Expert Survey:Visualising 4D topographic change objects extracted from LiDAR Time Series

Survey response 1

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Section 1: Classical Visualisations

Below is the classical map traditionally used for representing topographic change. This visualisation will serve as a baseline for comparison with the new approaches shown later in the survey. Please review it carefully before proceeding. Classical Map: Traditional Topographic Change Representation (Click to enlarge)

Section 2: Static Visualisations

Below are static bubble maps illustrating ground-movement events. Each bubble marks a detected erosion or deposition event at its location. Bubble size shows the duration of the change, while colour indicates vertical displacement (red = erosion, blue = deposition). Three variants are shown: Map 1: Overview of erosion and deposition events. Map 2: Zoomed-in view of a high-activity area. Map 3: Side-by-side maps comparing short, medium, and long-duration movements. Please review each map carefully, then continue to the questions. Map 1: Erosion and Deposition Overview (Click to enlarge) Map 2: Zoomed Inset of High-Activity Area (Click to enlarge) Map 3: Duration-Based Movement Maps (Short, Medium, Long) (Click to enlarge)

For each statement, select your level of agreement (1 = strongly disagree; 5 = strongly agree):

1. The static bubble map clearly shows the spatial locations of the movement events.
4

2. The encoding of event duration (bubble size) is clear and easy to interpret.
5

3. The encoding of displacement magnitude (colour scale) is clear and easy to interpret.
5

4. The zoomed inset helps interpret clustered events and details in dense areas.
5

5. Comparing the three duration-specific maps (short, medium, long) makes it easier to understand temporal patterns (short-term vs. long-term events).
5

6. Please comment on the static visualisations. For example, what aspects made them easy or difficult to interpret as compared to a classical map? Are there any specific improvements you would suggest?
The static visualisations were easy to interpret, with the scale, labels, legend, and color scheme all supporting clear understanding. Compared to a classical map, they highlighted patterns more directly, making the information straightforward to grasp

Section 3: Animated Visualisations

Below are animated bubble maps illustrating ground-movement events over time. Each bubble represents a detected erosion or deposition event at its location. Bubble size encodes the duration of the change, while colour indicates the magnitude of vertical displacement (red = erosion, blue = deposition). Two animations are provided: Animation 1: Events visualised by duration of ground movement. Animation 2: Events visualised by magnitude of vertical displacement. Please watch each animation carefully, then continue to the questions. Animation 1: Bubble Map by Duration Your browser does not support the video tag. Download video. (Use controls to play, pause, or expand) Animation 2: Bubble Map by Magnitude Your browser does not support the video tag. Download video. (Use controls to play, pause, or expand)

For each statement, select your level of agreement (1 = strongly disagree; 5 = strongly agree):

1. The duration-based animation (animation 1) clearly shows how events accumulate over time.
5

2. The magnitude-based animation (animation 2) clearly shows how event intensities grow.
5

3. The stepwise presentation (adding one event-size at a time) is easy to follow.
5

4. Showing erosion then deposition sequentially makes the dynamics clear.
5

5. Overall, the animated maps improve my understanding of temporal evolution compared to a static map.
5

6. What do you think about the animated visualisations? Did the animations make the data easier to understand? Please describe any difficulties or suggestions for improving the animations.
Already information is complete

Section 4: Interactive visualisations

In this section, we present interactive web maps (HTML format) that let you explore ground-movement patterns dynamically. Using sliders, dropdowns, and time controls, you can reveal different aspects of the data and observe how changes evolve. Map 1: Scroll through frames to see how medium- and long-duration events develop over time. Map 2: Use a slider to animate changes across different magnitude ranges. Map 3: Combine a dropdown (filtering by duration) with a slider (adjusting magnitude). Map 4: Explore spatio-temporal patterns interactively with a time slider, showing how events unfold across space and time. Important: The links to these interactive maps were provided in the invitation email. Please open each link in a new browser tab (by clicking or copying/pasting the URL). After exploring the maps, return to this survey to answer the questions.

For each statement, select your level of agreement (1 = strongly disagree; 5 = strongly agree):

1. The interactive controls (sliders, dropdown) are intuitive and easy to use.
5

2. Filtering by duration and/or magnitude helped me focus on relevant events.
5

3. The interactive maps reveal patterns that were difficult to see in static images.
5

4. The legends, axes, and labels in the interactive maps are clear and informative.
5

5. Overall, the interactive format is effective for exploring the 4D data.
5

Comment on the usability and usefulness of the interactive maps. Were there any difficulties in using the controls? How could the interactivity be improved?
The interactive maps were very easy to use and highly useful. Navigation and controls worked smoothly, making it simple to explore details. Interactivity allowed a clearer understanding of spatial patterns compared to static maps

Section 5: Your Feedback on the Visualizations

Please answer the following questions:

1. Thinking about the different types of visualisations you just evaluated (static, animated, and interactive), what do you see as their added value compared to more conventional visualisations (for example, standard colored point clouds or static maps)?
Static, animated, and interactive visualisations add value over conventional maps by highlighting patterns, showing changes over time, and allowing user exploration. They make complex data more engaging and easier to understand. Each type supports different insights depending on the purpose.

2. Please describe which aspects you find particularly helpful, innovative, or challenging. You may refer to specific features (bubble size, colour encoding, animation, interactivity, etc.) or share your general impressions.
Bubble size are perfectly encoded

3. Please provide any additional feedback or suggestions regarding the visualisation formats, their design, or this survey.
Everything is perfect

Thank you for your expert feedback! Your detailed responses will help evaluate which visualisation approach best supports the understanding of geomorphic changes.