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Landslides and Geophysics: a review of the advantages and limitations on the basis of the last twelve years open access international literature

Morelli S., Pazzi V., Fanti R.

Common research questions

- How large are the boundaries?
- How depth is the slip surfaces?
- Which are the constituent materials ?
- How are the material inhomogeneities distributed and which are their properties?
- Which are the deformation processes?
- Are there “precursor” before the trigger time?

→ Literature review of the employed geophysical methods to answer these questions

This presentation is based on the results published in:

Hindawi
International Journal of Geophysics
Volume 2019, Article ID 2983087, 27 pages
https://doi.org/10.1155/2019/2983087

Review Article

A Review of the Advantages and Limitations of Geophysical Investigations in Landslide Studies

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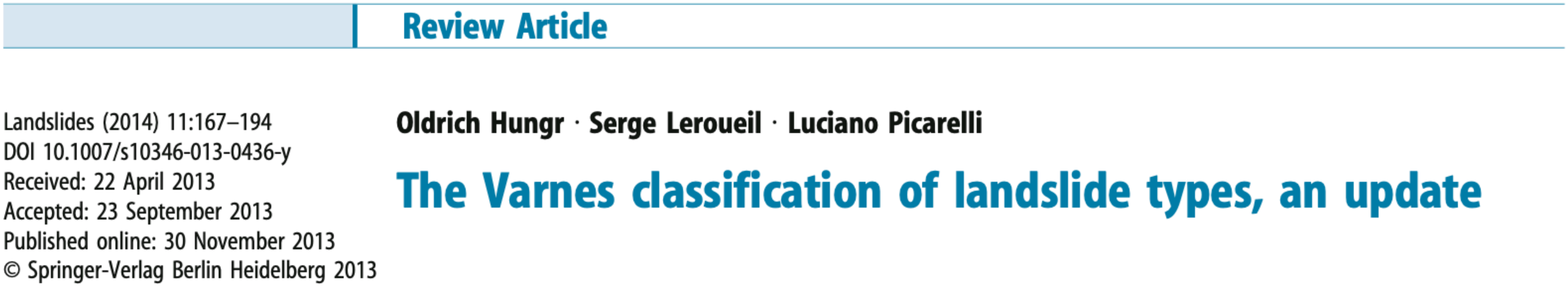
- Analysis carried out based on a “material landslide approach” (rock and soil) according to the recent landslide classification (Hungr et al. 2014, doi: 10.1007/s10346-013-0436-y)
- Analysis of the geophysical community efforts in overcoming the geophysical technique limitations (five drawbacks) highlighted by Jongmans & Garambois 2007 (doi: 10.2113/gssgfbull.178.2.101)
- Papers after 2007 (about 120) from open access peer-reviewed journals, (no proceedings of International conferences)

Hungr et al. 2014


Review Article

Landslides (2014) 11:167–194
DOI 10.1007/s10346-013-0436-y
Received: 22 April 2013
Accepted: 23 September 2013
Published online: 30 November 2013
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Oldrich Hungr · Serge Leroueil · Luciano Picarelli

The Varnes classification of landslide types, an update

- Modify the definition of landslide-forming materials, to provide compatibility with accepted geotechnical and geological terminology of rocks and soils
- 32 landslide types
- Each landslide types is backed by a formal definition to facilitate backward compatibility and the possible translation to other languages
- Complex landslides are not included as a separate category type

Jongmans & Garambois 2007

RESEARCH ARTICLE | MARCH 01, 2007

Geophysical investigation of landslides : a review

Denis Jongmans; Stéphane Garambois

Bulletin de la Société Géologique de France (2007) 178 (2): 101-112.

https://doi.org/10.2113/gssgfbull.178.2.101

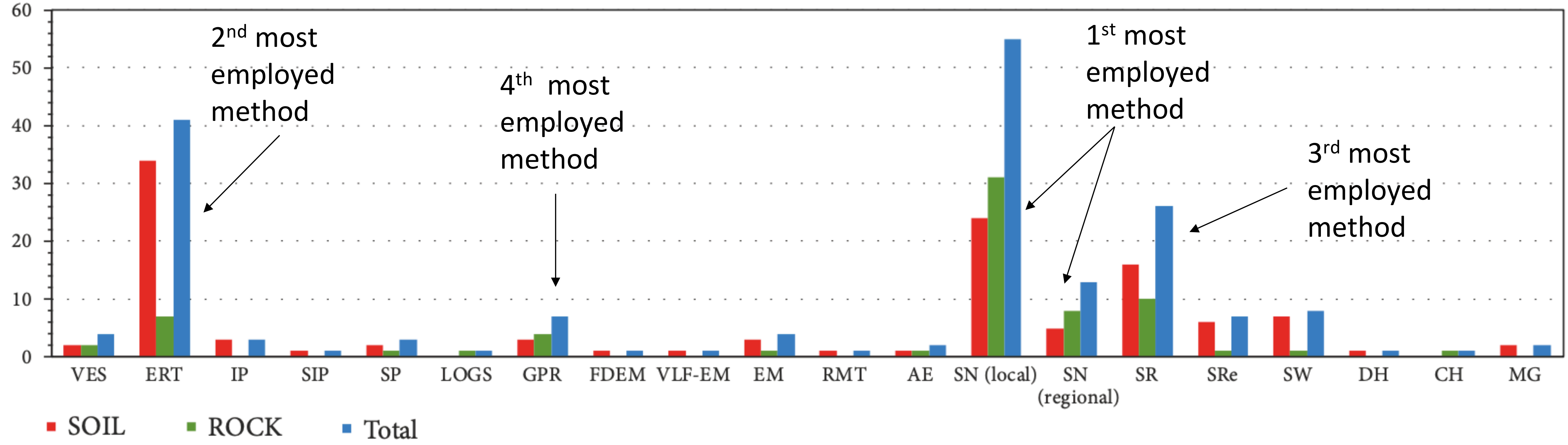
- Papers after 1990
- From peer-reviewed journals (written by “scientists”)
- Limited numbers of proceedings of International conferences (written by both “scientists” and “engineers”)
- Main goals: improve the exchange of expertise between geophysicists, geologists, geomorphologists and geotechnical engineers

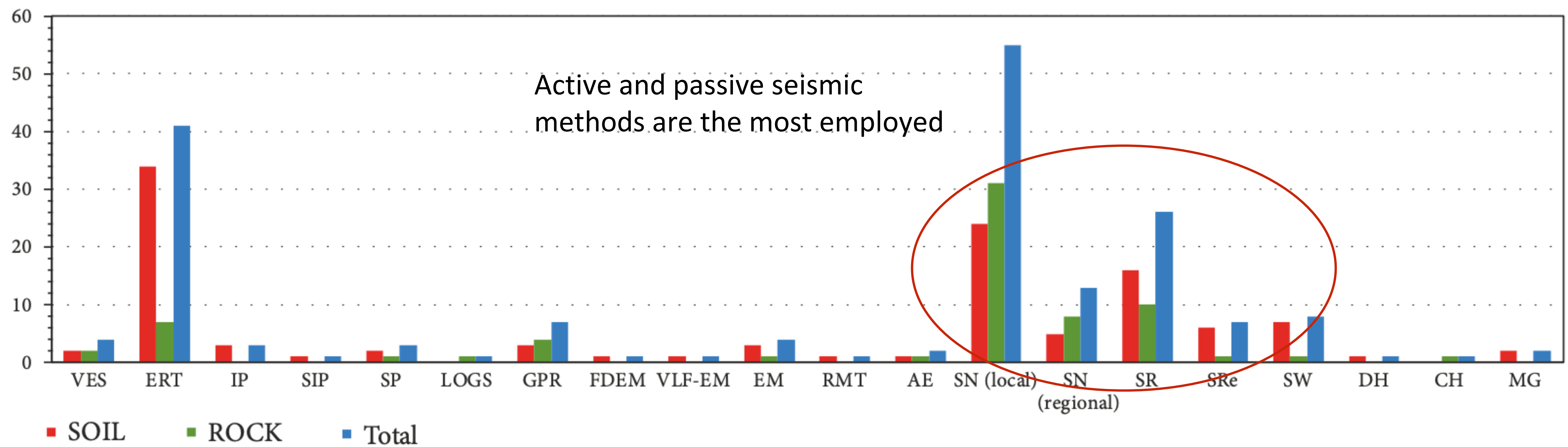
Jongmans & Garambois 2007

- Drawback1: Geophysicists have to make an effort in the presentation of the results
- Drawback2: The resolution and the penetration depth of each method are not systematically discussed in an understandable way
- Drawback3: The geological interpretation of geophysical data should be more clearly and critically explained
- Drawback4: The challenge for geophysicists is to convince geologists and engineers that 3D and 4D geophysical imaging techniques can be valuable tools for investigating and monitoring landslides
- Drawback5: Efforts should also be made towards obtaining quantitative information from geophysics in terms of geotechnical parameters and hydrological properties

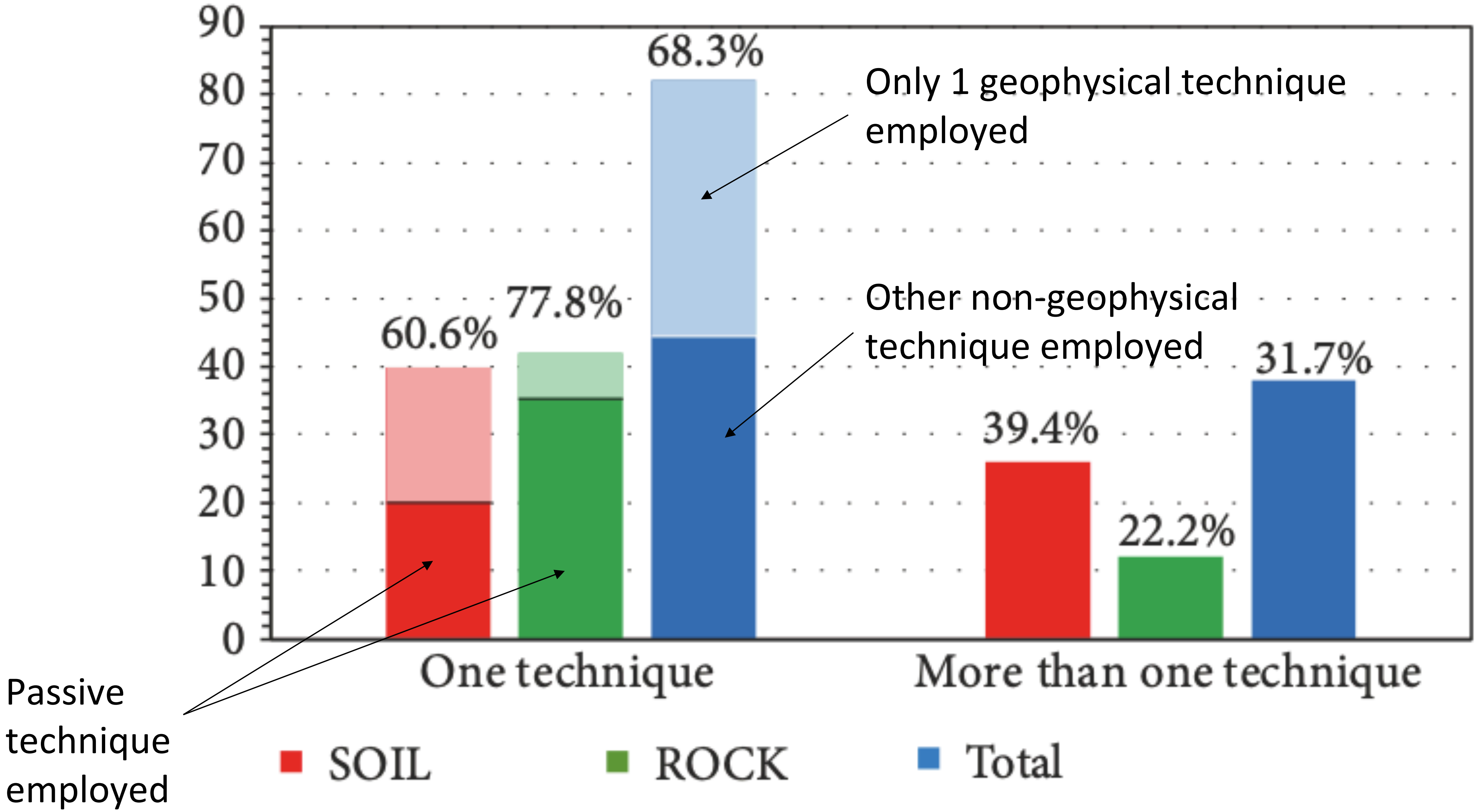
	Movement	# of landslide	Landslide		# of landslide	
Rock	Fall	41	*Rock/ice fall*		40	
	Topple	5	*Rock block topple*		5	
			Rock flexural topple		/	
	Slide	18	Rock rotational slide		1	
			Rock planar slide		2	
			Rock wedge slide		1	
			Rock compound slide		3	
			Rock irregular slide		1	
	Spread	1	Rock slope spread		1	
	Flow	6	*Rock/ice avalanche*		6	
	Slope Deformation	4	Mountain slope deformation		3	
			Rock slope deformation		1	
Soil	Fall	/	*Boulder/debris/silt fall*		/	
	Topple	/	*Gravel/sand/silt topple*		/	
	Slide	28	Clay/silt rotational slide	6		11
			Clay/silt planar slide	8		
			Gravel/sand/debris slide		1	
			Clay/silt compound slide		2	
	Spread	/	*Sand/silt liquefaction spread*		/	
			Sensitive clay spread		/	
	Flow	41	Sand/silt/debris dry flow		/	
			Sand/silt/debris flowslide		/	
			Sensitive clay flowslide		5	
			Debris flow		9	
			Mud flow		5	
			Debris flood		/	
			Debris avalanche		/	
			Earthflow		22	
			Peat flow		/	
	Slope Deformation	6	Soil slope deformation		6	
			Soil creep		/	
			Solifluction		/	

Main geophysical methods



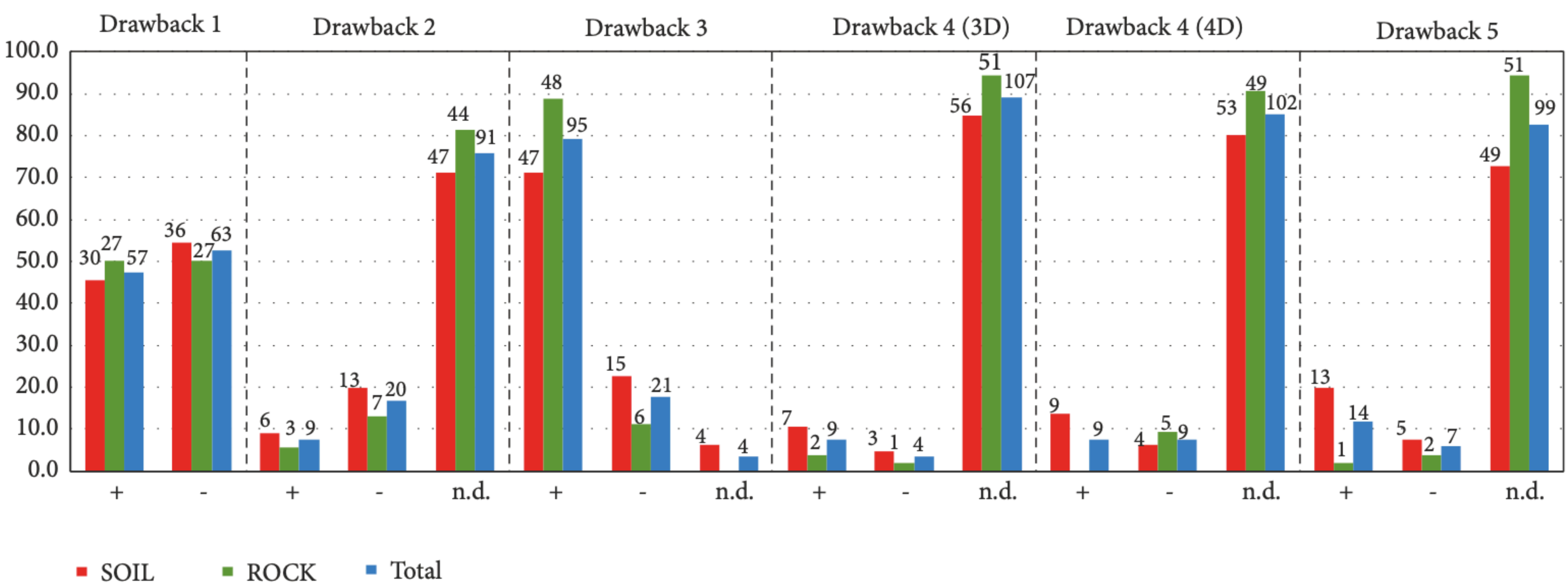


Employed techniques



Efforts made by authors

results presentation	resolution and depth discussion	geological interpretation	3D and 4D imaging is a valuable tools	quantitative information



+	Wide discussion/coloured and-or 3D figures
-	Few discussion/BW figures/raw data
n.d.	Absence of discussion/absence of figures