BR Geospatial Platform and Applications

ITU World Radiocommunication Seminar

7-11 December 2026, Geneva, Switzerland

Agenda

1. Overview of GIS systems

- Vector/rasters data
- GIS systems

2. Geospatial Platform

- Infrastructure and data
- Interpolation services
- Visualization tools

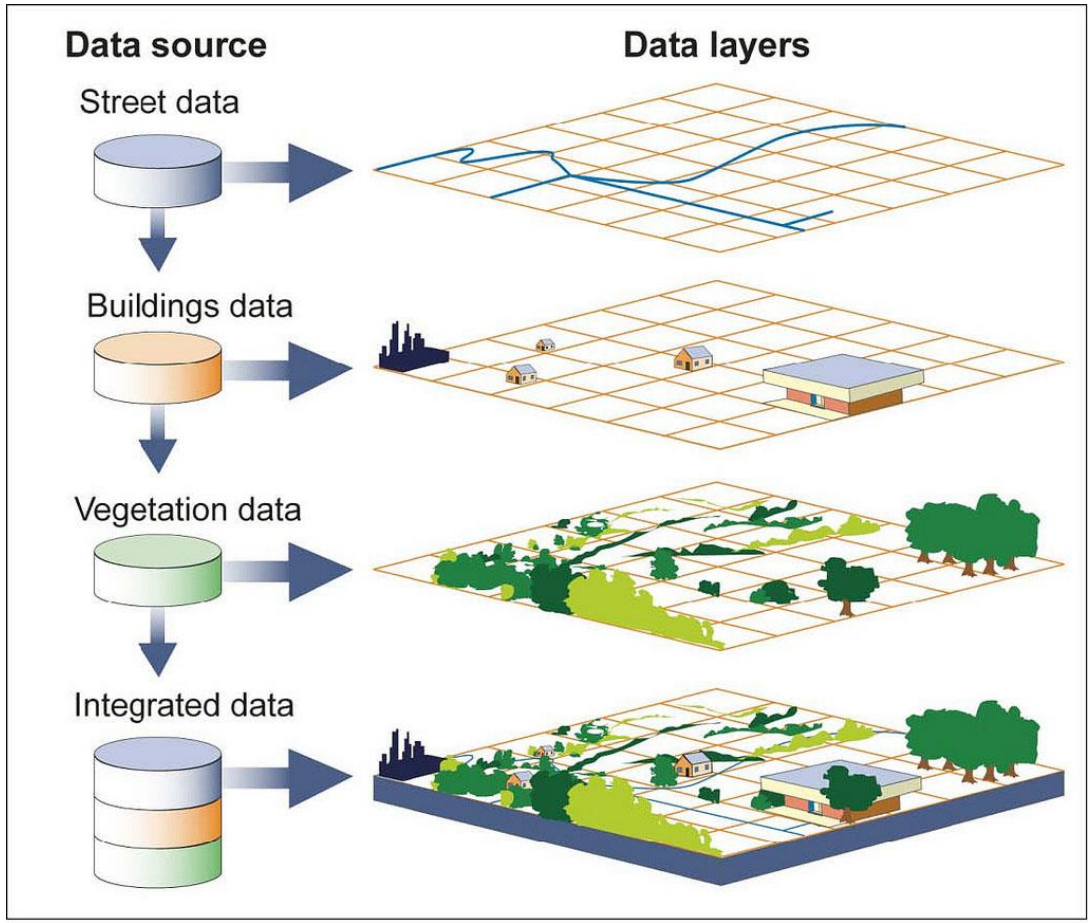
3. Geospatial services applications

- Geospatial data services and radio wave propagation prediction models
- Geospatial activities for broadcasting services
  - GE84 optimization process

4. GeoAI efforts to derive high-resolution global geospatial datasets

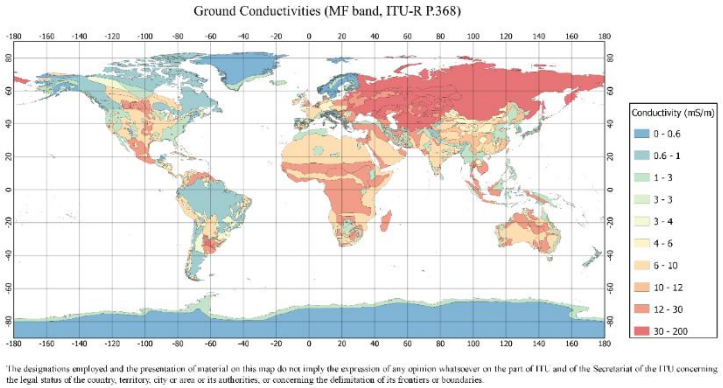
- AI for Good GeoAI Challenge 2026
- WHO-ITU Project

Geospatial data (vectors and rasters)



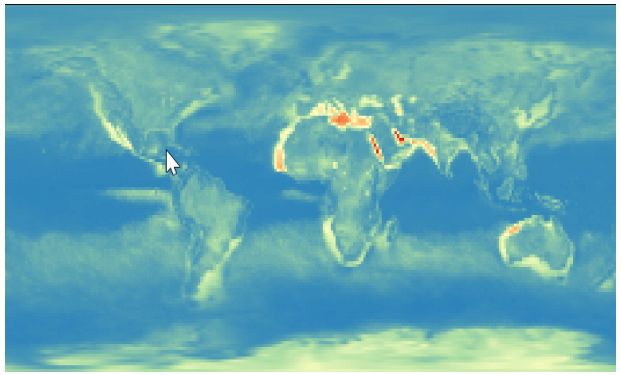
Source: GAO.

Vector data



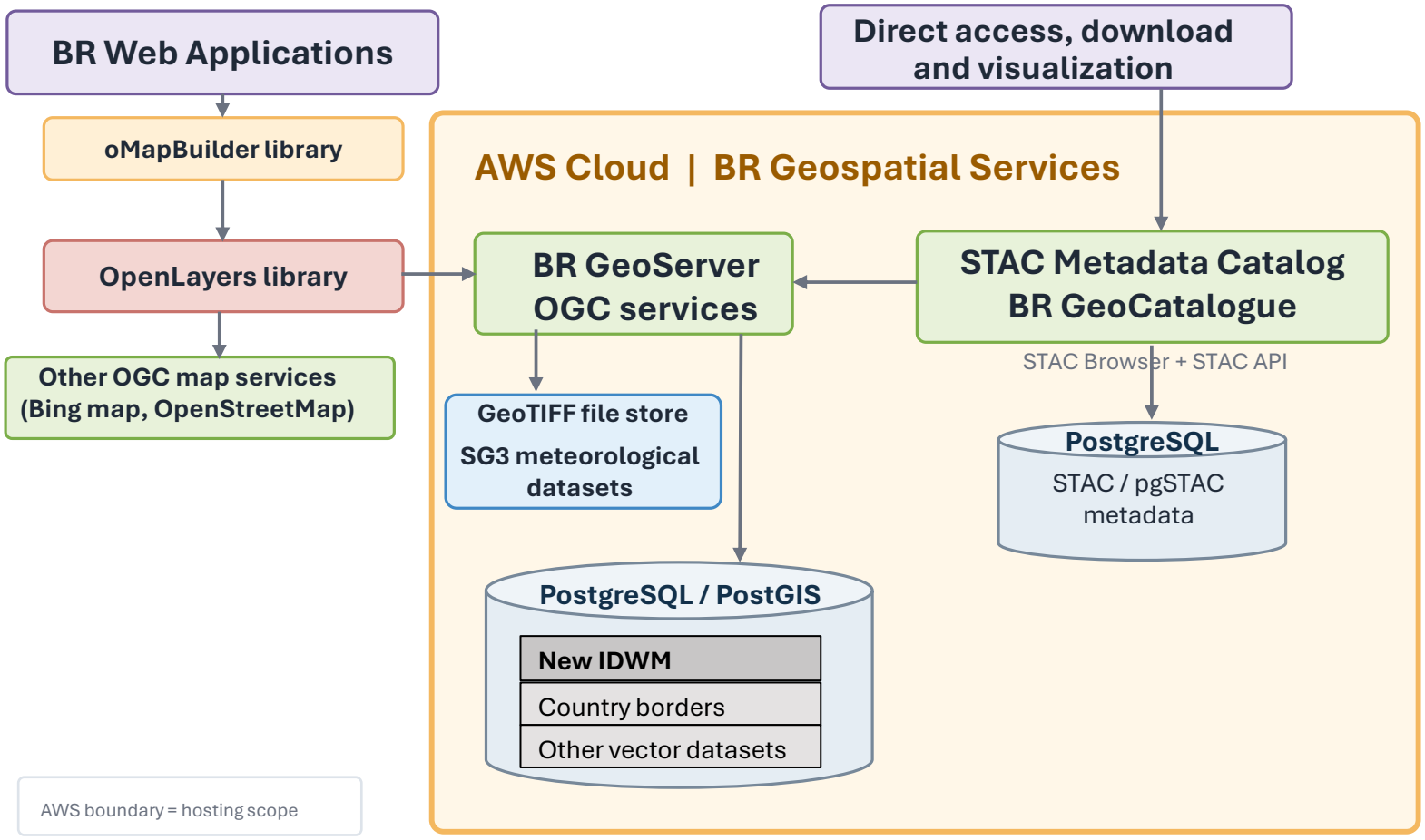
Raster data

Values of the radio refractivity gradient, dN, exceeded for 1% of time of an average year (Rec. ITU-R P.1546-6)



BR Geospatial Platform

Infrastructure and data: BR GIS platform



Challenges

- Data in different formats (non-geospatial)
- Mix of open-source and commercial software
- IDWM vs UN political boundaries data
- IDWM: old system to be re-engineered

Opportunities

- Integrated GIS platform for the BR
- Reuse services across the BR
- Consistent look-and-feel of map for BR users
- Modern geospatial data access for BR users

Infrastructure and data: cloud platform main features

1 CLOUD-NATIVE DEPLOYMENT

AWS Linux environment with Docker and Docker Compose for modular, portable services.

2 OPEN GEOSPATIAL SERVICES

GeoServer and OGC services, PostgreSQL/PostGIS, STAC API and catalogue access.

3 SECURE ACCESS

HTTPS through CloudFront, NGINX routing, WAF traffic protection and restricted administration.

4 OPTIMIZED DATA LAYER

Cloud-Optimized GeoTIFF rasters, GeoPackage vectors and persistent storage volumes.

5 MONITORING & RELIABILITY

CloudWatch metrics, centralized logs, alarms and synthetic availability checks every 30 minutes.

6 CONTROLLED EVOLUTION (to be finalized)

Separate QA and Production configurations, versioned ECR images and capacity testing for future scaling.

A secure, standards-based and reusable platform for BR geospatial data and applications.

Infrastructure and data: IDWM vector datasets

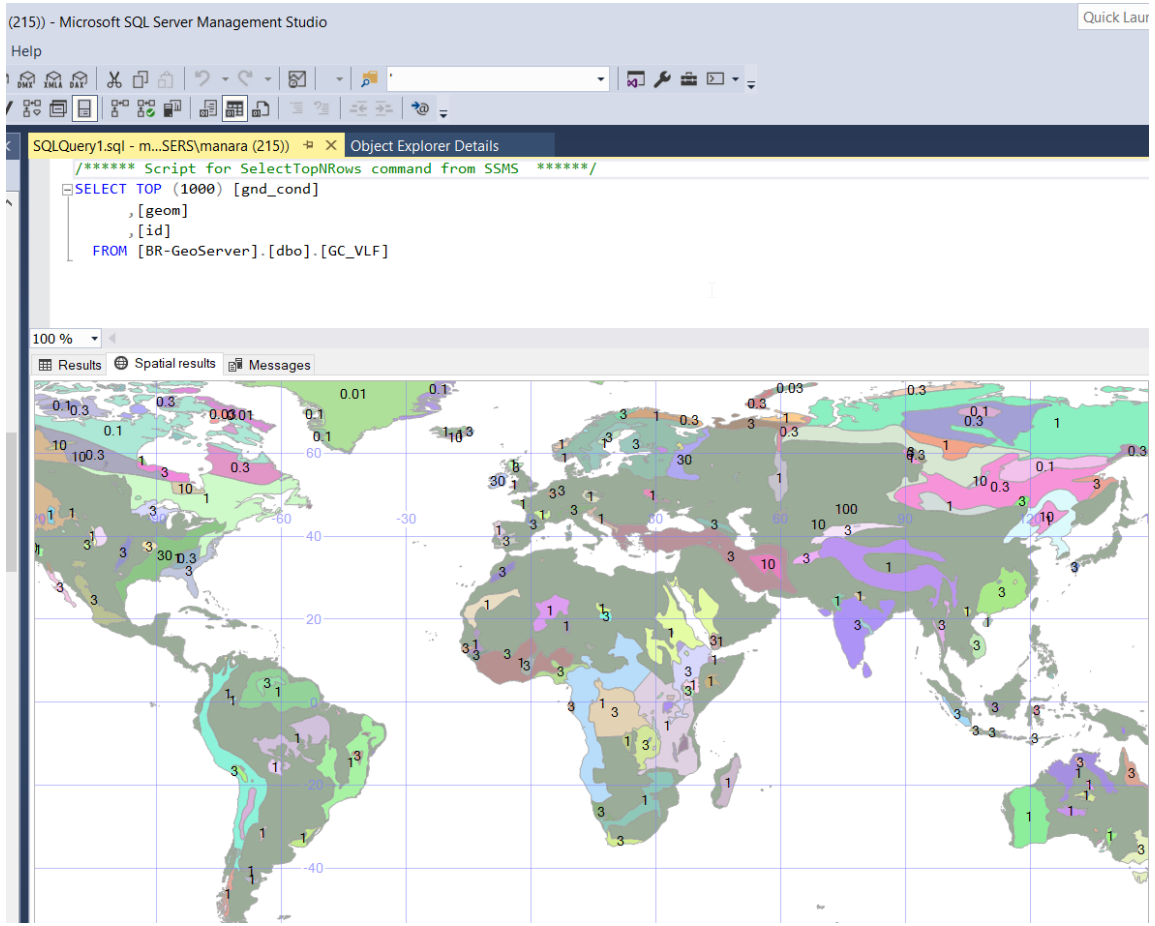
Datasets converted from IDWM ASCII files into geospatial vector format and stored into PostgreSQL / PostGIS spatial data tables.

The IDWM layers in the database can be used:

for all visualization projects in the BR.

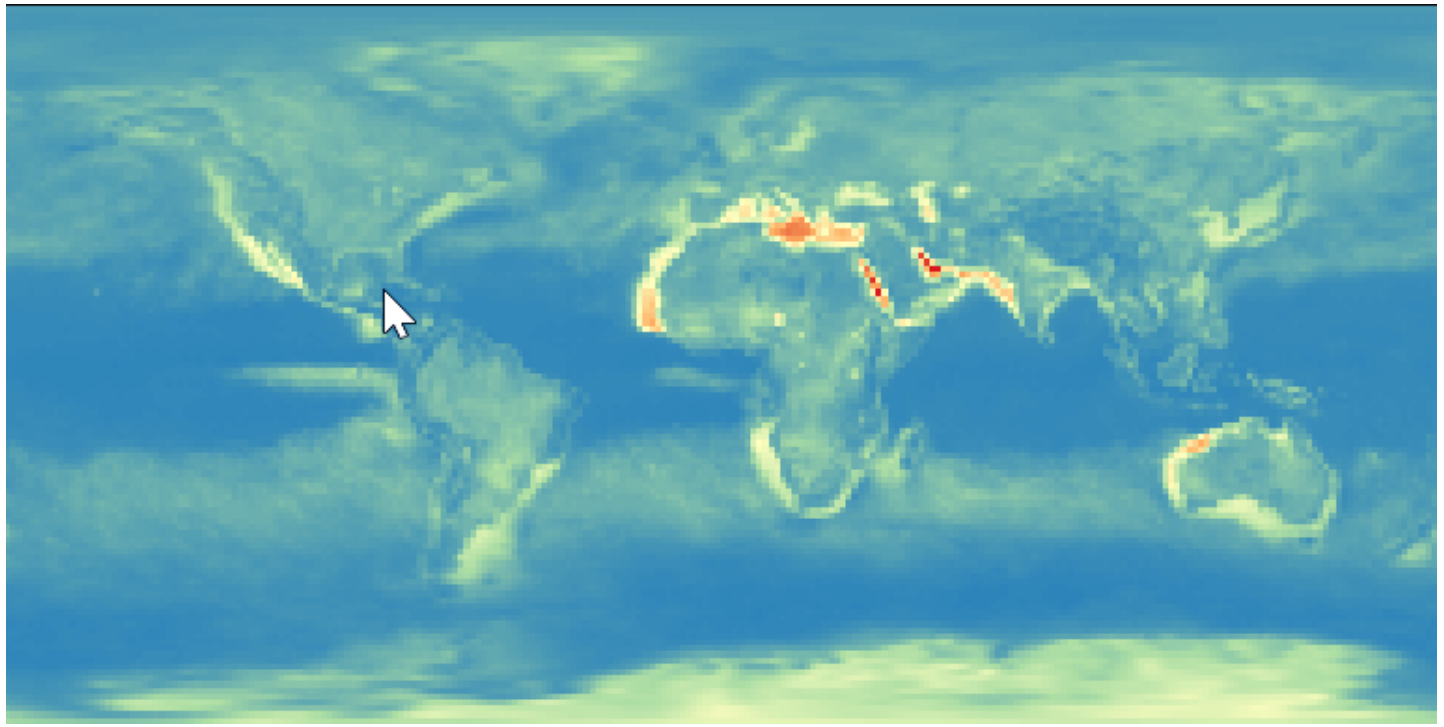
as the central repository for the future IDWM

ensuring consistencies in the BR calculations and visualization tools.



Infrastructure and data: SG3 radio-meteorological rasters

Values of the radio refractivity gradient, dN, exceeded for 1% of time of an average year (Rec. ITU-R P.1546-6)



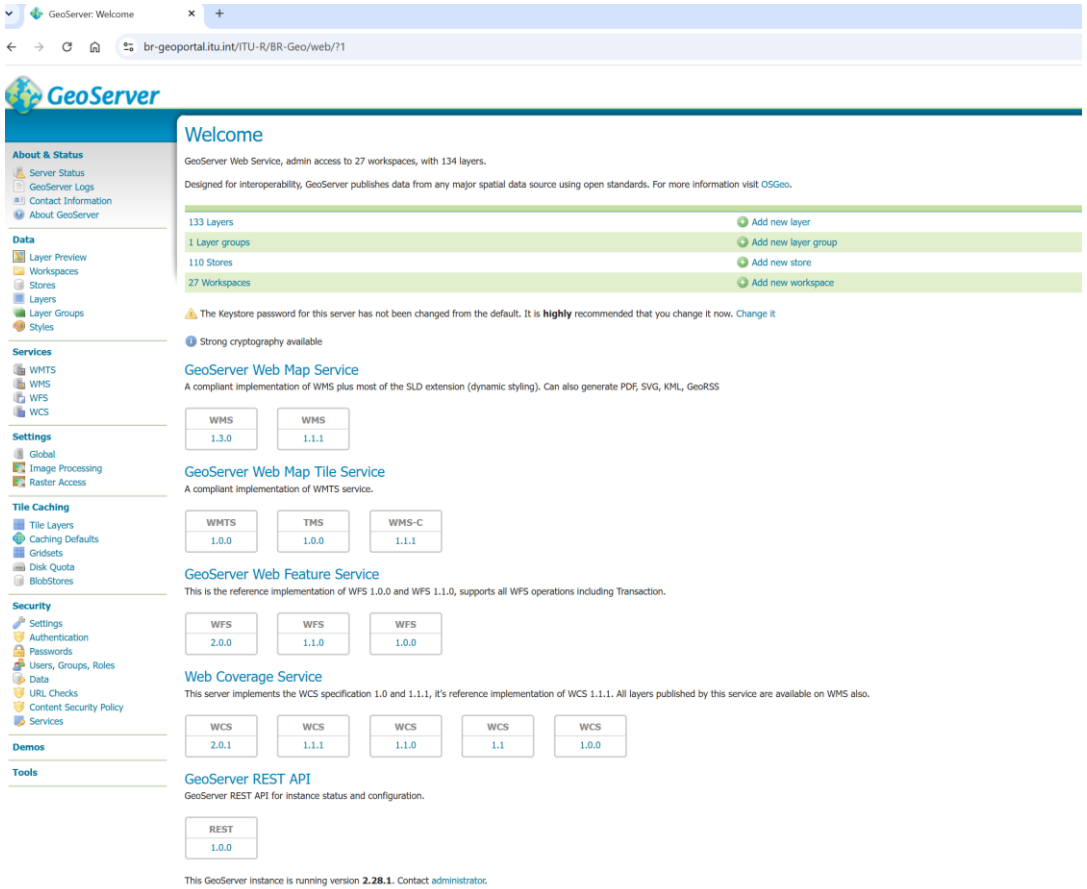
Raster data

Row data in text format from Membership

Georeferenced and optimized as GeoTIFF

Image Mosaic (time series)

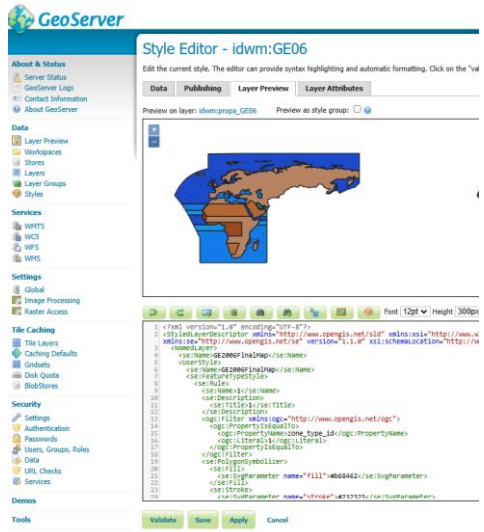
Infrastructure and data: GeoServer



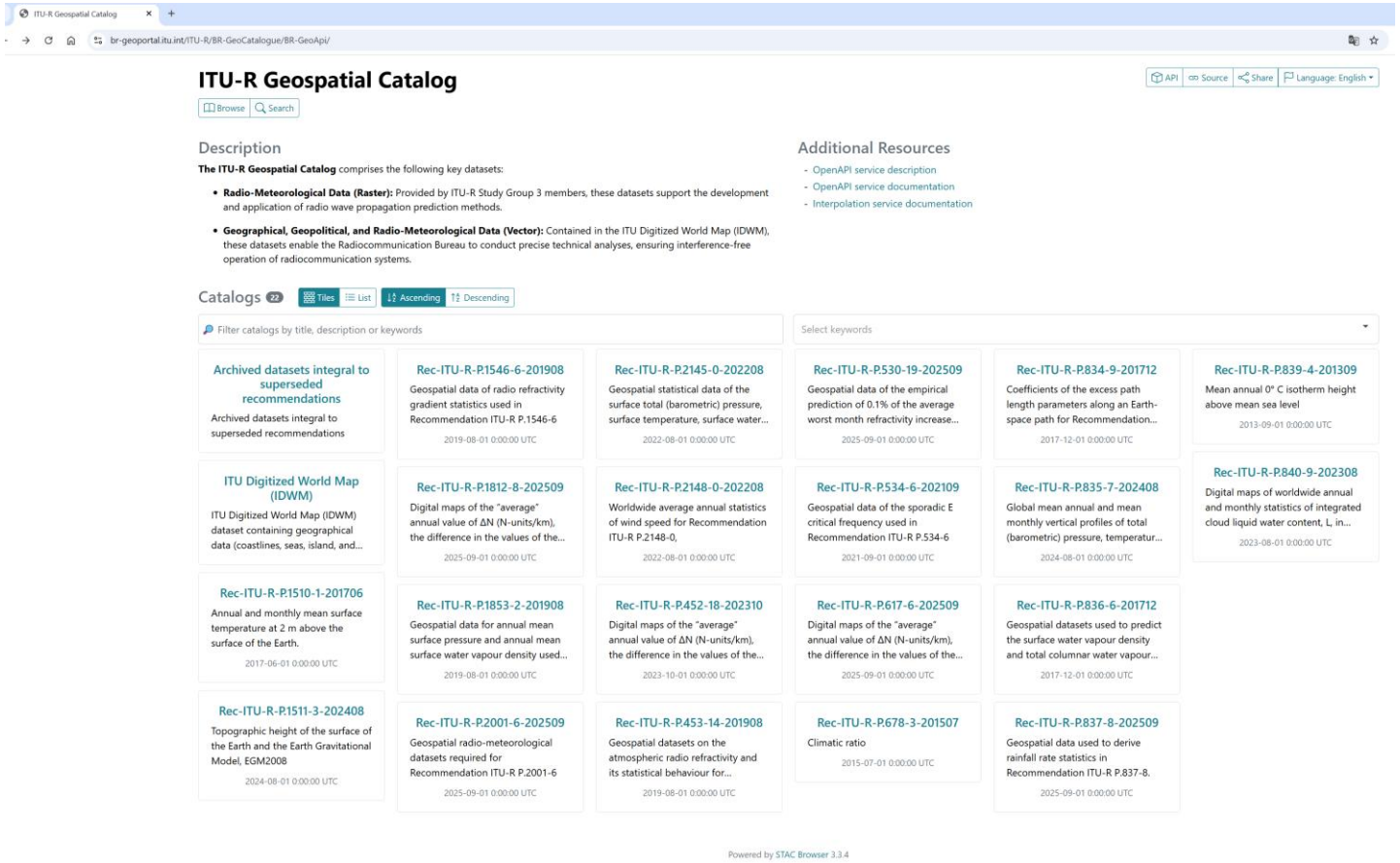
SG3 raster: GeoTIFF files

IDWM vectors: SQL Server

Styles prepared with QGIS, then uploaded in GeoServer and linked to the relevant dataset



Infrastructure and data: Geospatial Metadata Catalogue



STAC catalogue

Data search by keywords

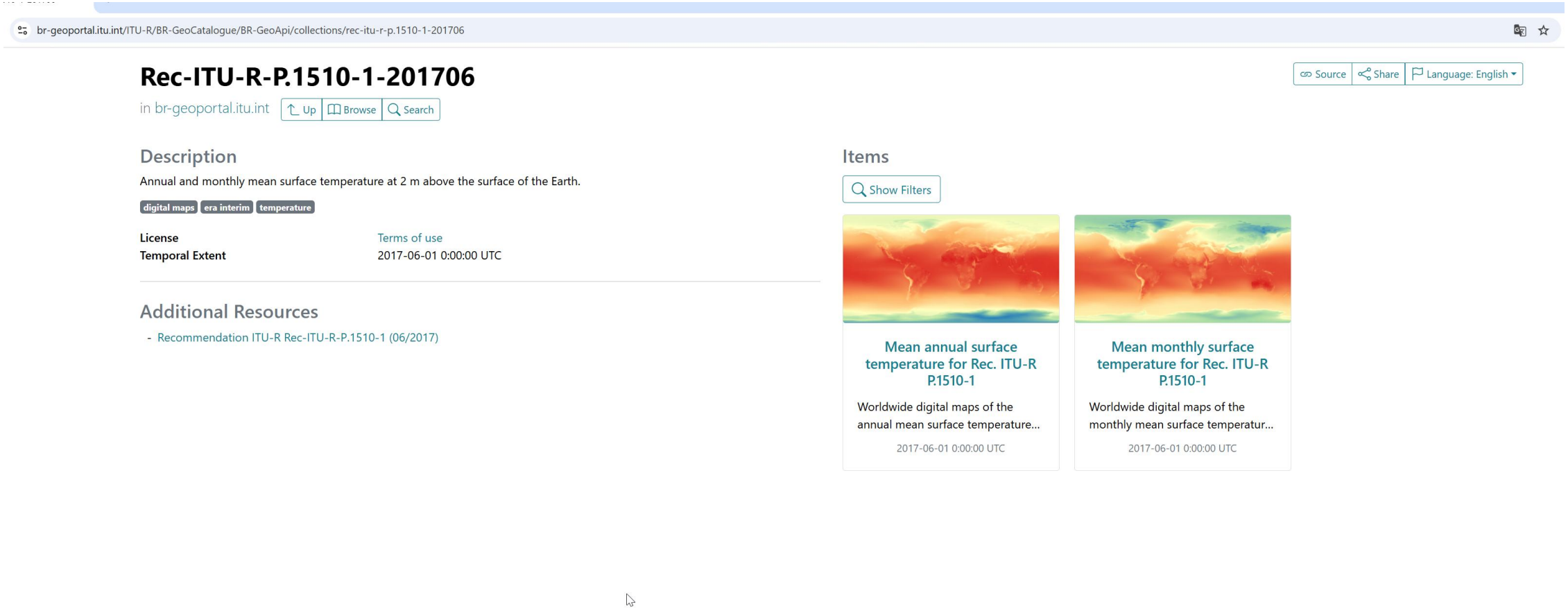
Data visualization

Data download (various formats)

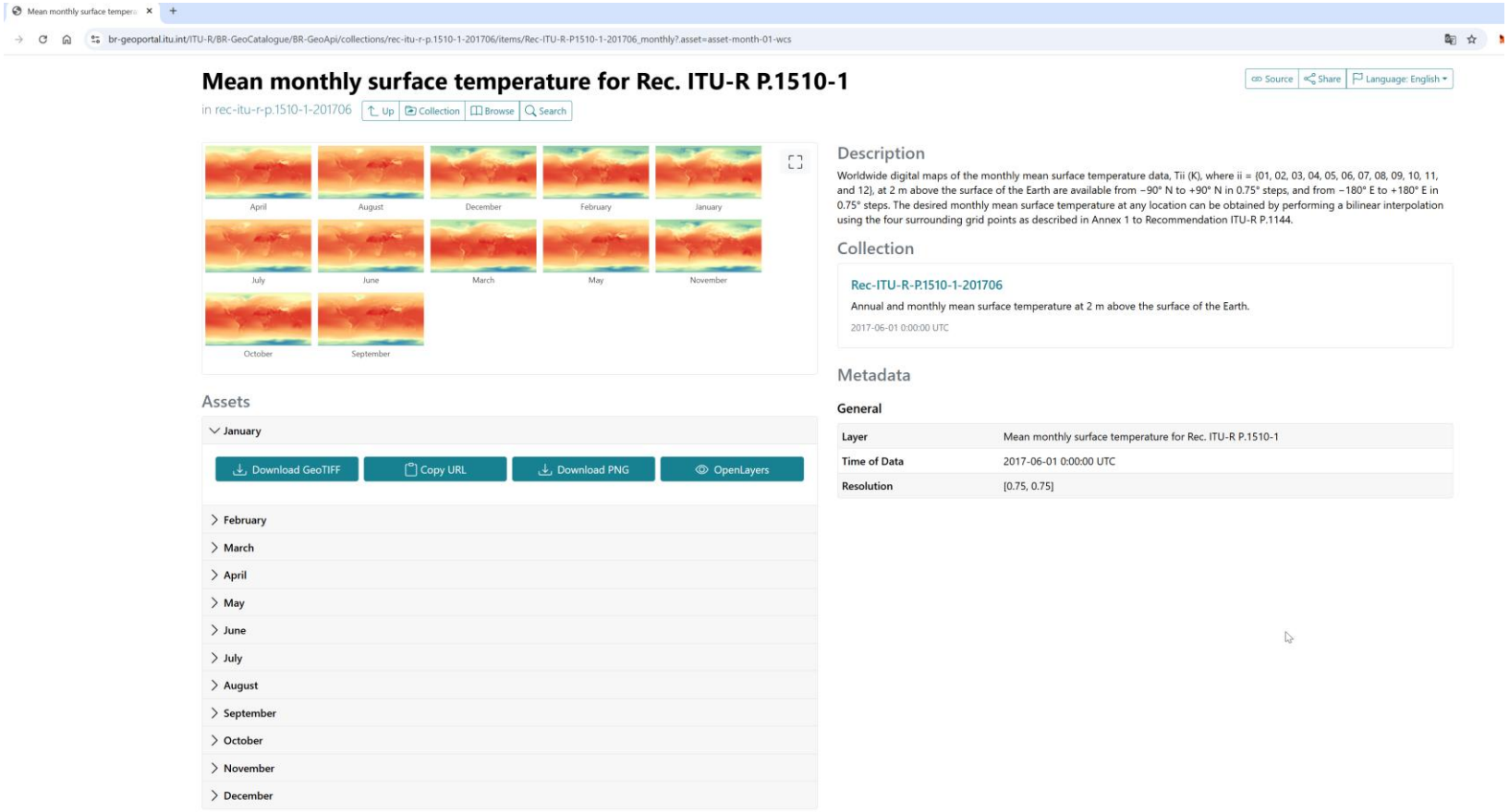
Data sharing via OGC services

User interface based on the open-source Radiant Earth STAC Browser, customized for ITU-R requirements

Infrastructure and data: Geospatial Metadata Catalogue



Infrastructure and data: Geospatial Metadata Catalogue



Location-specific values from ITU-R geospatial datasets

Request inputs

Catalogue item ID

Latitude and longitude in decimal degrees

Asset or month for datasets with a series

Returned values

Bilinear or bicubic interpolation,

or nearest-neighbour values

Method follows the relevant ITU-R Recommendation

The service works with datasets published in the ITU-R Geospatial Catalogue.

Reference: ITU Interpolation service documentation (PDF)

Infrastructure and data: Geospatial APIs

Recommendation-specific API	Quantities
ITU-R P.836-6	Surface water-vapour density and total columnar content
ITU-R P.2145-0	Pressure, temperature and water-vapour statistics for gaseous-attenuation calculations

Generic interpolation: example request template

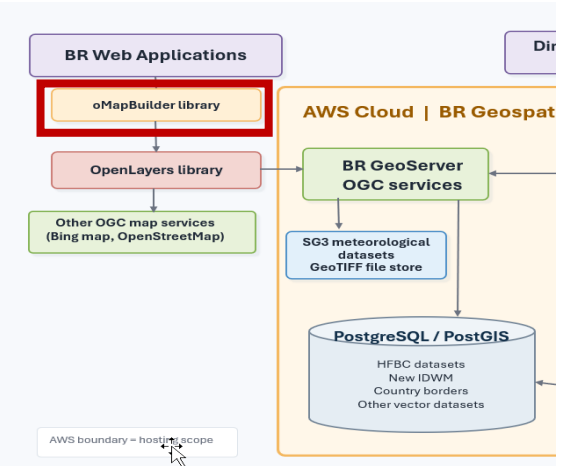
GET https://www.itu.int/ITU-R/BR-GeoApi/interpolate/{item_id}?lat=46.2&lon=6.1

Illustrative location near Geneva. Replace {item_id} with a catalogue item ID.

Series may require asset and/or month. Recommendation-specific APIs use their own endpoints and parameters.

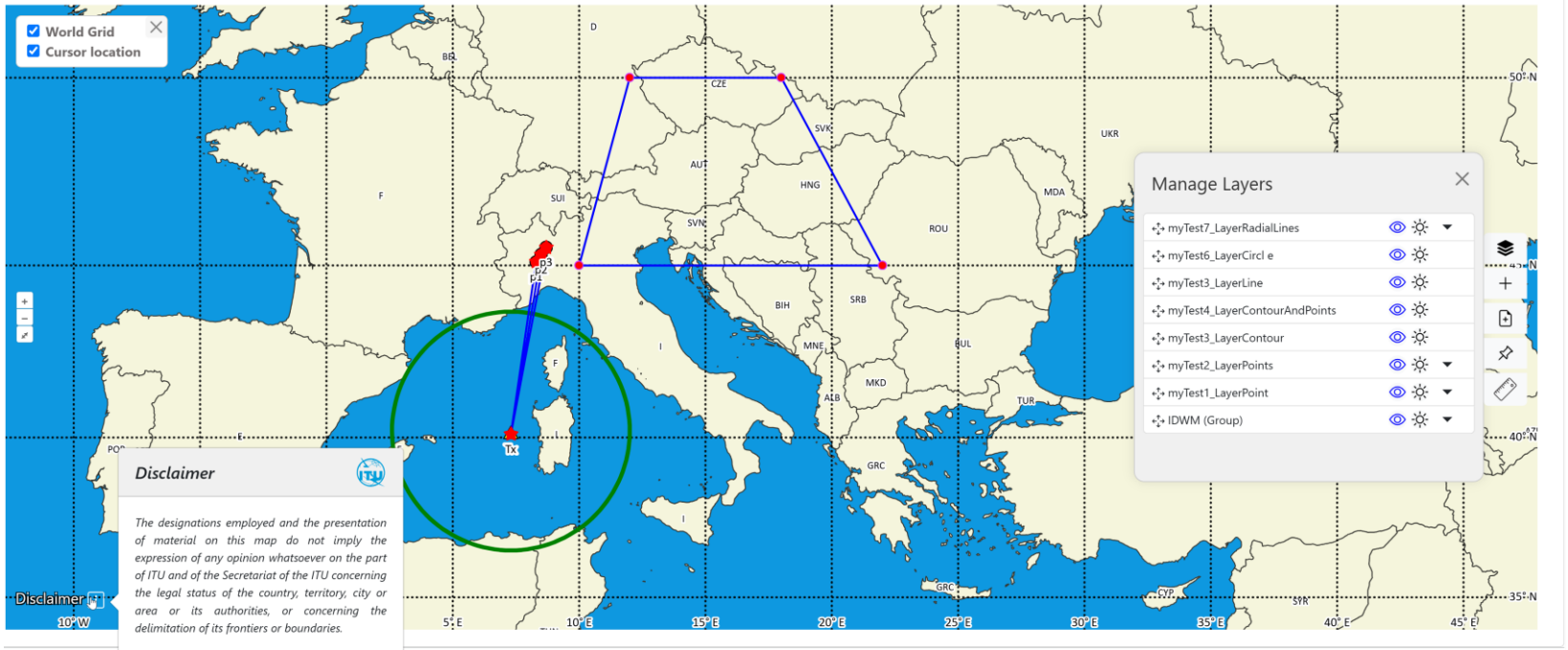
Reference: ITU Interpolation service documentation (PDF)

Visualization tools: Map template library

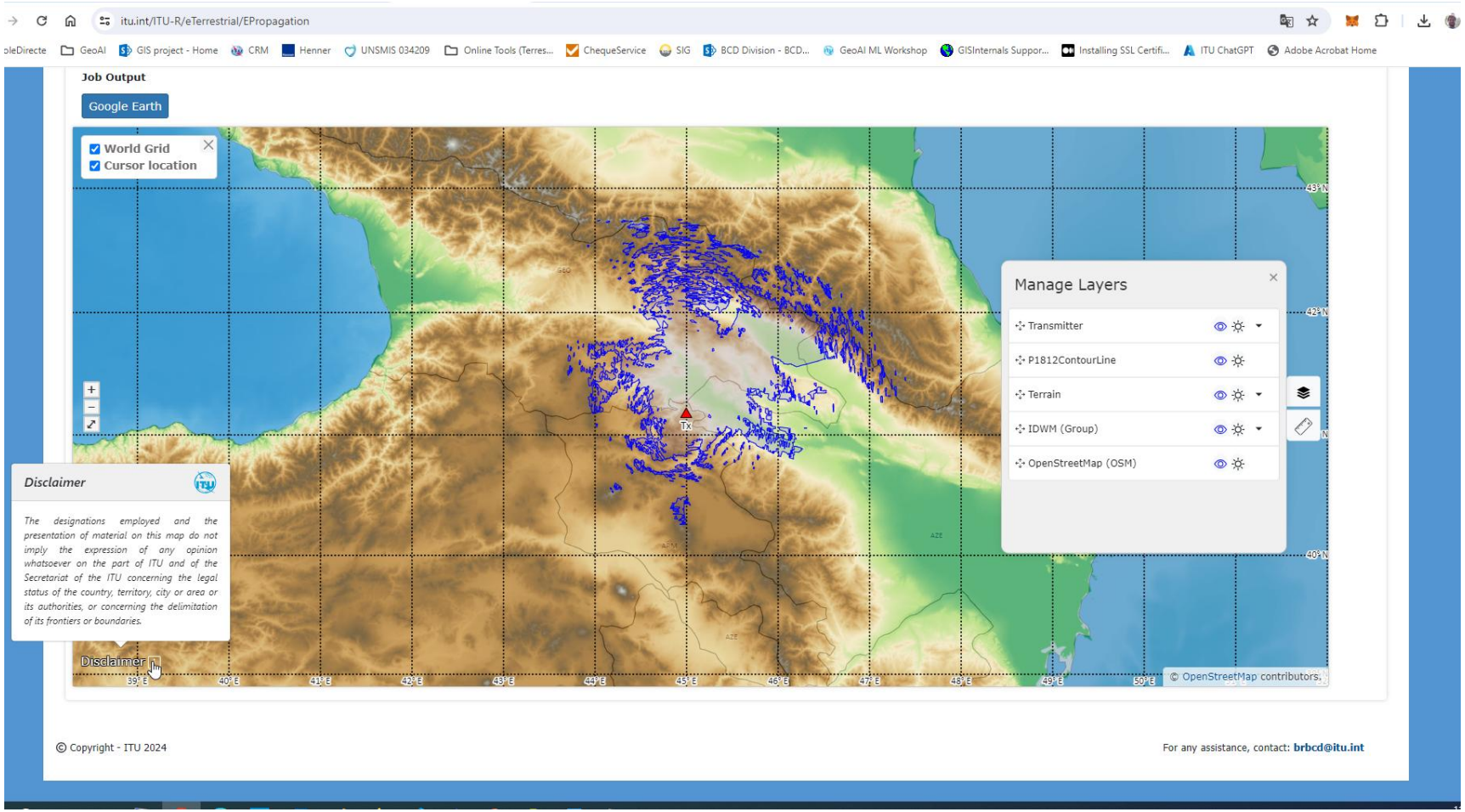


All buttons

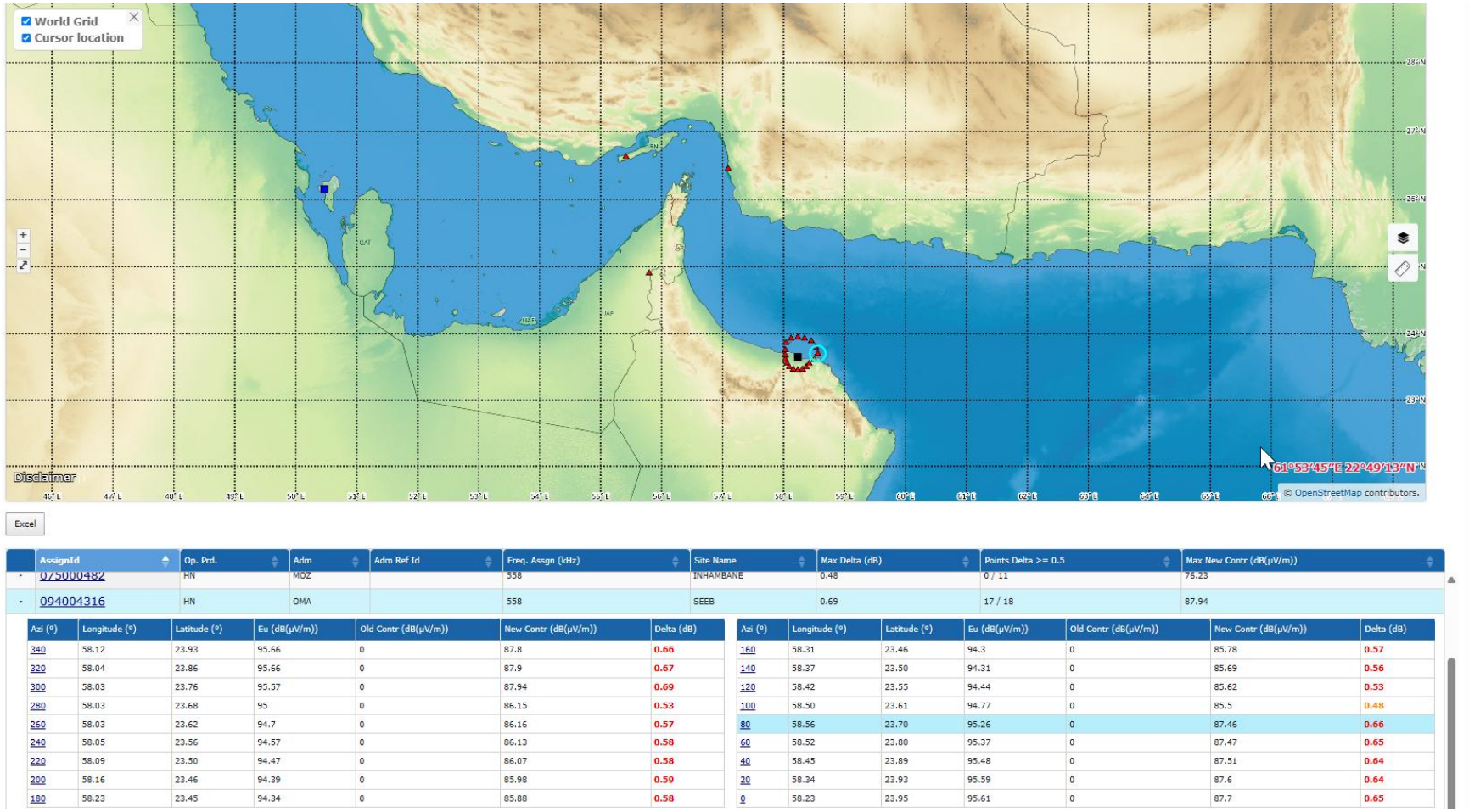
A map with all the toolbar buttons (manage layers, add layers, import markers, add marker) and one layer of each type: a single point, several points, a contour, polygon and points, a line, a circle and radial lines (hover a line to see its tooltip).



Visualization tools: P1812 Point to Area map library integration



Visualization tools: GE75 what-if studies map library integration



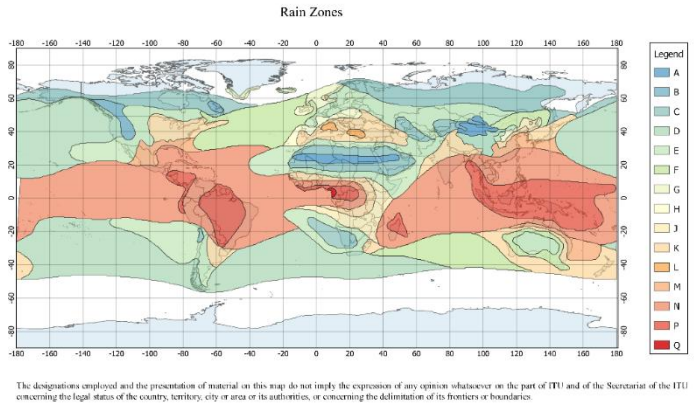
AssignId	Op. Prd.	Adm	Adm Ref Id	Freq. Assgn (kHz)	Site Name	Max Delta (dB)	Points Delta >= 0.5	Max New Contr (dBµV/m))
075000482	HN	MOZ		558	INHAMBANE	0.48	0 / 11	76.23
094004316	HN	OMA		558	SEEB	0.69	17 / 18	87.94

Azi (°)	Longitude (°)	Latitude (°)	Eu (dBµV/m))	Old Contr (dBµV/m))	New Contr (dBµV/m))	Delta (dB)
340	58.12	23.93	95.66	0	87.8	0.66
320	58.04	23.86	95.66	0	87.9	0.67
300	58.03	23.76	95.57	0	87.94	0.69
280	58.03	23.68	95	0	86.15	0.53
260	58.03	23.62	94.7	0	86.16	0.57
240	58.05	23.56	94.57	0	86.13	0.58
220	58.09	23.50	94.47	0	86.07	0.58
200	58.16	23.46	94.39	0	85.98	0.59
180	58.23	23.45	94.34	0	85.88	0.58

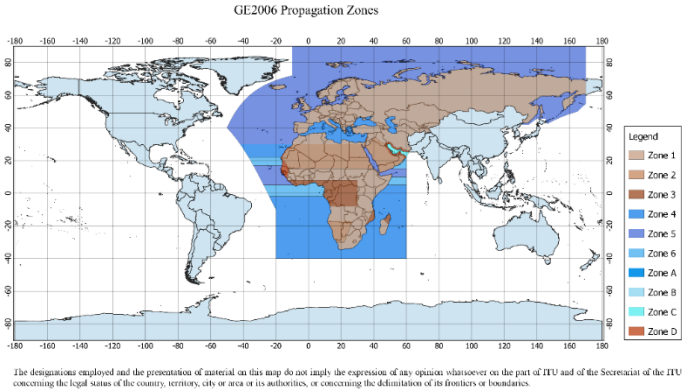
Azi (°)	Longitude (°)	Latitude (°)	Eu (dBµV/m))	Old Contr (dBµV/m))	New Contr (dBµV/m))	Delta (dB)
160	58.31	23.46	94.3	0	85.78	0.57
140	58.37	23.50	94.31	0	85.69	0.56
120	58.42	23.55	94.44	0	85.62	0.53
100	58.50	23.61	94.77	0	85.5	0.48
80	58.56	23.70	95.26	0	87.46	0.66
60	58.52	23.80	95.37	0	87.47	0.65
40	58.45	23.89	95.48	0	87.51	0.64
20	58.34	23.93	95.59	0	87.6	0.64
0	58.23	23.95	95.61	0	87.7	0.65

Visualization tools: Map production

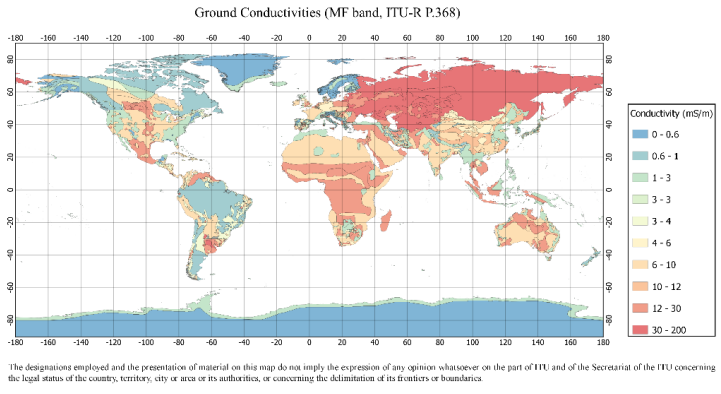
Rain zones



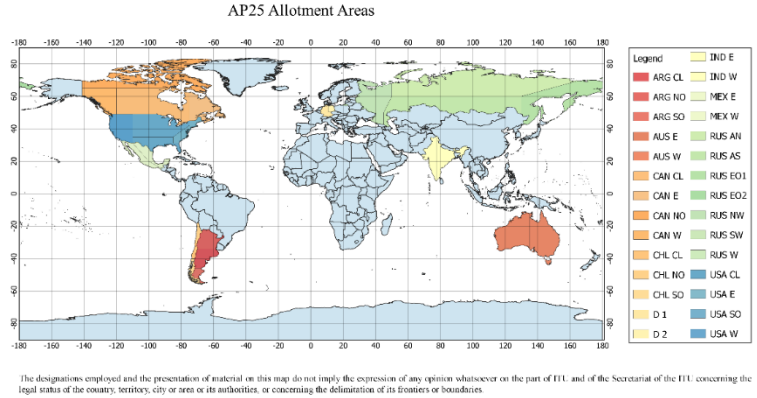
GE2006 propagation zones



Ground conductivity



AP25 allotment areas



BR Geospatial services applications

Geospatial data services and radio wave propagation prediction models

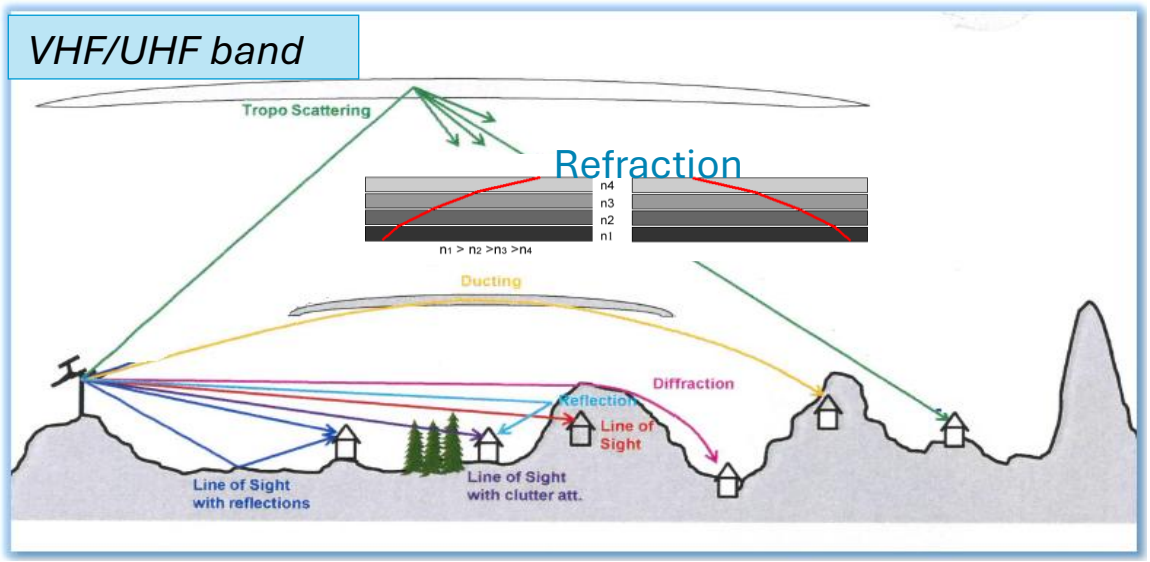
Radio communication services planning

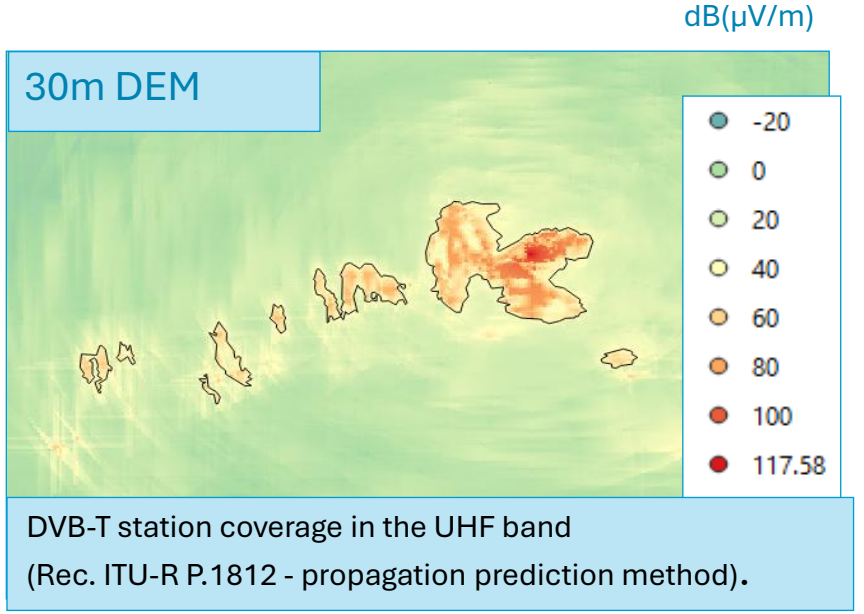
Coverage determination, interference analyses, international coordination

ITU-R propagation models

Geospatial data

radio-meteorological data, terrain height and surface features





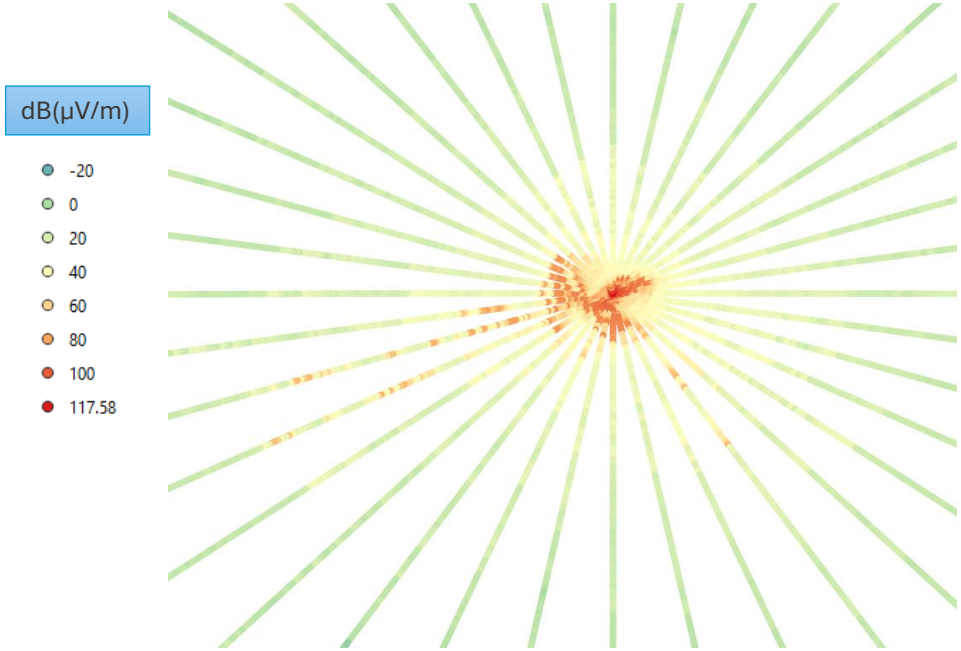
DVB-T station coverage in the UHF band
(Rec. ITU-R P.1812 - propagation prediction method).

Resolution ITU-R 40-4 Worldwide database of terrain height and surface features provides guidance on use of DEM

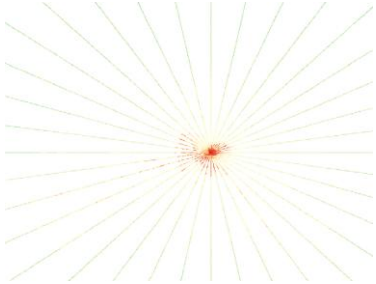
- 1 arc second resolution is suitable for planning

Geospatial data services and radio wave propagation prediction models

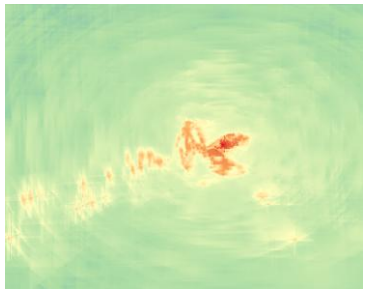
1) ITU-R P.1812 output vector data (location and fs)



2) Convert to raster



3) Interpolate to fill voids



4) Extract fs_wanted contour



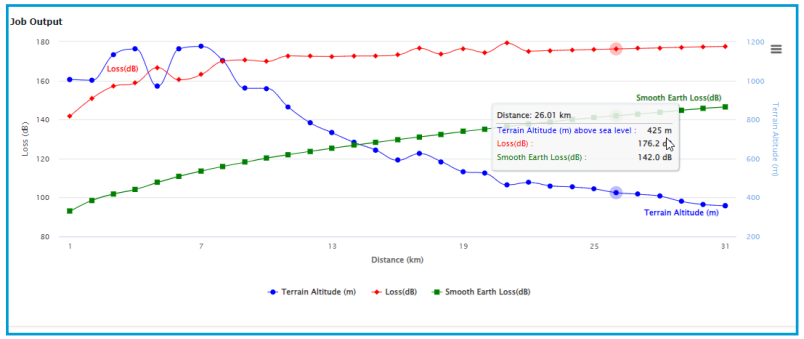
5) Simplify geometry



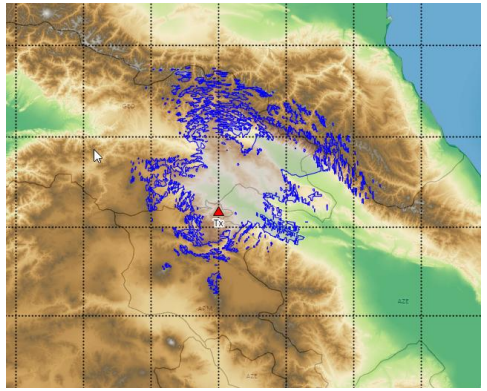
OSGeo: GDAL/OGR open source libraries

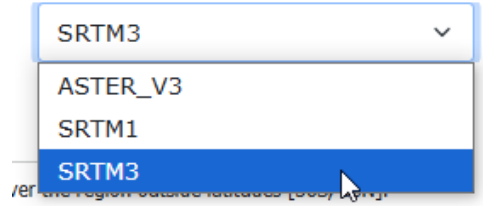
Geospatial data services and radio wave propagation prediction models

P. 452

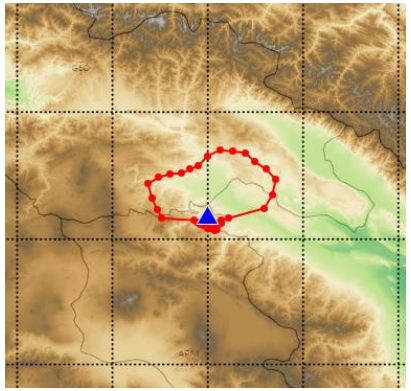


P. 1812

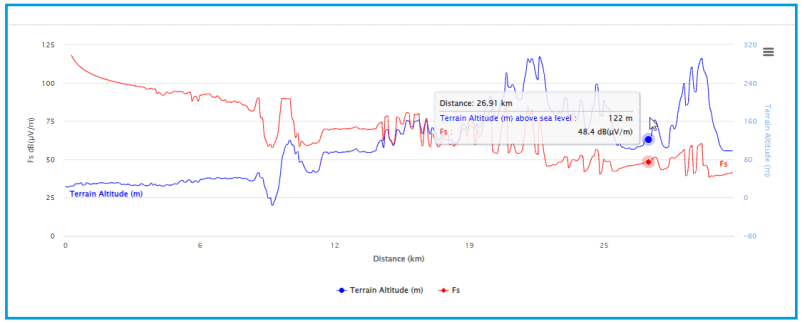




P. 1546



P. 1812



Last 2 years:

> 2 700 simulations

165 users

58 administrations

Geospatial activities for broadcasting services

GE84 plan

implements GE84 propagation curves (interference analyses).

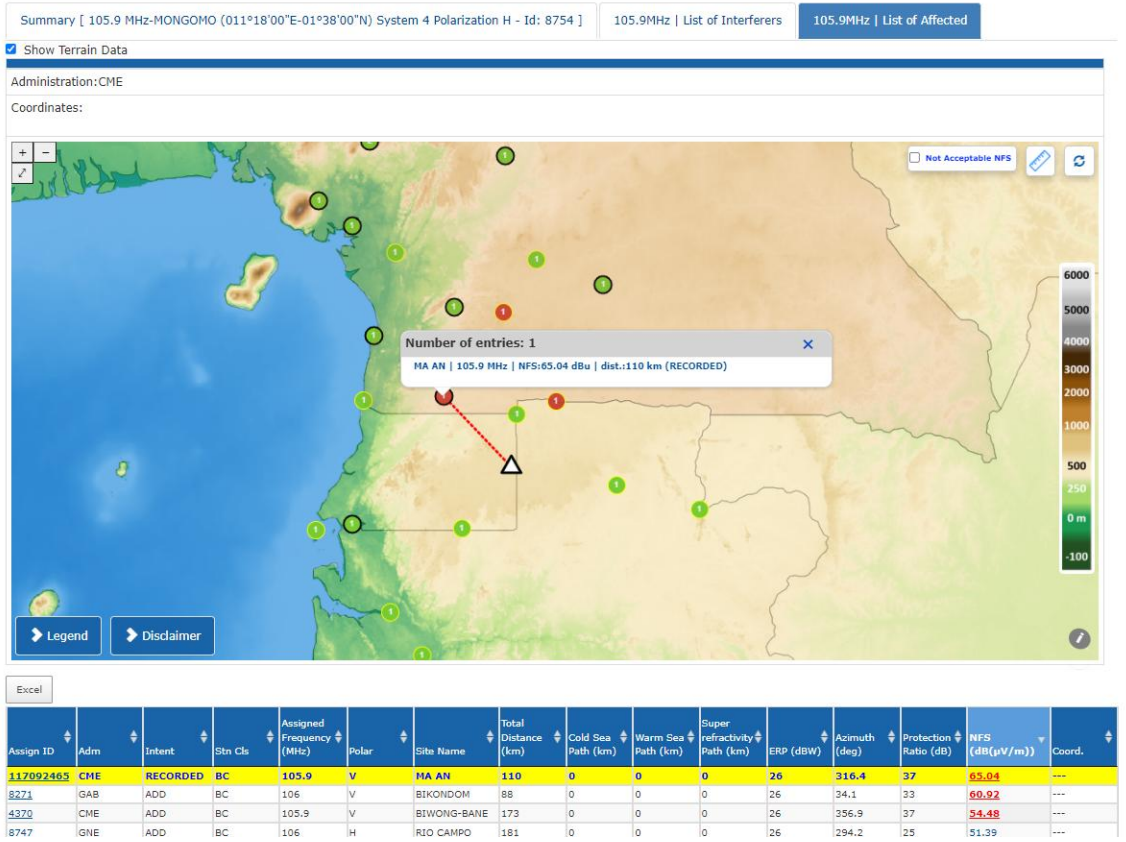
Terrain information considered only via effective antenna height

GE84Opt tool

allows the user to choose between the GE84 model or the Rec. ITU-R P.1812 (several DTM possible) propagation prediction model.

> 4000 simulations 200 users 65 admin

~1000 used DTM

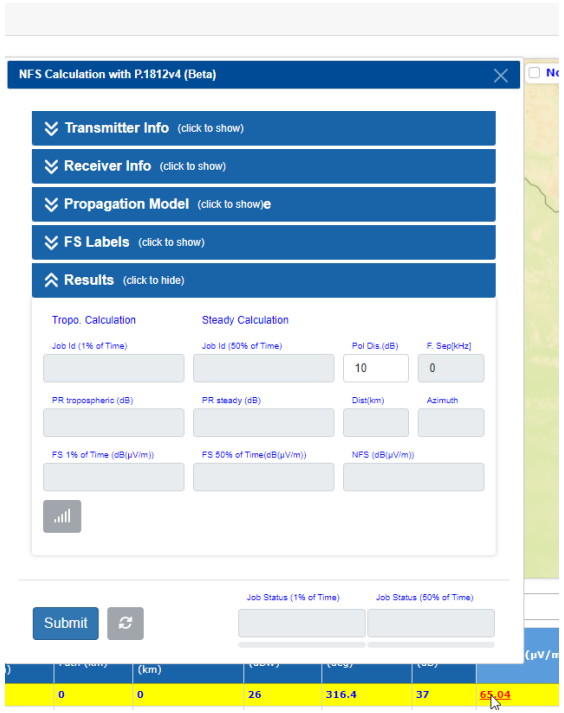


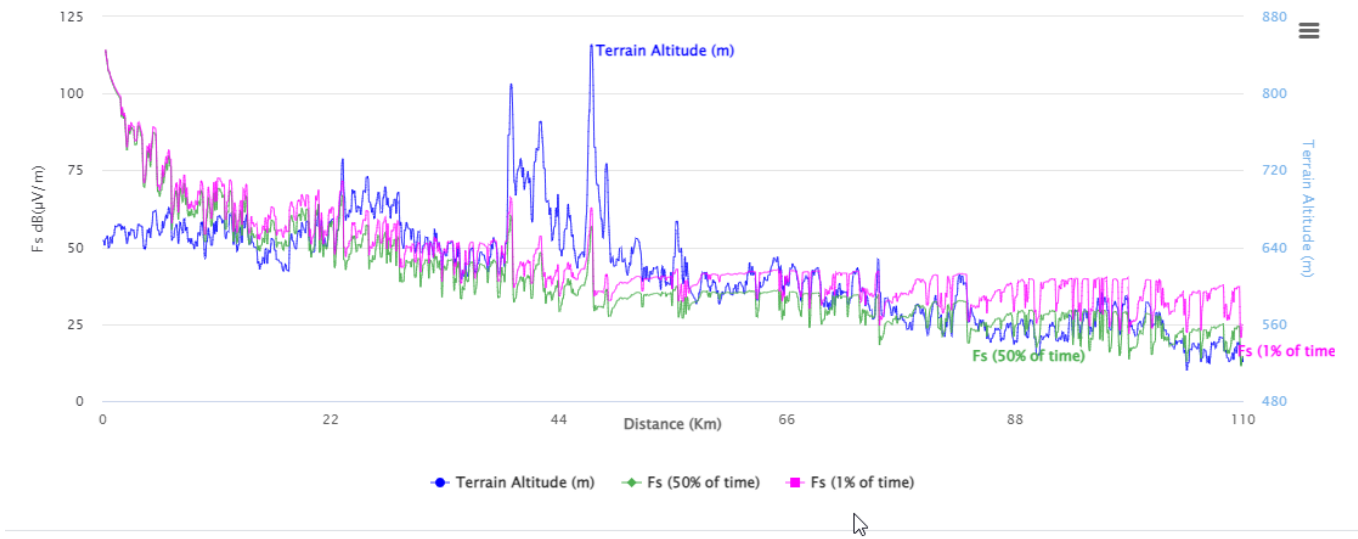
Assign ID	Adm	Intent	Stn Cls	Assigned Frequency (MHz)	Polar	Site Name	Total Distance (km)	Cold Sea Path (km)	Warm Sea Path (km)	Super refractivity Path (km)	ERP (dBW)	Azimuth (deg)	Protection Ratio (dB)	NFS (dB(µV/m))	Coord.
117092465	CME	RECORDED	BC	105.9	V	MA AN	110	0	0	0	26	316.4	37	65.04	---
8271	GAB	ADD	BC	106	V	BIKONDOM	88	0	0	0	26	34.1	33	60.92	---
4370	CME	ADD	BC	105.9	V	BIWONG-BANE	173	0	0	0	26	356.9	37	54.48	---
8747	GNE	ADD	BC	106	H	RIO CAMPO	181	0	0	0	26	294.2	25	51.39	---

Geospatial activities for broadcasting services

GE84Opt allows to calculate on the fly Point to Point field strength calculations (terrain data) using Rec. ITU-R P.1812

The user can choose to use different Digital Terrain Models.

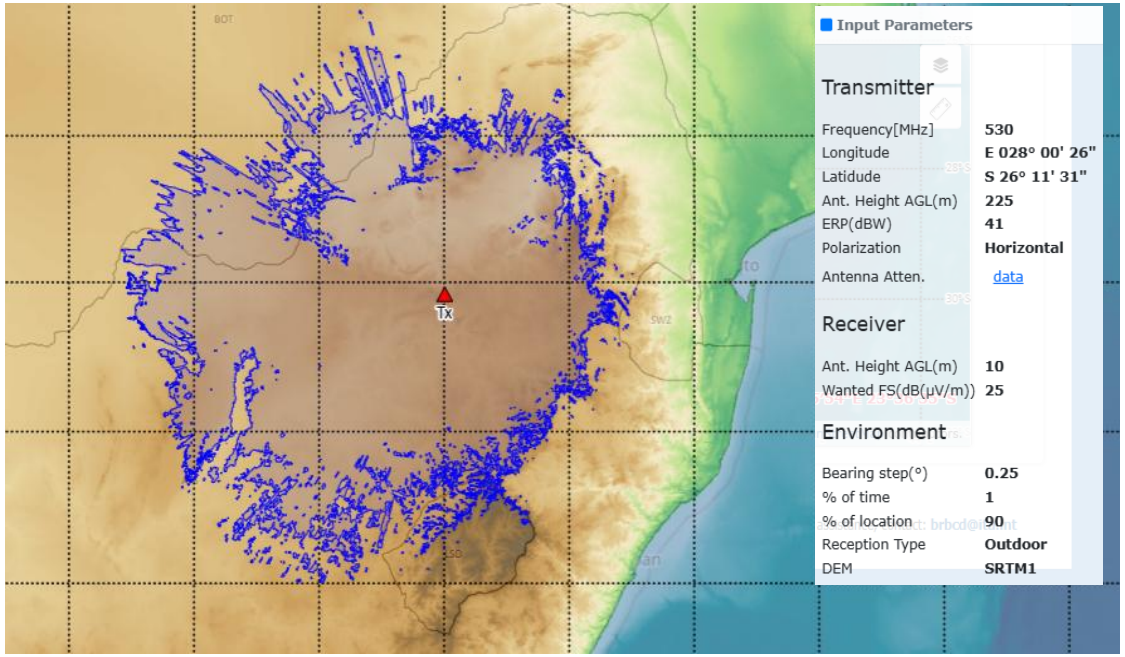




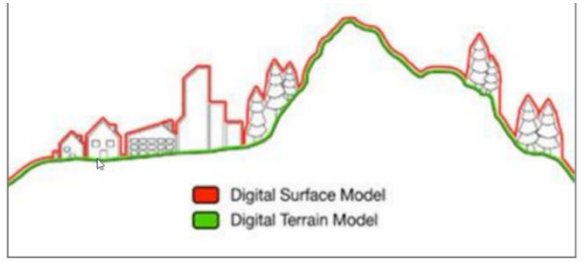
GeoAI efforts to derive high-resolution global geospatial datasets

Improving ITU-R Propagation Prediction with global geospatial datasets produced by Geospatial Foundation Models

Use case: coverage estimation for a DTT transmitter via ITU-R P.1812 propagation prediction method



Inputs for ITU-R propagation models



What we have today (open global dataset)

DSM + DTM (e.g. SRTM ~30 m resolution)

What is missing

DTM (terrain height)

Clutter height (DSM – DTM)

Surface classification (buildings / vegetation)

→ Missing inputs → inaccuracies in propagation loss and field-strength prediction

Geospatial foundation models can provide these missing inputs, enabling more accurate ITU-R propagation predictions at global scale.

Geospatial Foundation Models: From Imagery to Earth Data Products

Large Language Models (LLMs)
Text → embeddings → tasks
(e.g. summarization, drafting, Q&A)

Geospatial Foundation Models (GFMs)
Imagery → embeddings → outputs

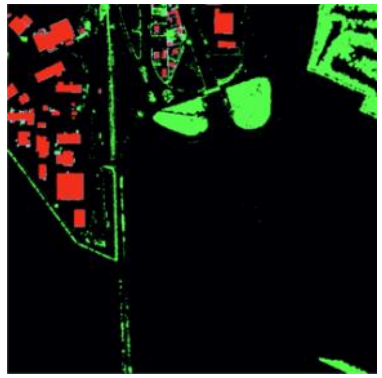


Satellite imagery

Geospatial Foundation Model

Learns general representations

Multiple outputs



Land cover



Surface height (DSM)

Reaching new heights with Geospatial Foundation Models

AI for Good GeoAI Challenge 2026 (video)



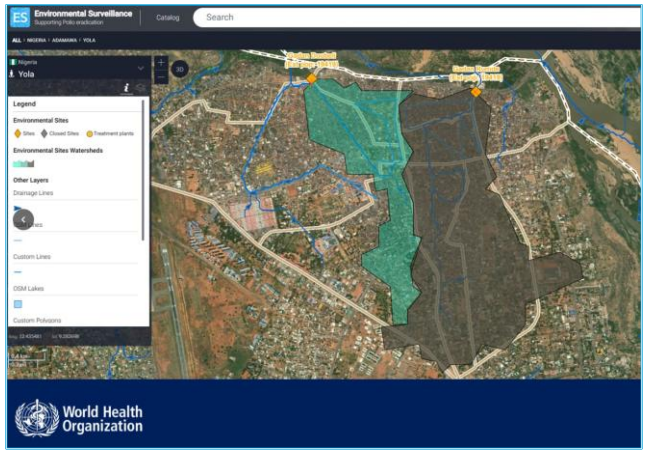
Global participation

- **180 teams worldwide**

Collective innovation to build the next generation of geospatial datasets

WHO–ITU research collaboration

- Developing and validating GFM-based models
- DTM / DSM / land-cover estimation
- Focus on public-health applications



Supporting data-driven decision making in public health

Thank you!

Andrea Manara
Broadcasting Service Division

brbcd@itu.int