UNIVERSITÀ DEGLI STUDI FIRENZE

DST DIPARTIMENTO DI SCIENZE DELLA TERRA

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Landslide susceptibility assessment including a set of novel explanatory variables: soil sealing, and multi-criteria geological parameterization

Photography encouraged

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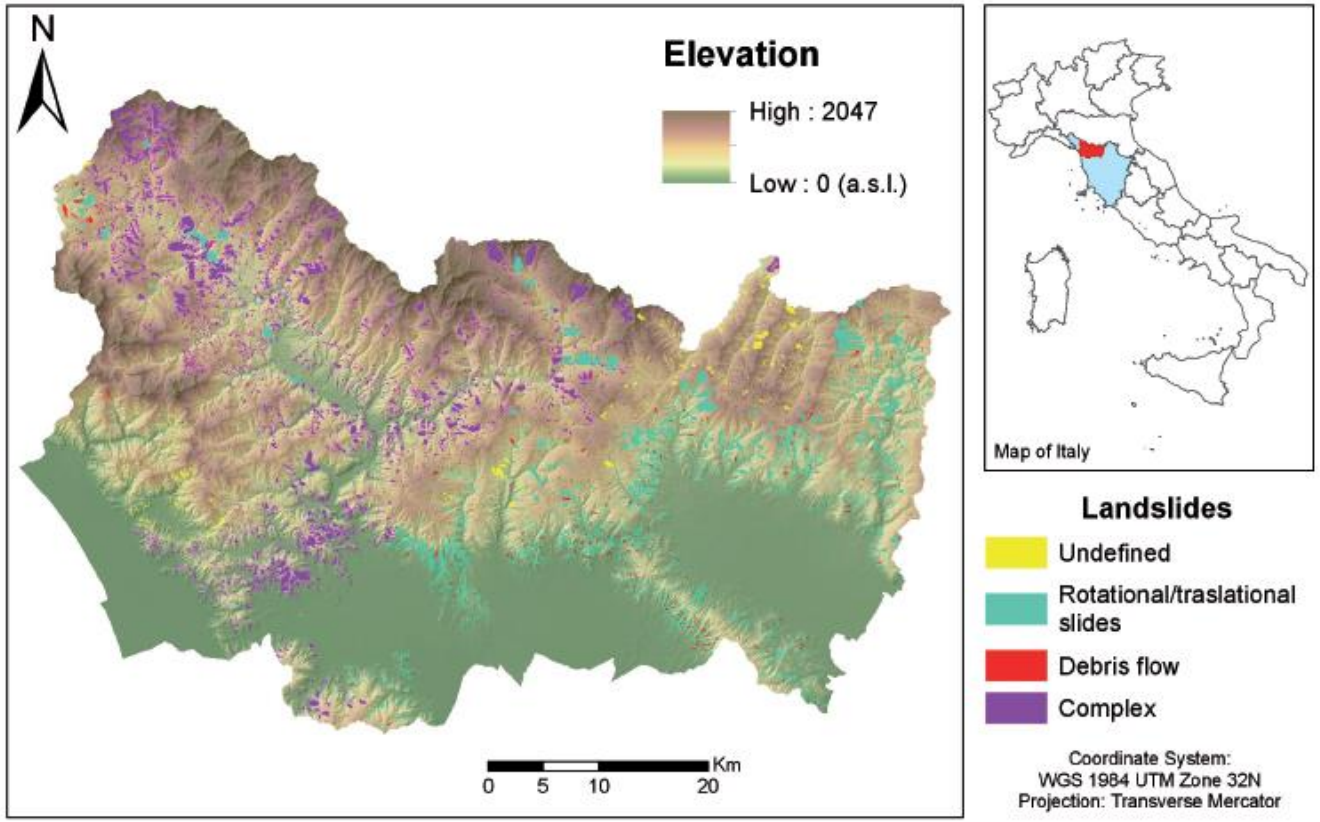
Introduction

Landslide susceptibility maps are based on the spatial distribution of a set of **selected predisposing factors**

The identification of new parameters to be used as input data is a promising field of research in susceptibility studies as it may contribute to enhance the results

- Lucca, Prato and Pistoia province, Northern Tuscany (Italy), 3100 km^2
- Italian national inventory of landslides (IFFI): about 7000 landslide polygons.
- Model Used: Random Forest



Soil Sealing Map

WHAT IS SOIL SEALING ?

Destruction or covering of soil by (partially) impermeable materials:

- infrastructures
- buildings
- services…

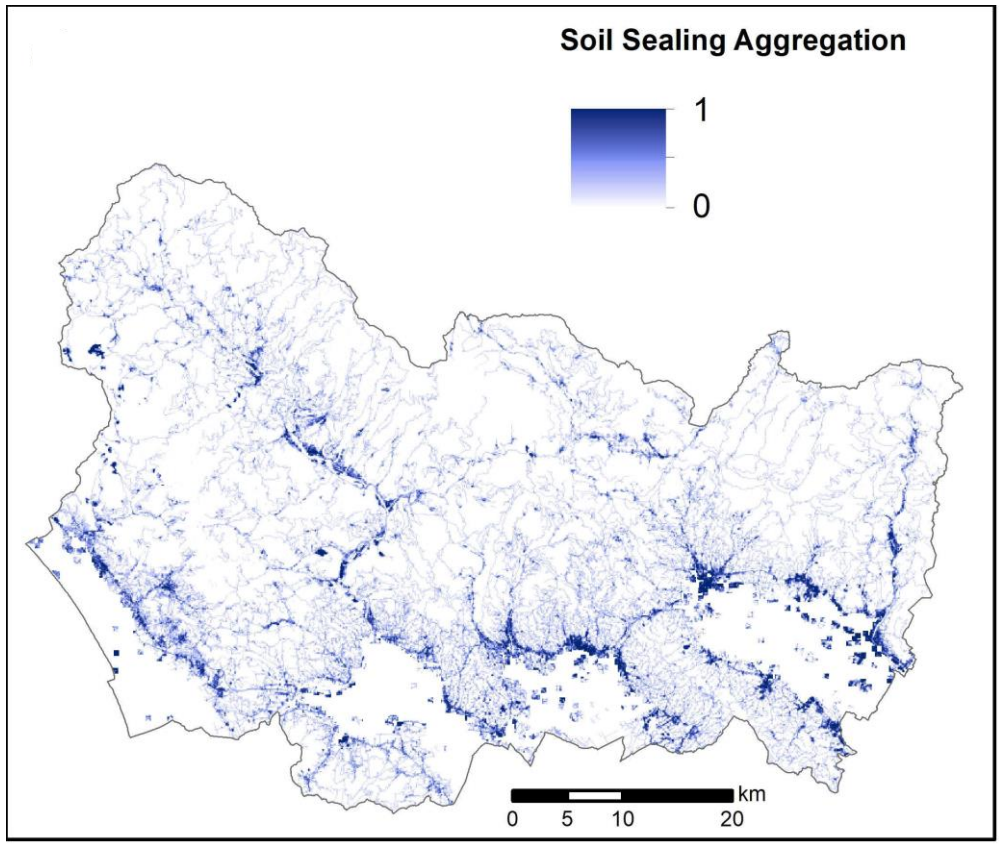
NATION-WIDE MONITORING PROGRAM

- By remote sensing techniques
- Specifically conceived and calibrated
- Binary map (sealed/not sealed)
- 10 m resolution raster
- Yearly updates
- Open access

ISPRA
Istituto Superiore per la Protezione e la Ricerca Ambientale

Soil sealing rate in Italy: 8 m^2/s
4 football fields a day

A new variable: % of sealed soil in each spatial unit (*Luti et al., 2020*)



Multi-Parametric Geological Maps

From 1:10.000 scale digital geological maps with 194 lithostratigraphic units (*Segoni et al., 2020*)

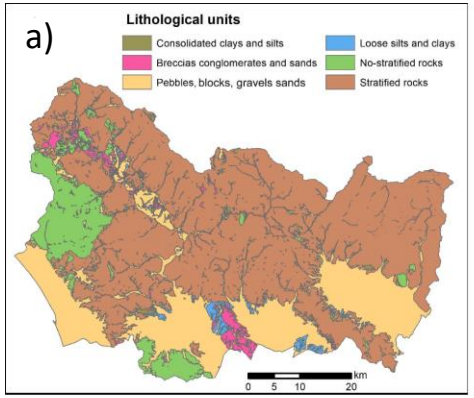
a) Lithological units: prevailing lithology

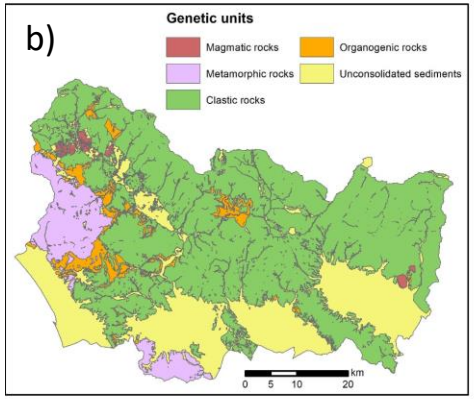
b) Genetic units: genetic process: magmatic rocks, metamorphic rocks, sedimentary-clastic rocks, organogenic rocks, soils

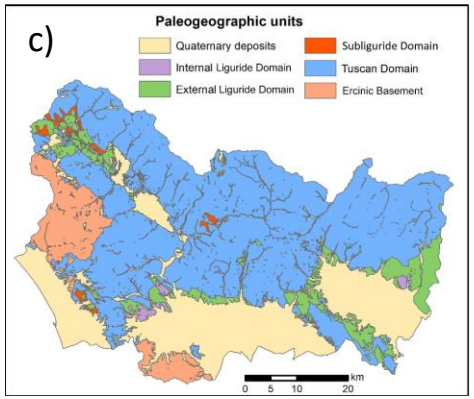
c) Paleogeographic units: highlight differences on mineralogical or textural characteristics according to the environment of deposition

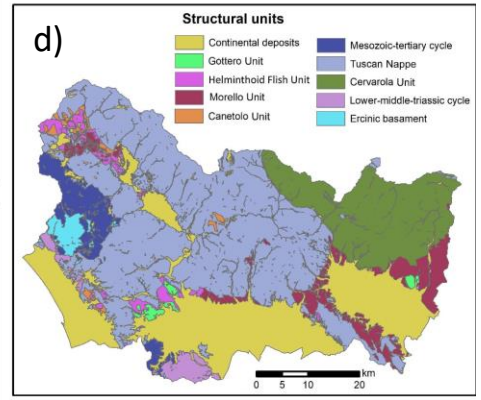
d) Structural units: accounts for tectonic evolution and tectonic stress: thrusting, folding, faulting, uplifting…

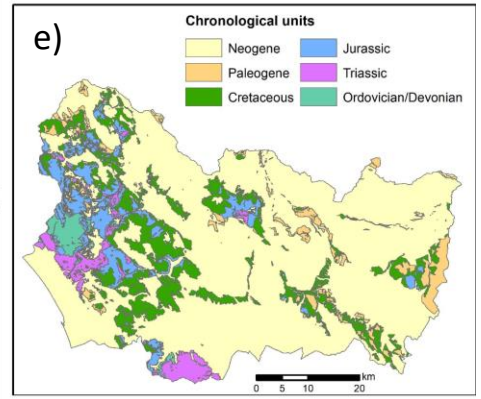
e) Chronological units: age of deposition; accounting for the degree of weathering and the exposition to tectonic stress



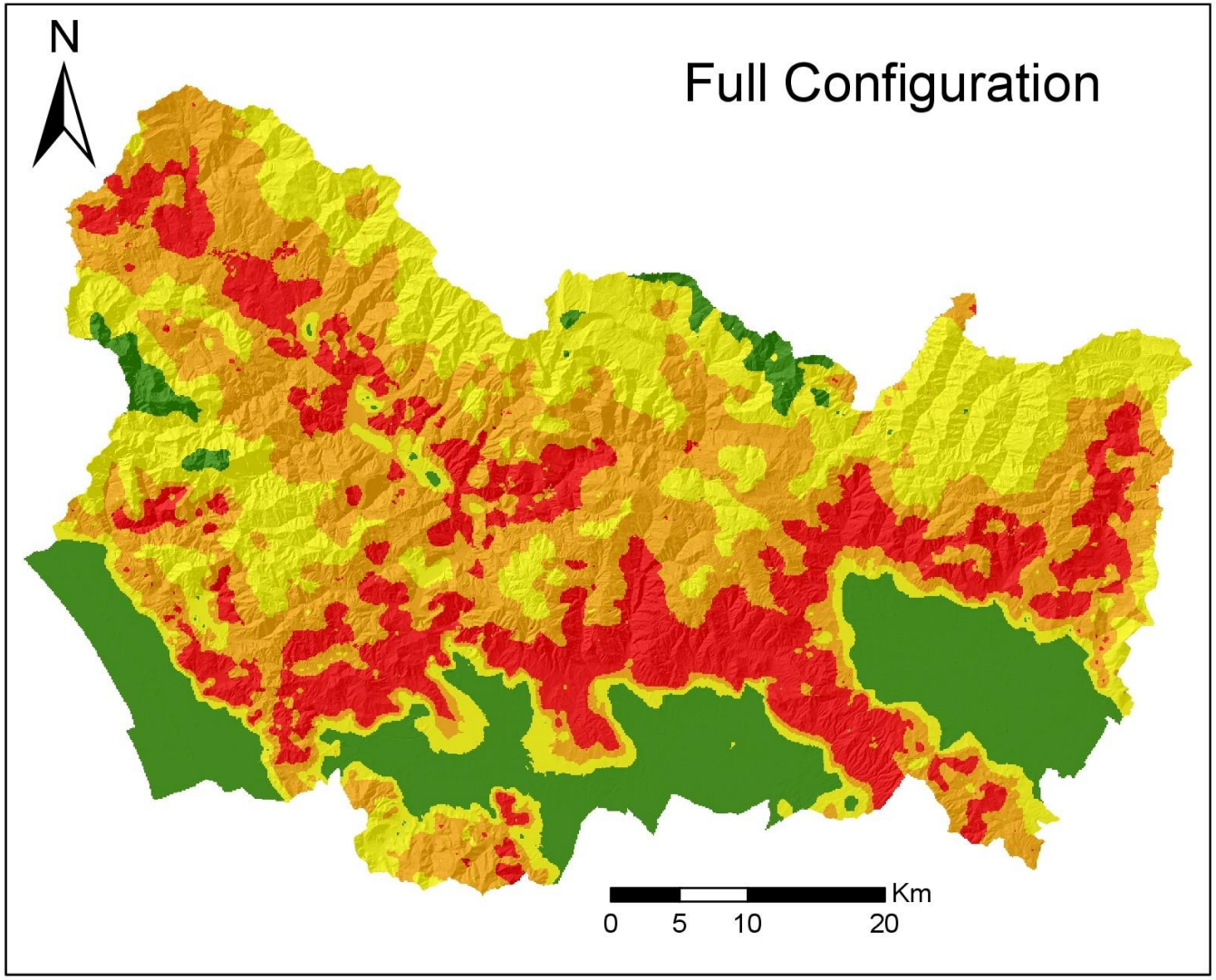


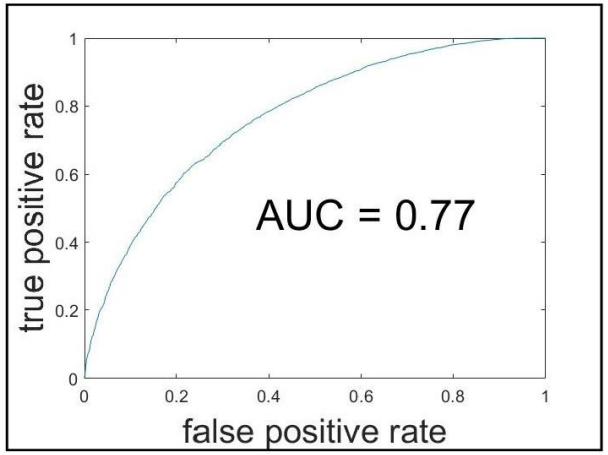






Results and discussion



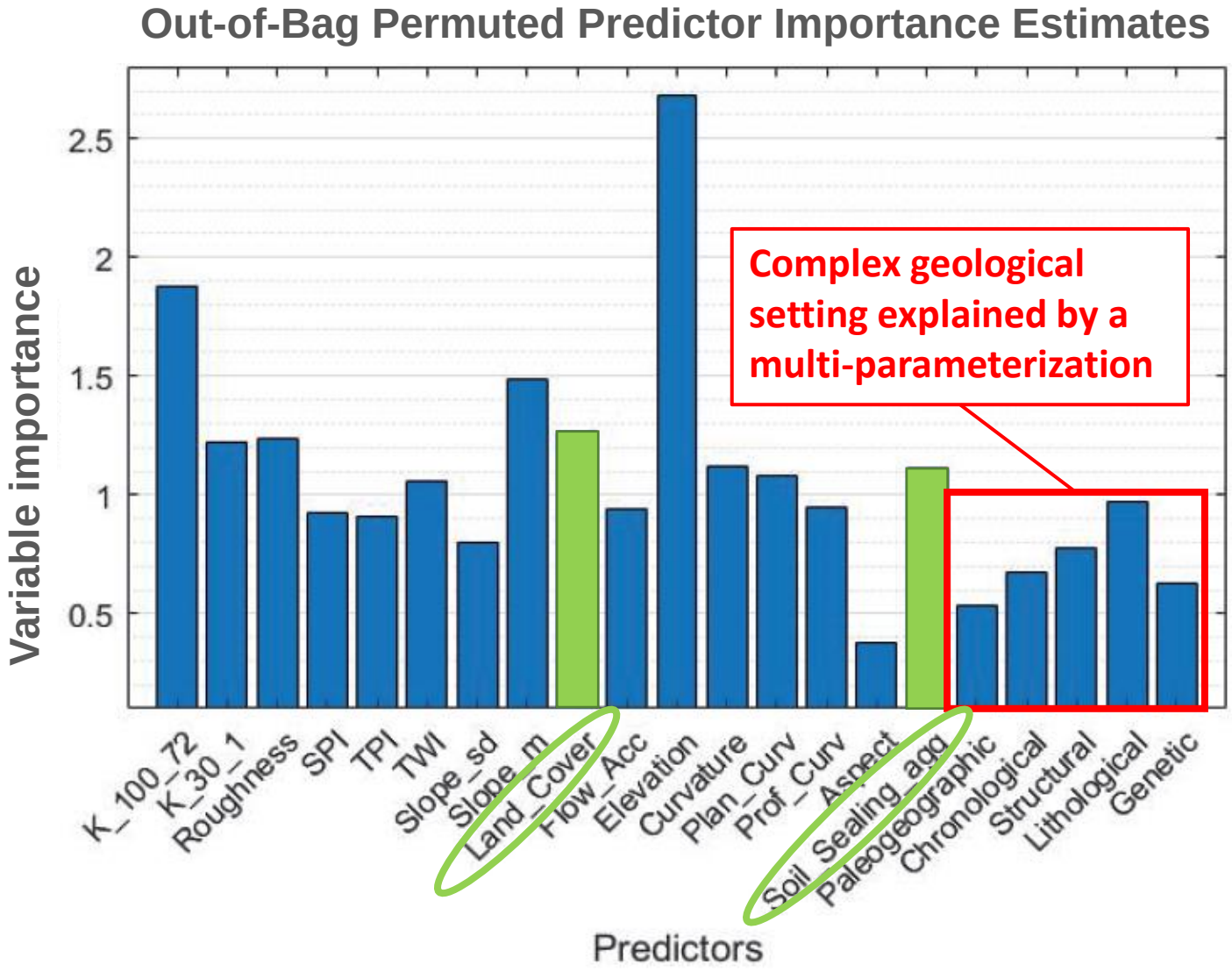


Susceptibility

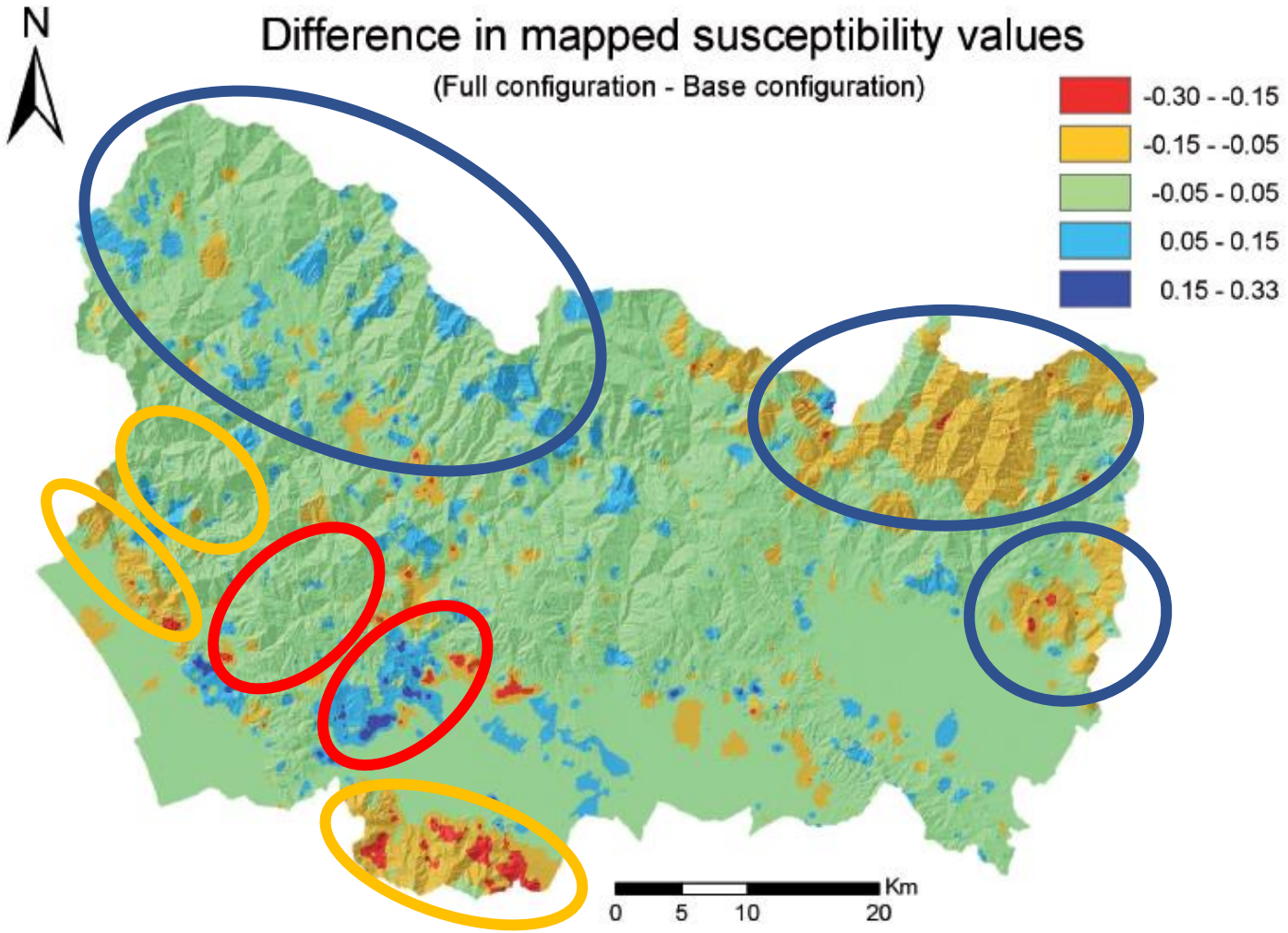
- 0 - 0.15
- 0.15 - 0.37
- 0.37 - 0.56
- 0.56 - 0.97

Results and discussion

	Name	Description	
Base Configuration	K_100_72	Return time of a 100 mm rainfall event in 72 hours	Full Configuration
	K_30_1	Return time of a 30 mm rainfall event in 1 hour	
	Roughness	Standard deviation of Elevation	
	SPI	Stream Power Index	
	TPI	Topographic Position Index	
	TWI	Topographic Wetness Index	
	Slope_sd	Standard deviation of Slope gradient	
	Slope_m	Slope gradient	
	Land_Cover	Land Cover from CORINE 2018	
	Flow_Acc	Flow Accumulation	
	Elevation	Elevation	
	Curvature	Total Curvature	
	Plan_Curv	Planar Curvature	
	Prof_Curv	Profile Curvature	
	Aspect	Aspect	
	Soil_Sealing_agg	Soil Sealing	
	Paleogeographic	Paleogeographic units	
	Chronological	Chronological units	
	Structural	Structural units	
	Lithological	Lithological units	
	Genetic	Genetic units	



Results and discussion



Same lithology, different Structural units

Same lithology, different Paleogeographic units

Same lithology, different Chronological units

Conclusion

SOIL SEALING IN LSM:

- No redundancy with CORINE database (updated yearly; different spatial, temporal and thematic accuracy)
- It incorporates information about road network (joint use with CORINE database is advisable; road network parameters can be discarded)

GEOLOGY IN LSM:

- Geology is a complex information that extends beyond lithology
- Prediction can be increased with a multi-criteria geological parameterization
- The expertise of a geologist is important in landslides susceptibility studies

Thank you for your attention!

For more informations:

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Segoni et al., 2021

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QR-Code for EGU22 Abstract

NEW EXPLANATORY VARIABLES TO IMPROVE LANDSLIDE SUSCEPTIBILITY MAPPING: TESTING THE EFFECTIVENESS OF SOIL SEALING INFORMATION AND MULTI-CRITERIA GEOLOGICAL PARAMETERIZATION

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