

# Survey on the significance of climate change impacts on geo-structures across EU countries

Prepared in the framework of the ELGIP Working Group on Climate Change Adaptation (<https://elgip.org/working-groups/climate-change-adaptation/>)

\*Please note that all the questions are anonymous. Responses will be used for statistical purposes and will be reported only in aggregated form.

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\* Required

## Part 1 - Background information

1. 1. Please indicate for which country you are filling in this questionnaire. \*

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2. 2. Type of Organization \*

*Check all that apply.*

Academic

Industry

Government

Other:  \_\_\_\_\_

3. 3. Scope of Organization \*

*Check all that apply.*

Local

National

International

## 4. 4. Area of Expertise \*

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## 5. 5. How familiar are you with the topic of climate change and its effects in your country? \*

*Mark only one oval.*

Very familiar

Quite familiar

Not familiar

## 6. 6. How familiar are you with the impacts of climate change on the engineering geo-structures in your country? \*

*Mark only one oval.*

Very familiar

Quite familiar

Not familiar

Part 2 - Impacts  
of climate  
change on geo-  
structures and  
their degree of  
significance in  
EU countries

For each of the questions 7-14, a specific Climate Change Signal (1st column) is given, which is expected to produce a set of Effects on geotechnical/geological processes (2nd column), that may then in turn lead to Impacts on geo-engineering structures (3rd column). Considering this flow and to the best of your knowledge, please rate each of the Impacts in the 3rd column in terms of their importance in your country.

7. 7. For the Climate Change Signal "Increased Precipitation", please indicate below the degree of importance of each "Potential impact" in your country. \*

Climate Change Signal	Effect	Potential Impact
Increased precipitation*  <small>*in terms of duration, frequency and/or intensity</small>	<ul style="list-style-type: none"> <li>- Degradation of material strength due to increased saturation and physical weathering</li> <li>- Increased mineral dissolution due to increased chemical weathering</li> <li>- Increased water erosion</li> <li>- Increased surface runoff</li> <li>- Increased surface and ground water level and flow</li> </ul>	<ul style="list-style-type: none"> <li>- Instability of slopes</li> <li>- Instability of embankments</li> <li>- Instability of other engineered structures</li> <li>- Structure collapse/damage on karstic topography</li> <li>- Damage/ failure of structure from flooding</li> <li>- Overtopping/breaching of dams and dikes</li> </ul>

Mark only one oval per row.

	High	Medium	Low	No significance	Don't know
Instability of slopes	<input type="radio"/>				
Instability of embankments	<input type="radio"/>				
Instability of other engineered structures	<input type="radio"/>				
Structure collapse/damage on karstic topography	<input type="radio"/>				
Damage/ failure of structure from flooding	<input type="radio"/>				
Overtopping/breaching of dams and dikes	<input type="radio"/>				

Part 2 - Impacts of climate change on geo-structures and their degree of significance in EU countries

For each of the questions 7-14, a specific Climate Change Signal (1st column) is given, which is expected to produce a set of Effects on geotechnical/geological processes (2nd column), that then may in turn lead to Impacts on geo-engineering structures (3rd column). Considering this flow and to the best of your knowledge, please rate each of the Impacts in the 3rd column in terms of their importance in your country.

8. For the Climate Change Signal "Decreased precipitation/increased drought periods", please indicate below the degree of importance of each "Potential impact" in your country.

Climate Change Signal	Effect	Potential Impact
Decreased precipitation/increased drought periods* <small>*in terms of duration, frequency and/or intensity</small>	- Degradation of material strength due to shrinkage/desiccation and increased physical weathering - Decreased surface and ground water level and flow - Increased wind erosion	- Cracking and instability of slopes - Cracking and instability of embankments - Cracking and instability of other engineered structure - Structure settlement/subsidence

Mark only one oval per row.

	High	Medium	Low	No significance	Don't know
Cracking and instability of slopes	<input type="radio"/>				
Cracking and instability of embankments	<input type="radio"/>				
Cracking and instability of other engineered structure	<input type="radio"/>				
Structure settlement/subsidence	<input type="radio"/>				

**Part 2 - Impacts of climate change on geo-structures and their degree of significance in EU countries**

For each of the questions 7-14, a specific Climate Change Signal (1st column) is given, which is expected to produce a set of Effects on geotechnical/geological processes (2nd column), that then may in turn lead to Impacts on geo-engineering structures (3rd column). Considering this flow and to the best of your knowledge, please rate each of the Impacts in the 3rd column in terms of their importance in your country.

9. For the Climate Change Signal "Increased air temperature and periods of warm weather winter", please indicate below the degree of importance of each "Potential impact" in your country. \*

Climate Change Signal	Effect	Potential Impact
Increased air temperature and periods of warm weather in winter	<ul style="list-style-type: none"> <li>- Degradation of material strength from increased saturation and physical weathering due to snow melting</li> <li>- Changed geotechnical properties of perennially frozen soil</li> <li>- Increased surface runoff from snowmelt</li> <li>- Increased water erosion</li> <li>- Increased surface and ground water level and flow</li> <li>- Increased mineral dissolution due to increased chemical weathering</li> </ul>	<ul style="list-style-type: none"> <li>- Instability of slopes</li> <li>- Instability of embankments</li> <li>- Instability of other engineered structures</li> <li>- Damage/ failure of structure from flooding</li> <li>- Overtopping/breaching of dams and dikes</li> <li>- Structure collapse/damage on karstic topography</li> </ul>

Mark only one oval per row.

	High	Medium	Low	No significance	Don't know
Instability of slopes	<input type="radio"/>				
Instability of embankments	<input type="radio"/>				
Instability of other engineered structures	<input type="radio"/>				
Damage/ failure of structure from flooding	<input type="radio"/>				
Overtopping/breaching of dams and dikes	<input type="radio"/>				
Structure collapse/damage on karstic topography	<input type="radio"/>				

**Part 2 - Impacts of climate change on geo-structures and their degree of significance in EU countries**

For each of the questions 7-14, a specific Climate Change Signal (1st column) is given, which is expected to produce a set of Effects on geotechnical/geological processes (2nd column), that then may in turn lead to Impacts on geo-engineering structures (3rd column). Considering this flow and to the best of your knowledge, please rate each of the Impacts in the 3rd column in terms of their importance in your country.

10. 10. For the Climate Change Signal "Increased number of intense rain/drought cycle", please indicate below the degree of importance of each "Potential impact" in your country. \*

Climate Change Signal	Effect	Potential Impact
Increased number of intense rain/drought cycle	<ul style="list-style-type: none"> <li>- Degradation of material strength due to increased saturation/desiccation and increased weathering</li> <li>- Increased shrink-swell behaviour of clay soils</li> <li>- Increased water and wind erosion</li> </ul>	<ul style="list-style-type: none"> <li>- Cracking and instability of slopes</li> <li>- Cracking and instability of embankments</li> <li>- Cracking and instability of other engineered structures</li> </ul>

Mark only one oval per row.

	High	Medium	Low	No significance	Don't know
Cracking and instability of slopes	<input type="radio"/>				
Cracking and instability of embankments	<input type="radio"/>				
Cracking and instability of other engineered structures	<input type="radio"/>				

Part 2 - Impacts of climate change on geo-structures and their degree of significance in EU countries

For each of the questions 7-14, a specific Climate Change Signal (1st column) is given, which is expected to produce a set of Effects on geotechnical/geological processes (2nd column), that then may in turn lead to Impacts on geo-engineering structures (3rd column). Considering this flow and to the best of your knowledge, please rate each of the Impacts in the 3rd column in terms of their importance in your country.

11. 11. For the Climate Change Signal "Increased number of frost-thaw cycle", please indicate below the degree of importance of each "Potential impact" in your country. \*

Climate Change Signal	Effect	Potential Impact
Increased number of frost-thaw cycle	- Degradation of material strength due to increased frost heave/thaw settlement and physical weathering	- Cracking and instability of slopes - Cracking and instability of embankments - Cracking and instability of other engineered structures

Mark only one oval per row.

	High	Medium	Low	No significance	Don't know
Cracking and instability of slopes	<input type="radio"/>				
Cracking and instability of embankments	<input type="radio"/>				
Cracking and instability of other engineered structures	<input type="radio"/>				

**Part 2 - Impacts of climate change on geo-structures and their degree of significance in EU countries**

For each of the questions 7-14, a specific Climate Change Signal (1st column) is given, which is expected to produce a set of Effects on geotechnical/geological processes (2nd column), that then may in turn lead to Impacts on geo-engineering structures (3rd column). Considering this flow and to the best of your knowledge, please rate each of the Impacts in the 3rd column in terms of their importance in your country.

12. 12. For the Climate Change Signal "Increased frequency and intensity of extratropical cyclones and storms", please indicate below the degree of importance of each "Potential impact" in your country. \*

Climate Change Signal	Effect	Potential Impact
Increased frequency and intensity of extratropical cyclones and storms	- Degradation of material strength due to increased saturation and physical weathering	- Instability of slopes
	- Increased mineral dissolution due to increased chemical weathering	- Instability of embankments
	- Increased surface runoff	- Instability of other engineered structures
	- Increased surface and ground water level and flow	- Structure collapse/damage on karstic topography
	- Frequent and higher sea water rise from storm surges	- Damage/ failure of structure from flooding and/or strong wave action
	- Increased loading due to strong wind and wave action	- Overtopping/breaching of dams and dikes
	- Increased water and wind erosion	- Damage/failure of tall structure foundation from strong wind action

Mark only one oval per row.

	High	Medium	Low	No significance	Don't know
Instability of slopes	<input type="radio"/>				
Instability of embankments	<input type="radio"/>				
Instability of other engineered structures	<input type="radio"/>				
Structure collapse/damage on karstic topography	<input type="radio"/>				
Damage/ failure of structure from flooding and/or strong wave action	<input type="radio"/>				
Overtopping/breaching of dams and dikes	<input type="radio"/>				
Damage/failure of tall structure foundation from strong wind action	<input type="radio"/>				

**Part 2 - Impacts of climate change on geo-structures and their degree of significance in EU countries**

For each of the questions 7-14, a specific Climate Change Signal (1st column) is given, which is expected to produce a set of Effects on geotechnical/geological processes (2nd column), that then may in turn lead to Impacts on geo-engineering structures (3rd column). Considering this flow and to the best of your knowledge, please rate each of the Impacts in the 3rd column in terms of their importance in your country.

13. 13. For the Climate Change Signal "Sea level rise", please indicate below the degree of importance of each "Potential impact" in your country. \*

Climate Change Signal	Effect	Potential Impact
Sea level rise	<ul style="list-style-type: none"> <li>- Degradation of material strength due to increased saturation and increased weathering</li> <li>- Increased water erosion</li> <li>- Landward encroachment of the sea</li> </ul>	<ul style="list-style-type: none"> <li>- Instability of coastal slopes</li> <li>- Instability of coastal embankments</li> <li>- Instability of other engineered coastal structures</li> <li>- Damage/failure of engineered coastal structures from flooding</li> <li>- Overtopping/breaching of dykes and levees</li> </ul>

Mark only one oval per row.

	High	Medium	Low	No significance	Don't know
Instability of coastal slopes	<input type="radio"/>				
Instability of coastal embankments	<input type="radio"/>				
Instability of other engineered coastal structures	<input type="radio"/>				
Damage/failure of engineered coastal structures from flooding	<input type="radio"/>				
Overtopping/breaching of dykes and levees	<input type="radio"/>				

**Part 2 - Impacts of climate change on geo-structures and their degree of significance in EU countries**

For each of the questions 7-14, a specific Climate Change Signal (1st column) is given, which is expected to produce a set of Effects on geotechnical/geological processes (2nd column), that then may in turn lead to Impacts on geo-engineering structures (3rd column). Considering this flow and to the best of your knowledge, please rate each of the Impacts in the 3rd column in terms of their importance in your country.

14. 14. For the Climate Change Signal "Increased wind speed", please indicate below the degree of importance of each "Potential impact" in your country. \*

Climate Change Signal	Effect	Potential Impact
Increased wind speed	<ul style="list-style-type: none"> <li>- Increased wind erosion</li> <li>- Increased dynamic load</li> </ul>	<ul style="list-style-type: none"> <li>- Instability of slopes</li> <li>- Instability of embankments</li> <li>- Instability of other engineered structures</li> <li>- Damage/failure of tall structure foundation</li> </ul>

Mark only one oval per row.

	High	Medium	Low	No significance	Don't know
Instability of slopes	<input type="radio"/>				
Instability of embankments	<input type="radio"/>				
Instability of other engineered structures	<input type="radio"/>				
Damage/failure of tall structure foundation	<input type="radio"/>				

**Part 3 - Additional Information**

15. 15. Are there any other Climate Change Signals, Effects or Impacts you would like to add to those given above? (For a complete list of all the Climate Signals, Effects and Impacts considered, please click the link:

[https://www.dropbox.com/s/ok21go3mf0vi00c/Dropbox\\_Link\\_Table\\_PDF.pdf?dl=0](https://www.dropbox.com/s/ok21go3mf0vi00c/Dropbox_Link_Table_PDF.pdf?dl=0) \*

*Mark only one oval.*

YES

NO

16. 16. If the answer to the previous question is YES, please specify.

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17. 17. Other remarks

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