and Social (People). The exposure list on the left shows four items, all categorized as "buildings":

- ex1_buildings_52: tanzania_residential_exposure
- ex1_buildings_63: tanzania_industrial_exposure
- ken_v9_buildings_141: Kenya exposure v9 by ImageCat
- tanzania_arusha_exposure_buildings_...: Tanzania Gridded Building Exposure f...

The bottom of the interface shows "Loaded 4 of 4 matched" and a scale bar indicating 100 km. The map is credited to "© OpenStreetMap contributors | Imagery from MapBox".

HEV-E | Who made it possible

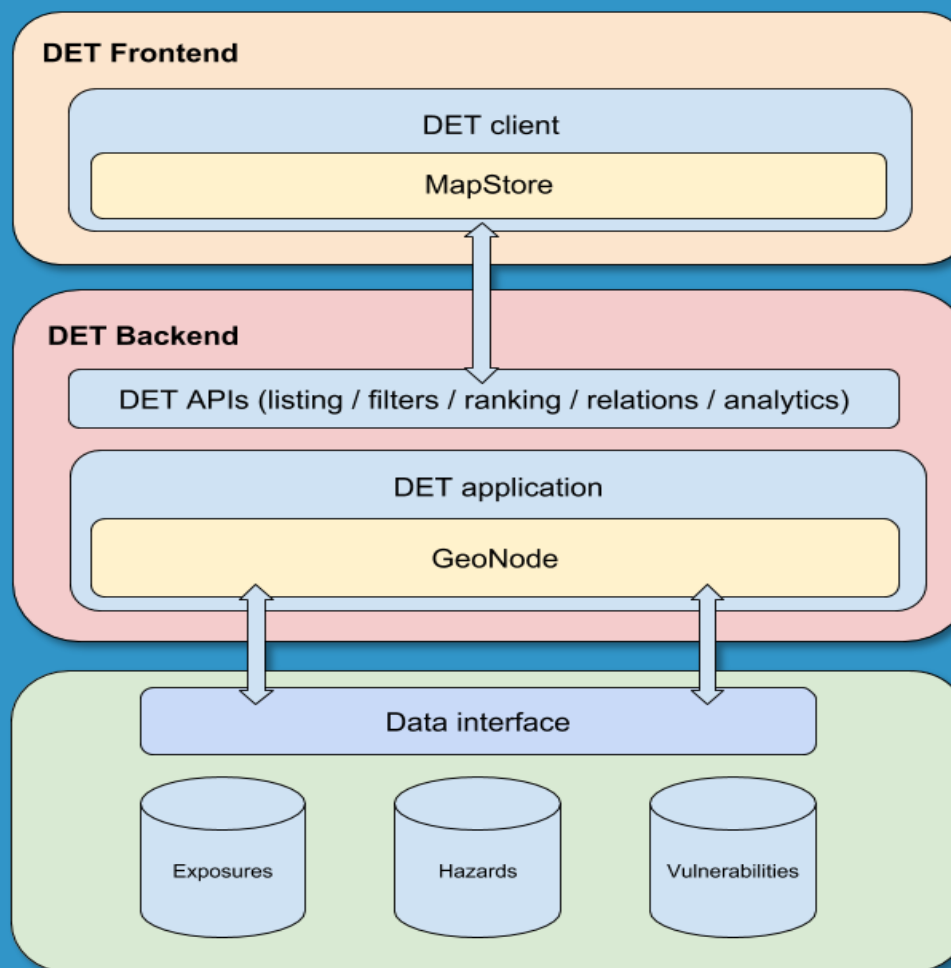
- PostgreSQL / PostGIS
- Django
- GeoNode
- Geoserver
- MapStore



django



HEV-E | High level architecture



HEV-E | Data Ingestion

Original DBs (PG dumps)



Pre-processing

Custom Django management commands

1. DBs health check
2. Grouping of data into multiple layers
3. Create MATERIALIZED VIEWS for each group of data
4. Precalculate relevant statistics, normalize taxonomies, check and cast geometry fields

HEV-E DB



HEV-E | Data Ingestion

HEV-E DB



Ingestion

Custom Django
management commands

5. Create Geoserver's store and workspace
6. Publish each MATERIALIZED VIEW as a single layer
7. Create styles for the different type of layers and geometries

Geoserver



HEV-E | Data Ingestion

GeoServer

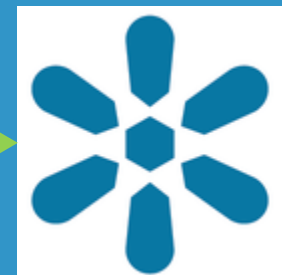


Ingestion

Custom Django
management commands

8. Import Geoserver layers in GeoNode
9. Populate keywords and categories from DB views attributes
10. Populate title and description fields
11. Define Geofence rules

GeoNode



HEV-E | PostGIS

- Data pre-processing (pg/plsql + Python code)
- **MATERIALIZED VIEWS**
 - avoid data duplication
 - lowest runtime overhead
- Spatial queries to extract spatial relations between datasets
- Extract countries boundaries with available data



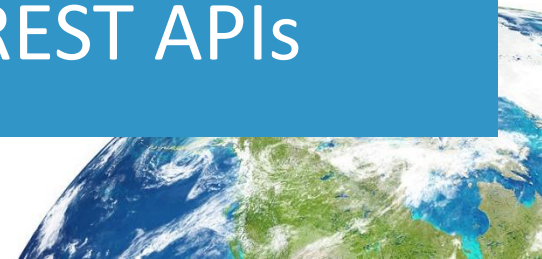
HEV-E | GeoServer

- **OGC / WMS** service to view contents on map
- **(E)CQL** to filter layers and contents on map
- **SLD** for styling multiple geometries and geometry types
- **SLD** filters for styling content
- **Geofence** rules to restrict access to layers and services
- **GeoWebCache** for tile caching



HEV-E | GeoNode

- **Enrich original data** with metadata and additional informations (keywords and categories)
- Support frontend functionalities
- Publish a CSW catalog of the (simplified) layers
- **Geoserver APIs** for management commands
- **Proxy WMS** requests under ACLs
- Implement some of the HEV-E REST APIs



HEV-E | MapStore

- HEV-E frontend → Downtream **MapStore** project
 - Reuse **MapStore** standard building blocks
 - Add specific new building blocks
 - Super Fast development (sort of 😊)
- **Single Page Application**
 - It's 2018 right?
- **Responsive***
- **Mobile Friendly***

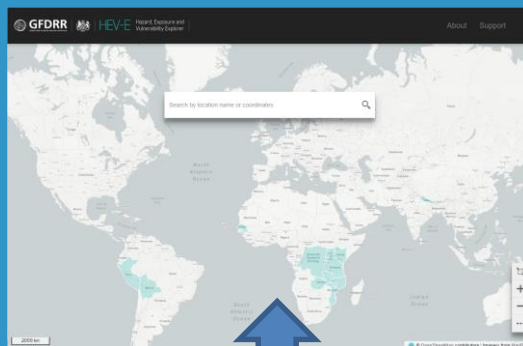
* Work in progress 😊



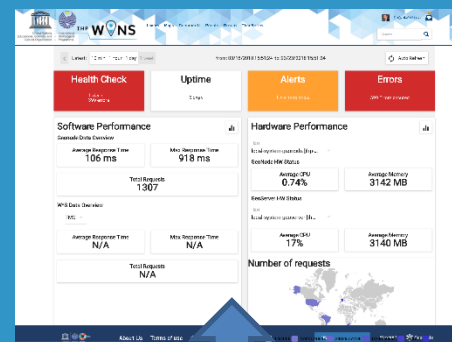
HEV-E | MapStore

Time for a new approach for GeoNode based projects?

End User UI



Contrib Modules Admin UI



REST APIs

GeoNode Core + modules

Admin UI

That's all!



<http://www.geo-solutions/contacts>

info@geo-solutions.it