A method to estimate the terrestrial component of ambient dose equivalent rate from EURDEP routine monitoring data to improve the European Geogenic Radon Map

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Benefit

Use of EURDEP data in the context of European Atlas of Natural Radiation

European Atlas of Natural Radiation (EANR)

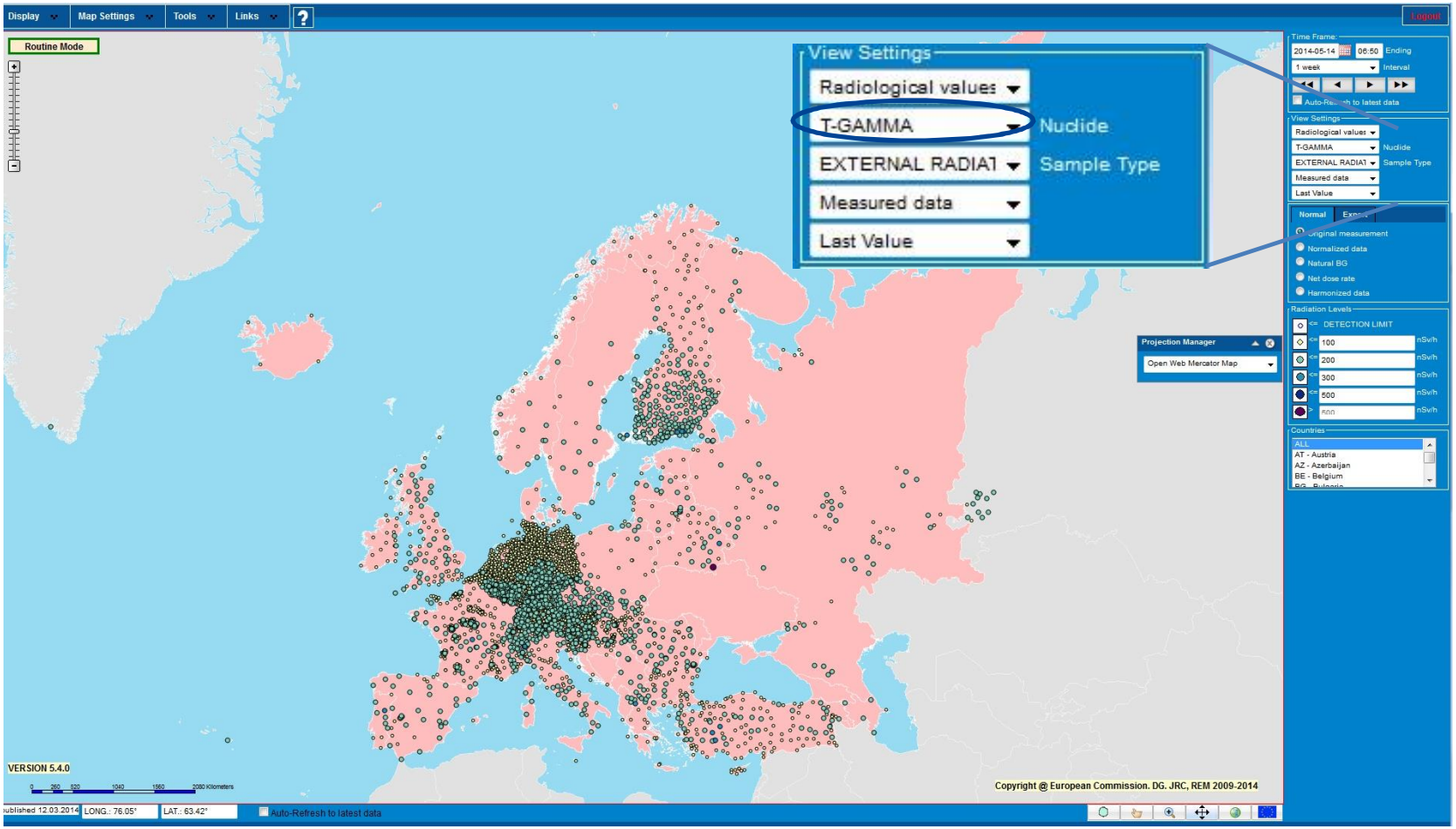
MAPS

- Indoor radon
- **Terrestrial gamma dose rate** ← **Estimate from EURDEP data**
- **Geogenic radon** ← **Use the terrestrial gamma dose as input variable**
- Outdoor radon
- Cosmic radiation, Water, Exposure, Total dose by natural radiation

EURDEP Data

European Commission

Data available in EURDEP (≈ 6,600 stations)



http://eurdepweb.jrc.ec.europa.eu/EurdepMap/Default.aspx

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EURDEP Data

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Contributions to the Ambient Dose Equivalent Rate (hereafter total-γ)

Constant

- Inherent background
- Cosmic dose rate
- Artificial gamma dose rate(^{137}Cs after Chernobyl)
- **Terrestrial gamma dose rate (TGDR)** (^{238}U, ^{235}U, ^{232}Th families and ^{40}K)

Variable

- Airborne gamma dose rate
- Wet deposition gamma dose rate
- Radiological release

Sampling Area

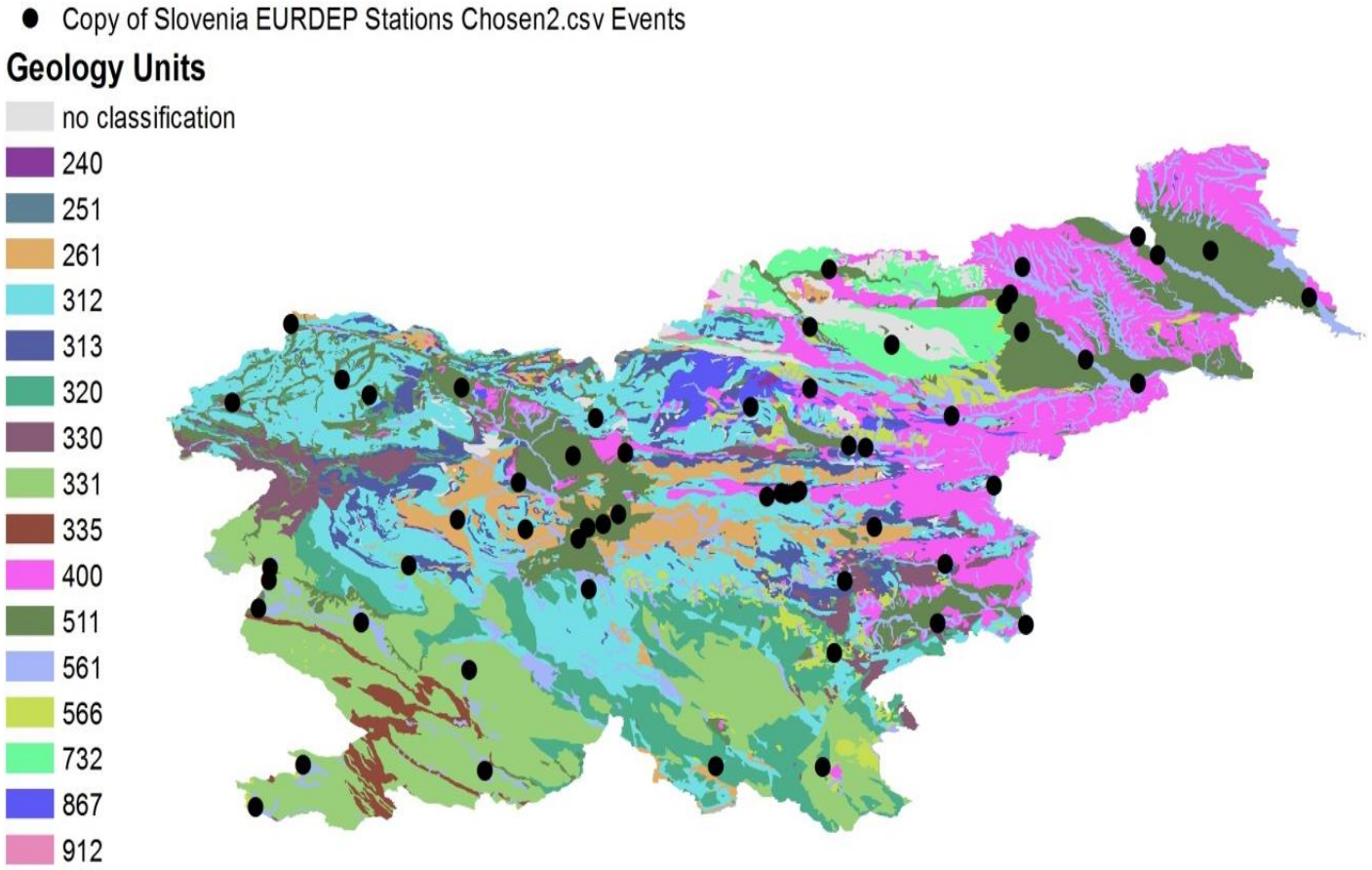
European Commission

The database of Slovenia has been taken as benchmark

- 54 stations
- One year (2012) of total-γ data (30-minutes values measured)
- Monitoring devices: MFM-202 (in 15 stations) and MFM-203 (in 39 stations) both manufactured by AMES (Slovenia), supplied with two energy compensated GM probes of different sensitivities
- All detectors are located 1 m above the ground
- Inherent background correction was applied by the data provider, subtracting a value of 68 nSv/h for both instruments

Sampling Area

European Commission



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Methodology

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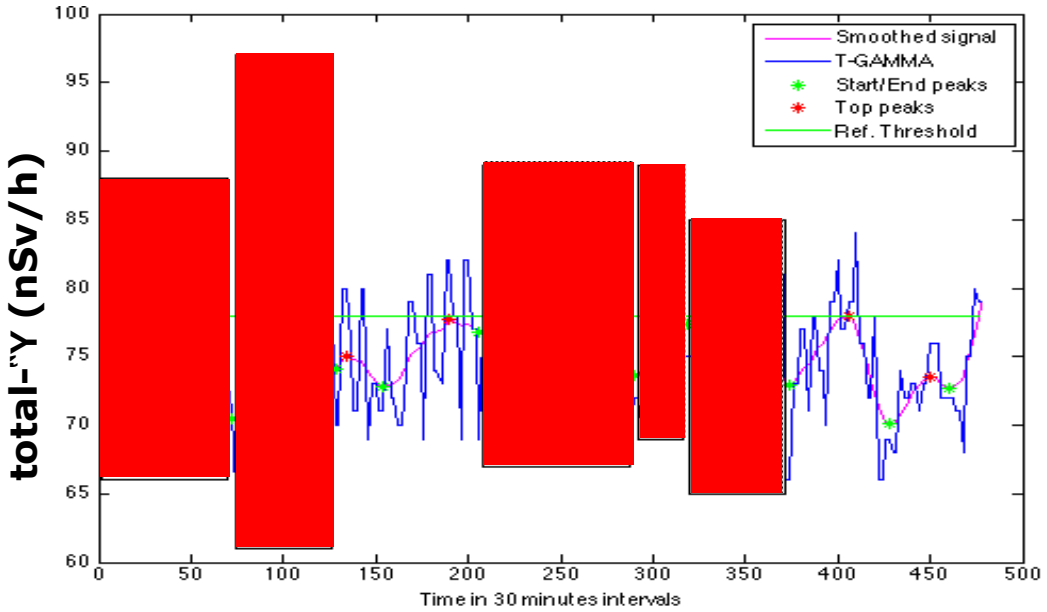
1. Smoothing of total-γ to remove the short-term variations in the data whilst preserving the medium-term trend



2. Definition of the 75th percentile (P75) as the minimum threshold to select peaks with the highest concentrations

3. Identification of valley values corresponding to the lowest values before and after the selected peaks

Methodology

4. Estimation of the cosmic dose rate considering the altitude value in each station - the latitude and the longitude has not been taken into account.

5. Subtraction of constant contribution: cosmic contribution and the inherent background correction has been applied to the data.

6. Estimation of the TGDR: the average of "net" valley values in time series has been considered to represent the estimated TGDR at 1 metre above the ground

Preliminary results

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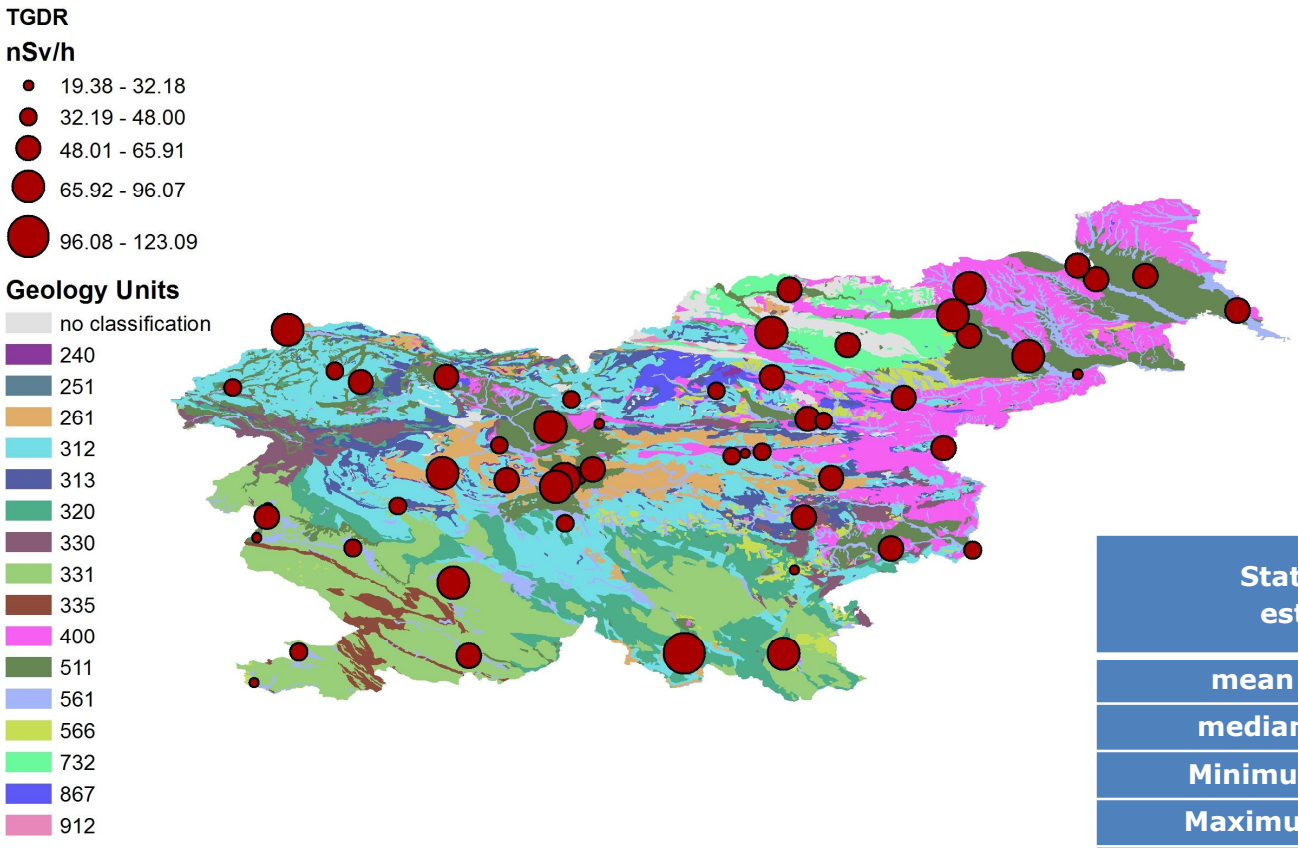

Statistics parameters of the estimated TGDR (nSV/h)	
mean	54.57
median	52.86
Minimun	21.45
Maximun	123.09
1. Quartile	40.62
3. Quartile	83.92
Std. Dev.	19.38

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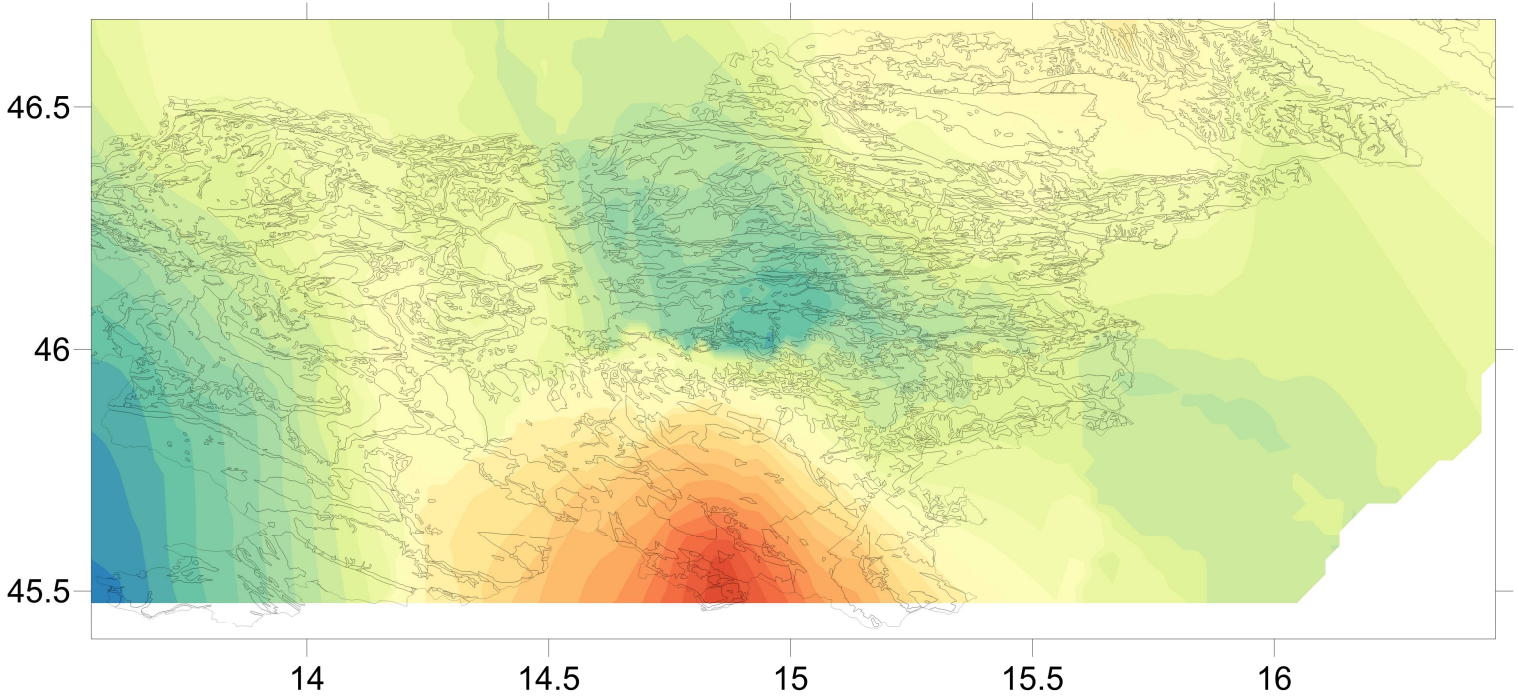
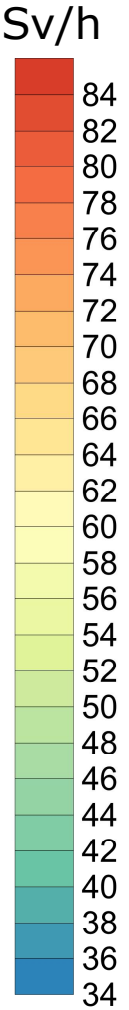
Preliminary results





Preliminary results

European Commission

The variability in the TGDR values between stations can be due to:

- different kind of detector

- irregularities in monitoring siting

- variation of radionuclide contents (geology)

Evaluation of the variation of TGDR explained by:

a) Geology

b) Detector type

Preliminary results

European Commission

Monitoring stations grouped by geological unit					
Geological Unit				n. of	Geological Group
261					
331	La				
313	Ladinian	Rhaetian	Limestone	1	
312	Induan	Tithonian	Dolomite	9	A
400	Burdigalian Burdigalian Rupelian Priabonian	Piacenzian Serravallian Burdigalian Chattian	Clastic sediment, Limestone, Limestone Conglomerate Mud	4	
511	Pleistocene	Holocene	Clastic sediment	20	B
561	Holocene	Holocene	Clastic sediment	16	
566	Holocene	Holocene	Mud	2	

Geology	
Percentage (%)	0.24

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Preliminary results

European Commission

Monitoring stations grouped by geological unit and type of detector						
Geological Unit	**Lower Age**	**Upper Age**	**Lithology**	**Detector Type**	**n. of stations**	**Geological Group**
312	Induan	Tithonian	Dolomite	MFM 203	10	A
400	Burdigalian Burdigalian Rupelian Priabonian	Piacenzian Serravallian Burdigalian Chattian	Clastic sediment, Limestone, Limestone Conglomerate Mud	MFM 202	3	
511	Pleistocene	Holocene	Clastic sediment	MFM 203	26	

	Detector Type	
	Geological Group A	Geological Group B
Percentage (%)	**7.86**	**2.15**

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Conclusions

- A method to estimate the TGDR from EURDEP routine monitoring γ-total data has been developed
- It was applied to 54 stations of the Slovenia monitoring network
- The estimated TGDR ranges between 21 and 123 nSv/h with an average of 55 nSV/h
- The percentage of the variation of the TGDR explained by geology has been estimated to be 0.24% while in the two geological groups respectively 7.86 and 2.15% explained by detector type.
- The method WILL BE APPLIED TO THE 6000 EURDEP STATIONS

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Thank you very much for your attention

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