32ND ITU WORLD
RADIOCOMMUNICATION SEMINAR

ITUWRS GENEVA2026

7–11 December 2026
Geneva, Switzerland

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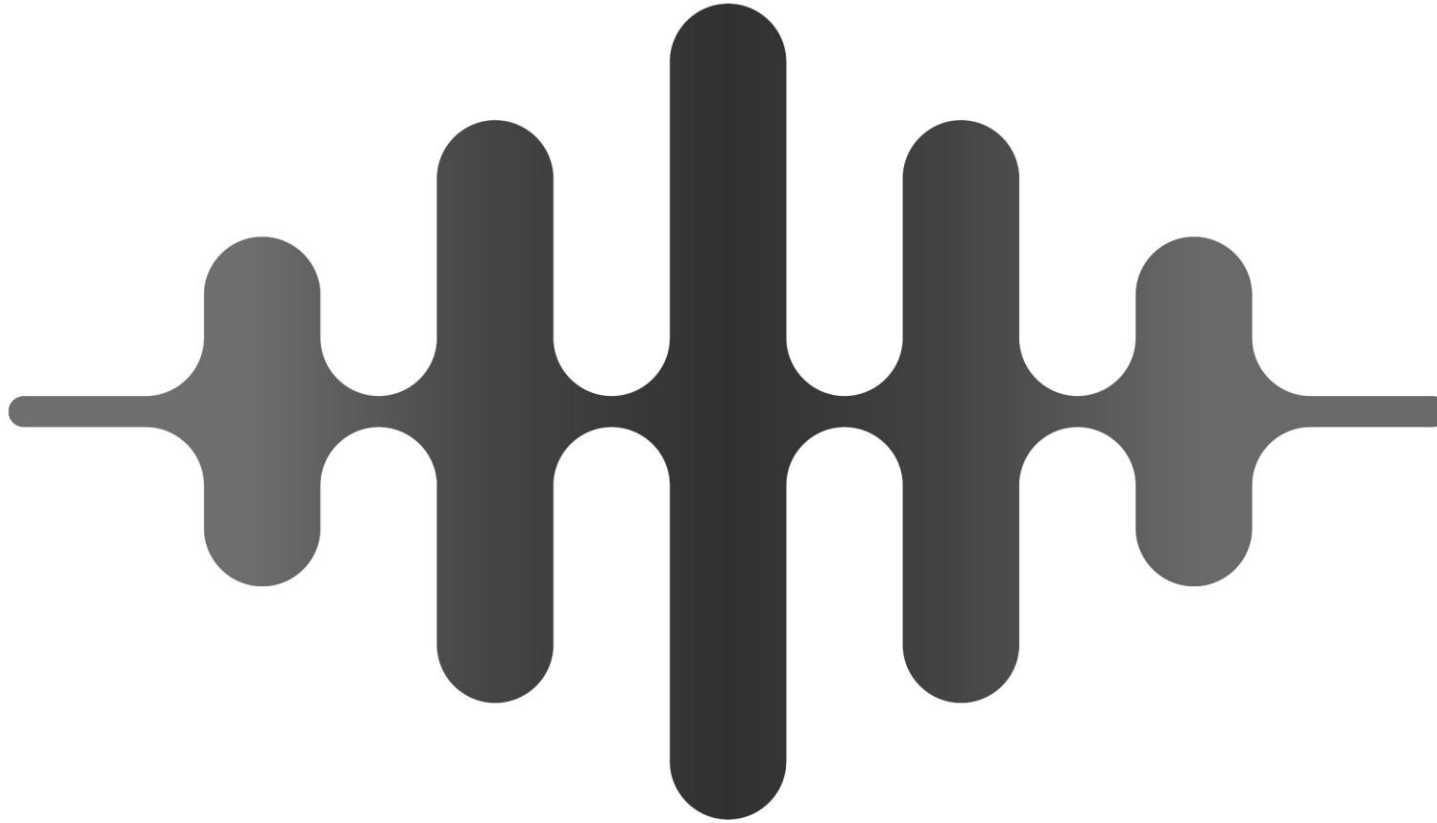

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ITU

ITU World Radiocommunication Seminar

ePropagation model tool using Rec. ITU-R P.452

BR/TSD/FMD
7-11 December 2026, Geneva, Switzerland

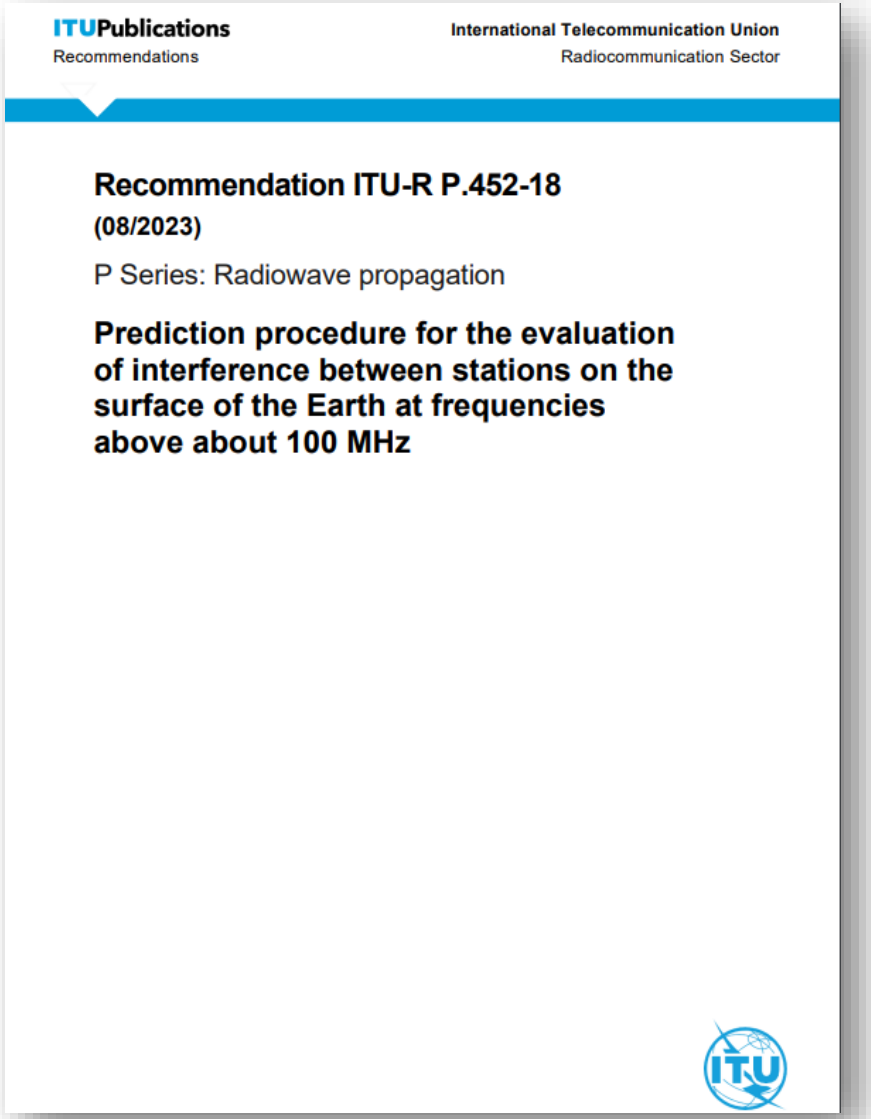
Outline

- Recommendation ITU-R P.452-18
- Interference propagation mechanisms
- P.452 Point-to-Point tool
- Calculation based on DEM and Smooth Earth
- Possible usages
- Future development



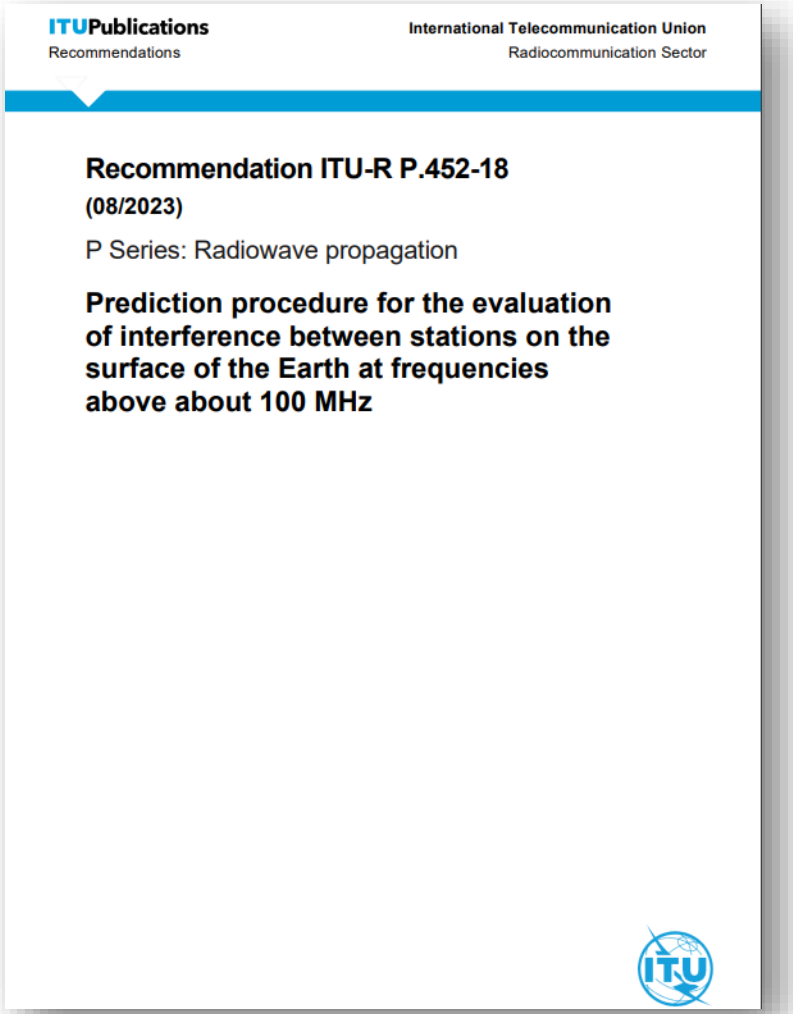
ITUWRS GENEVA2026

Recommendation ITU-R P.452-18



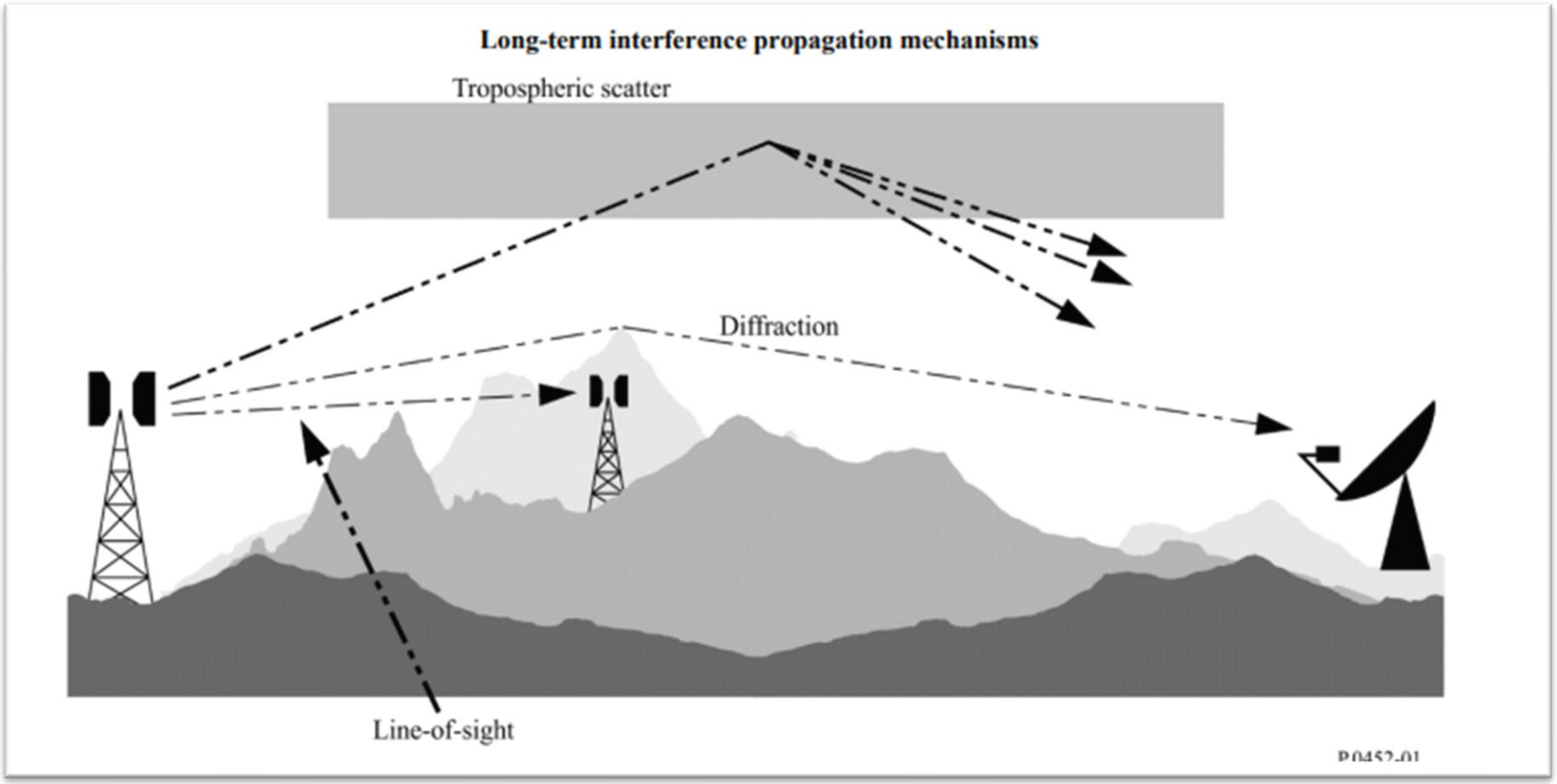
Prediction requirements:

- Tx and Rx within surface layer of atmosphere
- Not appropriate for large antenna height such as aeronautical system
- Frequency range 0.1 GHz to 50 GHz
- Time percentage from 0.1% to 50%
- Considering practical situation, the distance is limited up to 2000 km



5 basic types of propagation mechanism:

- ***line-of-sight***
- ***diffraction***
- ***tropospheric scatter***
- *anomalous propagation*
- *height-gain variation in clutter*



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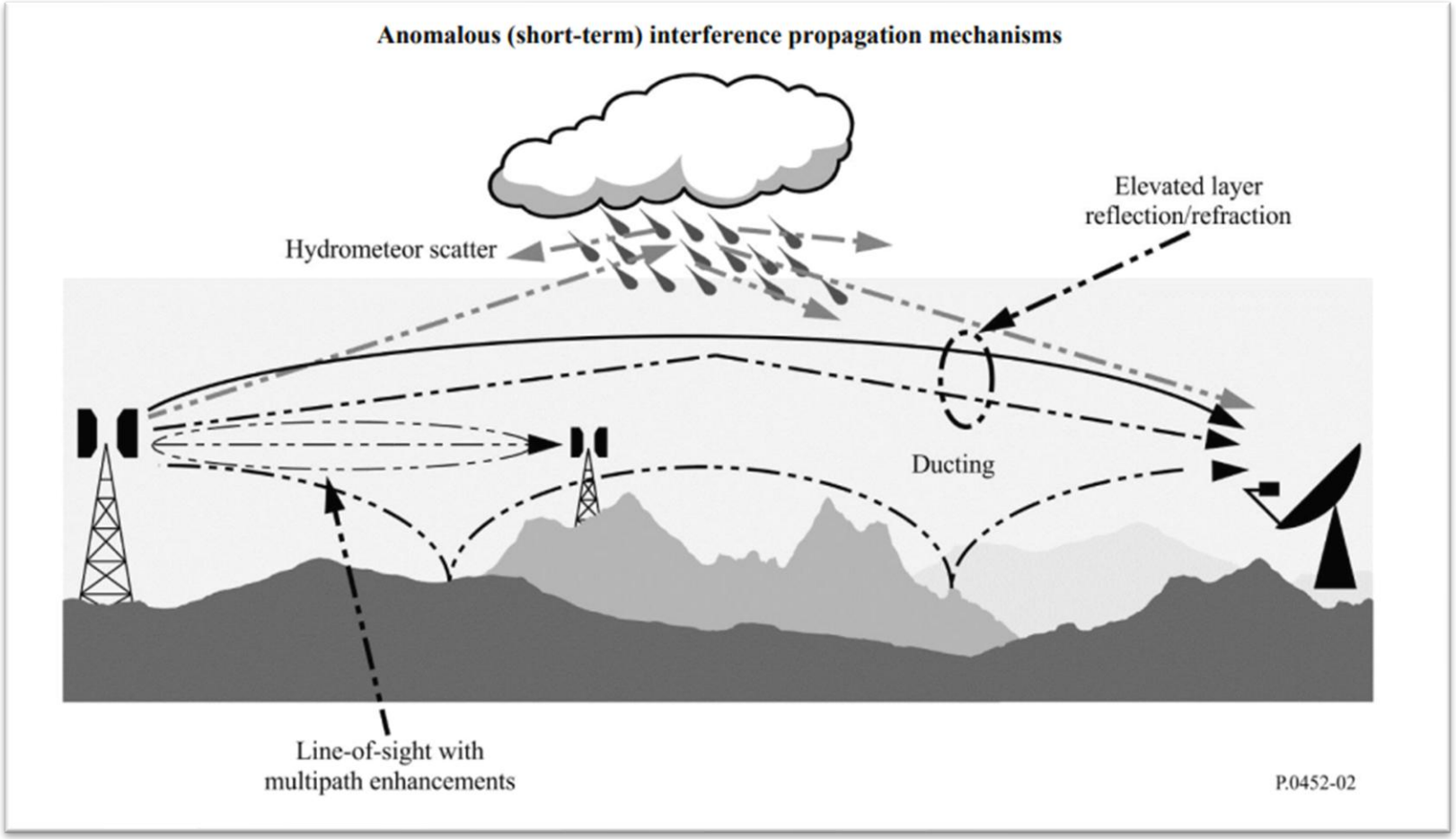
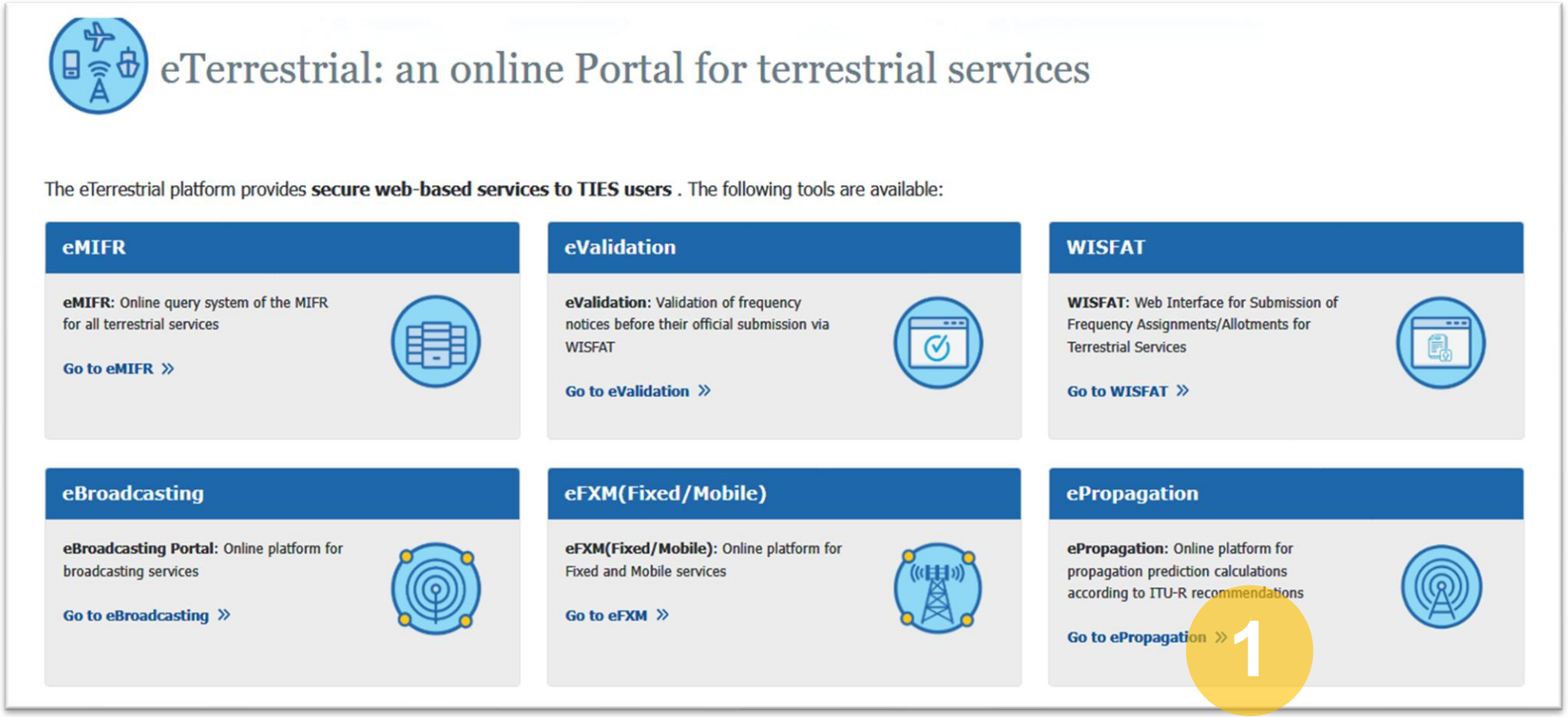
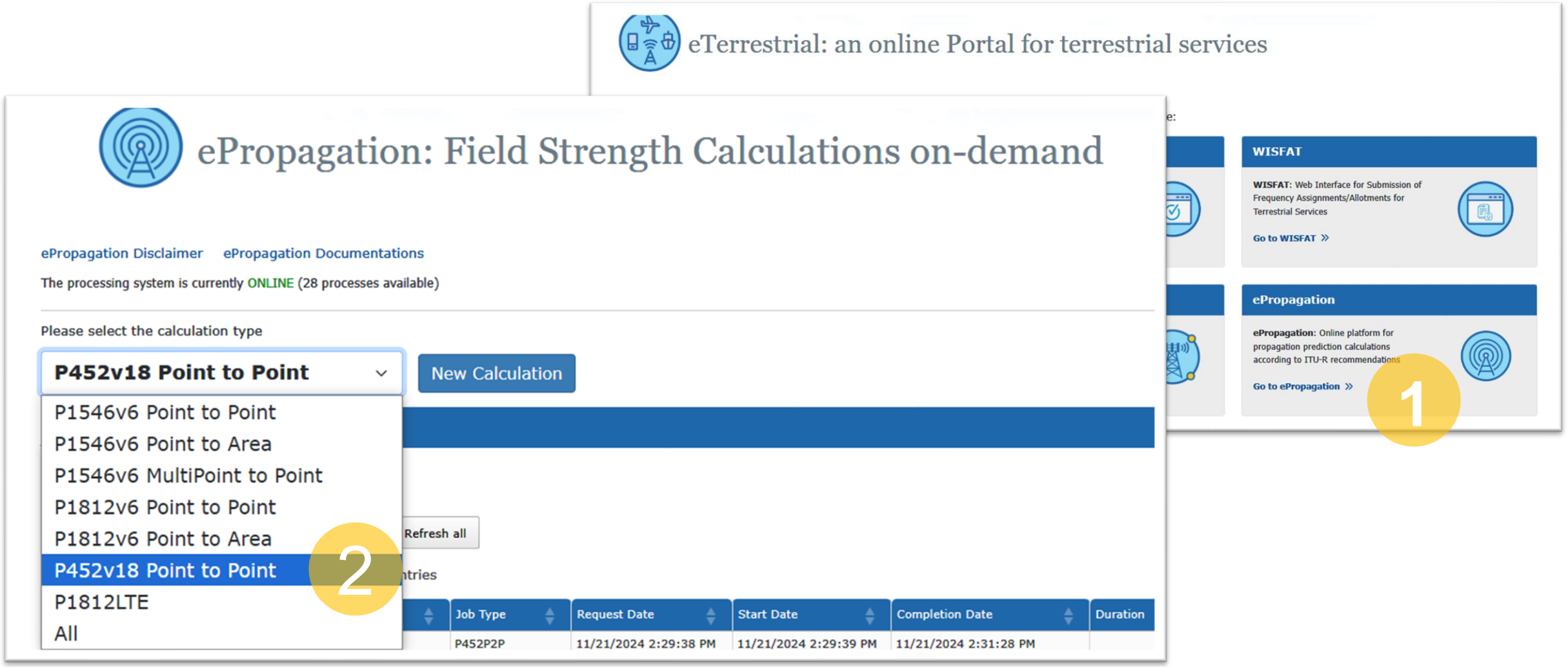


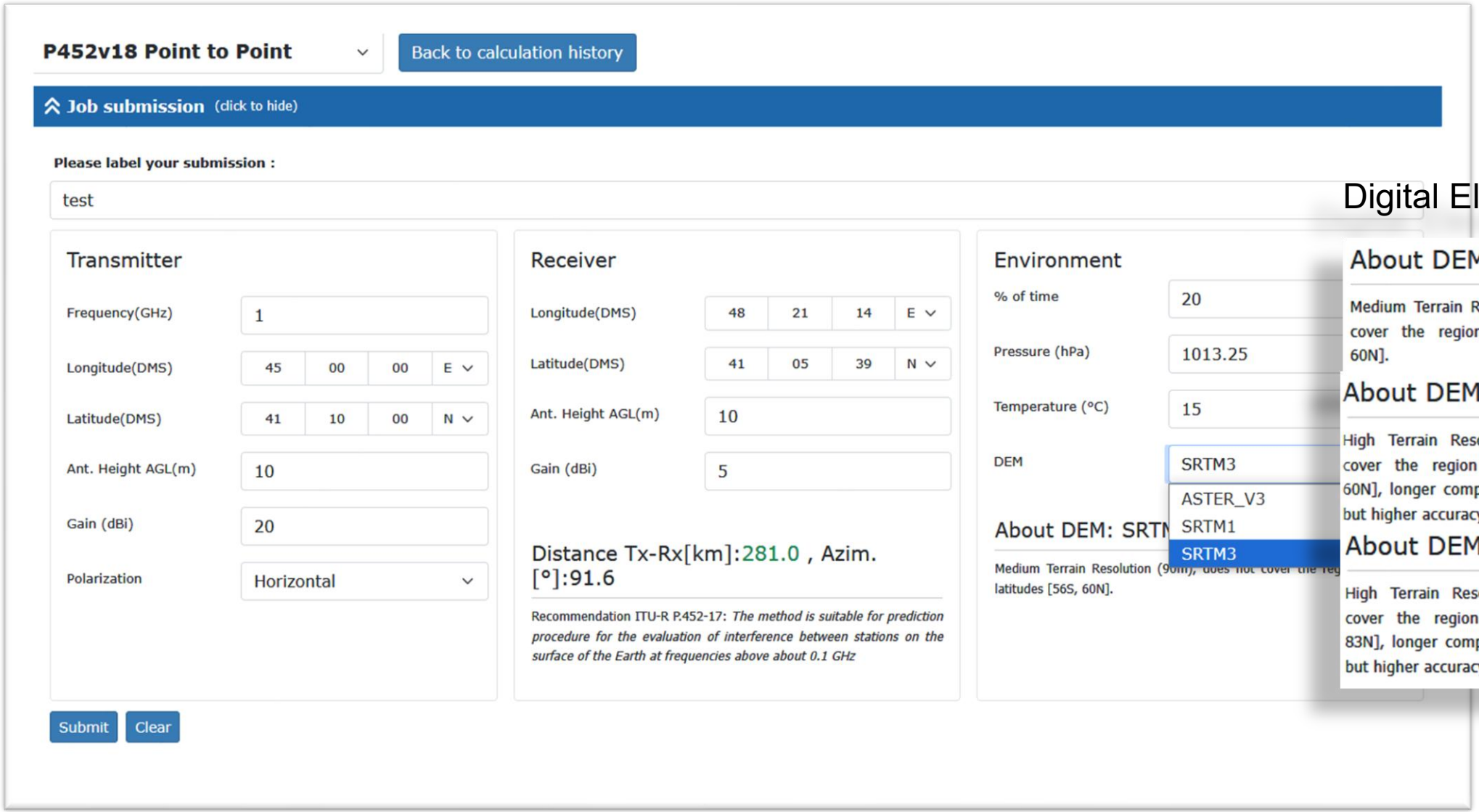
P.452 Point-to-Point tool https://www.itu.int/ITU-R/eTerrestrial



P.452 Point-to-Point tool https://www.itu.int/ITU-R/eTerrestrial



Input Parameters



Digital Elevation Model

About DEM: SRTM3

Medium Terrain Resolution (90m), does not cover the region outside latitudes [56S, 60N].

About DEM: SRTM1

High Terrain Resolution (30m), does not cover the region outside latitudes [56S, 60N], longer computation time than SRTM3 but higher accuracy.

About DEM: ASTER_V3

High Terrain Resolution (30m), does not cover the region outside latitudes [83S, 83N], longer computation time than SRTM3 but higher accuracy.

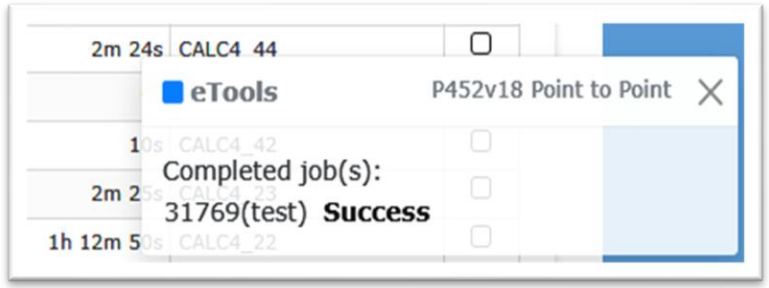
Process a job

Job status in calculation history list

Showing 1 to 12 of 12 entries Show 25 entries Search:

Job Id	Job Name	Job Status	Job Type	Request Date	Start Date	Completion Date	Duration	Running Process
31769	test	InProcess	P452P2P	11/27/2024 3:53:57 PM	11/27/2024 3:54:29 PM			CALC4_22
31754	test	Success	P452P2P	11/21/2024 2:29:38 PM	11/21/2024 2:29:39 PM	11/21/2024 2:31:28 PM	1m 50s	CALC4_47
31753	test	Success	P452P2P	11/19/2024 10:15:04 AM	11/19/2024 10:15:42 AM	11/19/2024 10:16:54 AM	1m 49s	CALC4_25
31751	test	Success	P452P2P	11/19/2024 10:09:11 AM	11/19/2024 10:15:29 AM	11/19/2024 10:16:59 AM	7m 48s	CALC4_23

Pop up notification



Email reminder

BETA: ePropagation on-demand calculation (job 31769) completed successfully

EI eBCD, ITU
To Zhang, Lin

Dear Madam/Sir
Your submission P452P2P (job 31769) completed successfully
You can check the outcome of the calculation in the ePropagation portal
For any clarification please contact brbcd@itu.int

Output

A sample case from Geneva to Sardinia island (739 km)

Job Output (click to hide)

Job Output



A1: coast
A2: inland
B: sea

Export to Excel

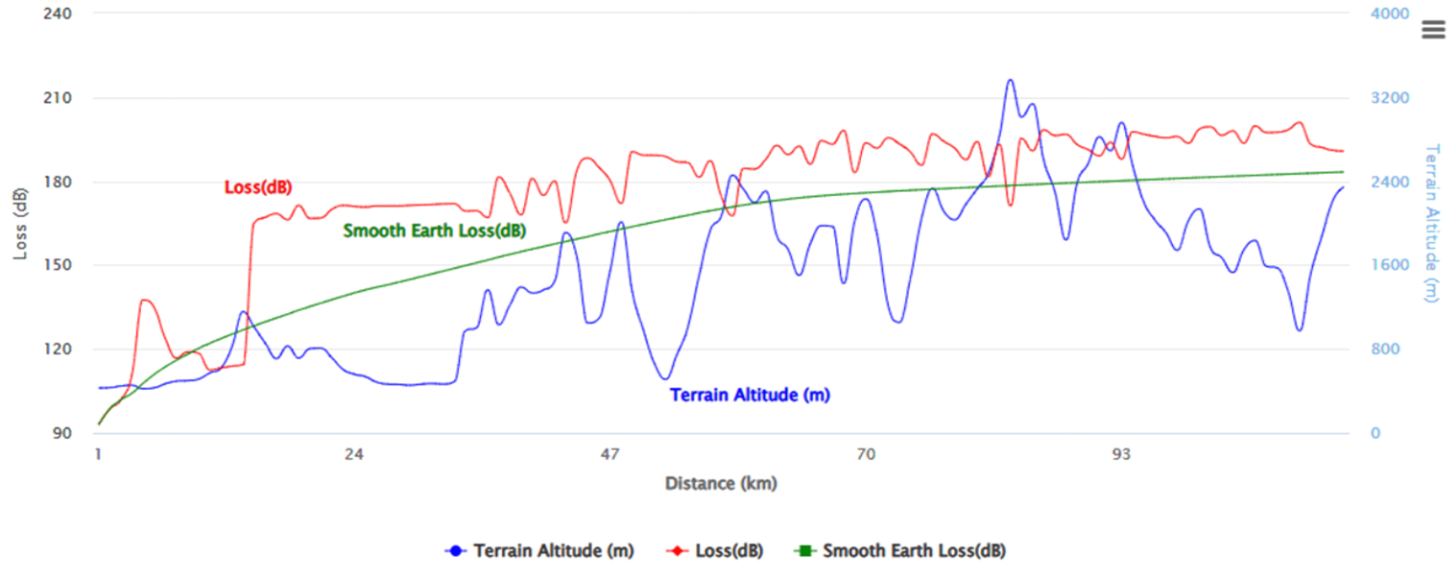
Dist (km)	Height (m)	Zone	Loss (dB)	Loss Smooth Earth (dB)
1.08	426	A2	92.9506	92.9505
2.07	410	A2	115.0025	98.5036
3.06	420	A2	105.8525	101.8096
4.05	472	A2	104.1638	104.1632
5.04	484	A2	118.6654	107.7019
6.03	499	A2	117.2279	110.8814
7.02	567	A2	108.741	113.59
8.01	601	A2	109.8317	115.9669
9	659	A2	110.7942	118.1005
10.08	785	A2	111.7311	120.2198
11.07	775	A2	150.2038	122.0155
12.06	626	A2	160.4922	123.7011
13.05	672	A2	157.4301	125.2986

Output

A sample case from Geneva to Courmayeur (113 km)

Job Output (click to hide)

Job Output

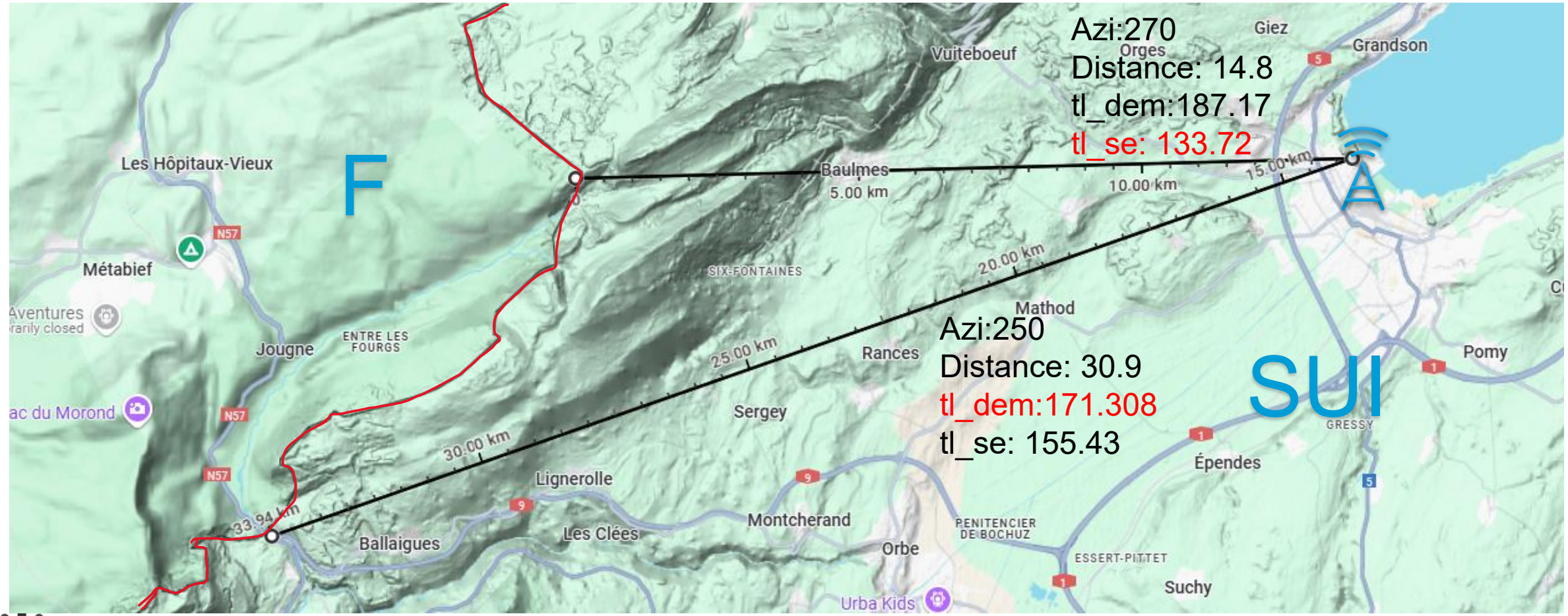


Export to Excel

Dist (km)	Height (m)	Zone	Loss (dB)	Loss Smooth Earth (dB)
78.03	2032	A2	191.7541	177.3033
79.02	2180	A2	187.7049	177.6887
80.01	2325	A2	194.068	177.8717
81	2472	A2	181.6432	178.0527
82.08	2825	A2	193.069	178.248
83.07	3366	A2	171.3255	178.4254
84.06	3012	A2	195.2245	178.6012
85.05	3136	A2	190.8862	178.7755
86.04	2600	A2	198.3353	178.9486
87.03	2296	A2	196.314	179.1203
88.02	1842	A2	196.7308	179.2908
89.01	2379	A2	193.0957	179.4602
90	2571	A2	191.2293	179.6285
91.08	2822	A2	189.0413	179.8108

DEM vs Smooth Earth

Yverdon-les-Bains
Tx: (6.6397, 46.775) f: 3.55 GHz Power: 30 dbw Max Antenna gain: 17 Antenna height: 20 Bandwidth: 100 MHz



Possible Usage

Prediction of power flux density (pfd)

- **No. 5.530A** stipulates that unless otherwise agreed between the administrations concerned, any station in the fixed or mobile services of an administration shall not produce a power flux-density in excess of **–120.4 dB(W/(m² · MHz))** at 3 m above the ground of any point of the territory of any other administration in Regions 1 and 3 for more than 20% of the time. In conducting the calculations, administrations should use the most recent version of Recommendation ITU R P.452;

- **Resolution 166 (Rev. WRC-23) resolves**

4 that, for the purpose of protecting mobile-service systems operating in the frequency band 25.25-27 GHz in the territory of neighbouring administrations, coordination of a transmitting HAPS ground station is required when the pfd in dB(W/(m2 · MHz)) at the border of a neighbouring administration exceeds a pfd limit of **–110.3 dB(W/(m² · MHz)),** and the pfd values shall be verified considering a percentage of time of 1% using the most recent version of Recommendation ITU R P.452 and a mobile-station antenna height of 20 m;

- **Resolution 167 (Rev. WRC-23) resolves**

5 that, in order to ensure the protection of the radio astronomy service (RAS), the pfd level produced by any HAPS ground station operating in the frequency band 31-31.3 GHz at RAS station locations at a height of 50 m shall not exceed **–141 dB(W/(m² · 500 MHz))** in the frequency band 31.3-31.8 GHz; this limit relates to the pfd which would be obtained under assumed propagation conditions predicted by the most recent version of Recommendation ITU R P.452 using a time percentage of 2%;

- **Resolution 168 (Rev. WRC-23) resolves**

4 that, for the purpose of protecting mobile-service systems operating in the frequency band 38-39.5 GHz in the territory of neighbouring administrations, coordination of a transmitting HAPS ground station is required when the pfd in dB(W/(m² · MHz)) at the border of a neighbouring administration exceeds a pfd limit of **–110.8 dB(W/(m² · MHz**)), and the pfd values shall be verified considering a percentage of time of 1% in the relevant propagation model of the most recent version of Recommendation ITU R P.452 and a mobile-station antenna height of 20 m.

Prediction of power flux density (pfd)

- If it is required to check the conformity with these pfd limits, the pfd level produced at the border or at the receiving location of the neighbouring country can be calculated from the path loss (LB) obtained from this P.452 Point-to-Point tool either over smooth Earth path or DEM path, using the following formula.

$$\mathbf{PFD\ (dBW/m^2) = EIRP\ (dBW) - LB\ (dB) + 20\ log\ (f\ (Hz)/c\ (m/s)) + 10\ log\ (4\pi)}$$

where c is the light velocity 3×10^8 (m/s).

Thank you!

ITU – Radiocommunication Bureau
Questions to brfmd@itu.int