# Data Supplement

## 1 The Database (DB) categories:

*ID*: each landslide body is classified with a unique number (ID).

Published name of the landslide: how the landslide is reported in the literature.

*Publication source*: the reference, or the body of references, that were used for describing the spreading.

The DB category *Location* contains three database sub-categories: i) *broad geographic location* that identifies the location of the landslide as offshore deposit of a specific nation or adjacent to specific known geological structures (ridges, continental margins, continents); ii) point-latitude, and iii) point-longitude in geographic coordinates, indicate a point-site where spreading is observed.

*Object type* defines whether the sediment body is a distinct Mass Transport Deposit (MTD), and thus an individual feature, or a Mass Transport Deposit Complex (MTDC), which means more than one MTD occurring at the same time, or closely separated in time.

*Depth Below Sea level* (in m) indicates the bathymetric depth interval at which the landslide can be found, several papers reviewed indicate the depth of the headscarp with accuracy and then indicate the depth interval where to find the depositional body of the landslide.

The DB category *Physiography of the Landslide* is divided up in four DB sub-categories *General morphology*, *Headscarp morphology*, *Scar morphology* and *Slip Surface*. This database category contains general physiographic information describing the entire landslide body, where spreading morphology is also observed.

The DB sub-category *General morphology* includes the following table fields:

* *Setting*: the depositional setting where the MTD occurred (e.g. continental shelf, continental slope, slope rise, deep basin etc..)
* *Area*: estimated area in square km covered by the entire landslide deposit, buried portions of the landslide are also mentioned in this field;
* *Volume* indicates the mobilized volume of the entire deposit in km3;
* *Landslide length* indicates the full length of the whole landslide body calculated downslope from the headscarp to the toe, in km.
* *Maximum deposit width* identifies the maximum lateral extent of the whole deposit as measured along-slope, in km.

The DB sub-category *Headscarp morphology* includes the following table fields: the *headscarp length*, that is the extent of the headscarp (in m), and the *headscarp height,* which identifies the height of the headscarp (in m).

The DB sub-category *scar morphology* includes the following table fields: *scar width* and *scar surface nature*. Similar to the deposit width, the scar width refers to the width of the erosional surface of each mass movement. The table field *scar surface nature* gives a brief description of the general morphology of the scar and its metadata.

The DB sub-category of *Slip surface* contains the following table fields:

*Thickness of the failed material:* (in m) this represents the thickness of the detached portion of the slope that slides downslope; *type of the material identified as slip surface*: geological information on the slip surface.

The DB category of *slope angle* contains information about the average slope of the entire landslide body in degrees, or, when available, of the different sections where the slope angle was measured (e.g. headscarp or toe area).

*Landslide age* indicates the dating of the landslide deposit in years BP and reference to the manuscripts containing this information, if different than the DB category ‘Publication Source’.

*Margin* identifies the location of the landslide body in relation to active or passive margin.

*Modes of failure* identifies the type of failure that characterizes the mass movement: rotational or translational, or a mixture of both.

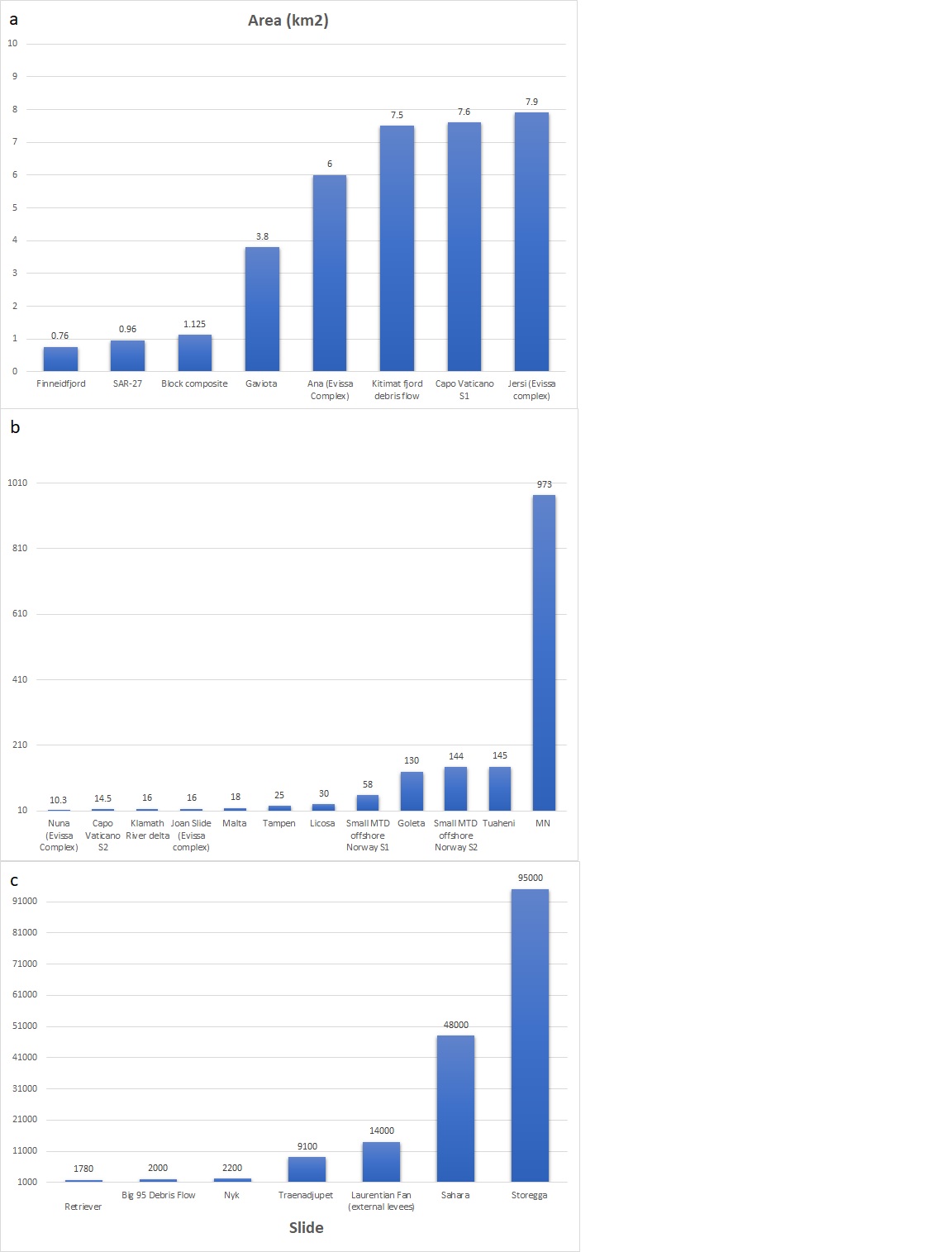
*Predominant Geological unit and sedimentation rate*: this field provides information on the background geology and the major geological units in the area where the landslide deposit is identified, and the sedimentation rate of the area.

The DB category *Spreading Features* contains a general description of the features and physiographic aspects involved in this mass movement (incorporating a summary of the spreading features, their occurrence, and description) and the sub-category *’Morphometric parameters of spreading*’. The latter is characterized by the quantitative table fields that describe in detail the ridges and troughs (Micallef, Masson et al. 2007): ridge length (m), ridge height (m), ridge width (m), ridge spacing (m), bathymetric depth of spreading, and the area occupied by the spreading (km2), and the area as a percentage of the whole mass transport where spreading features are identified.

The last group of DB categories represents supplementary data on the *geotechnical dataset available* for the landslide body and the *speculated trigger mechanism*, which identifies the potential or inferred trigger mechanism of the landslide. The table field *evidence of fluid flow and/or gas emission* is also included. The table field ‘*Other observations’* contains additional information collected from other related sources (e.g. special geotechnical reports or other papers related to the mass movement considered).

## 2. Topographic characteristics

**Figure1DS** Summary of the landslide deposits recorded in the DB showing spreading morphology in increasing order of the values of length (km). Note the Tampen Slide has a length greater than 120 km but this value is here considered a minimum threshold for statistical purposes.

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**Figure 2DS** Histograms that summarize in increasing order the aerial extent of the landslides hosting subaqueous spreading. Note the area covered by the Tampen Slide has been mapped as greater than 48000 km2however this value has been used as minimum threshold for statistical purposes.

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| --- | --- | --- |
| SLIDE | Area (km2) | Spreading area as estimated percentage of the total area of the slide (%) |
| 1. Finneidfjord | 0.76 | NA |
| 1. Rissa | 0.76 | ~5 |
| 1. Block composite | 1.125 | ~30 |
| 1. Gaviota | 3.8 | ~ 50 |
| 1. Ana (Evissa complex) | 6 | ~[40 - 50] |
| 1. Kitimat fjord debris flow | 7.5 | ~ 90 |
| 1. Capo Vaticano S1 | 7.6 | ~ [60-70] |
| 1. Jersi (Evissa complex) | 7.9 | [40 - 50] |
| 1. Nuna (Evissa complex) | 10.3 | ~[40 - 50] |
| 1. Capo Vaticano S2 | 14.5 | ~ [60 -70] |
| 1. Klamath River delta | 16 | NA |
| 1. Joan (Evissa complex) | 16 | [40 -50] |
| 1. Malta | 18 | ~ 70 |
| 1. Tampen | 25 | 3.6 (Barrett et al 2020) |
| 1. Licosa | 30 | ~ 90 |
| 1. Small MTD offshore Norway S1 | 58 | ~ 60 |
| 1. Goleta | 130 | ~ 50 |
| 1. Small MTD offshore Norway S2 | 144 | ~ 60 |
| 1. Tuaheni | 145 | ~ 40 |
| 1. MN | 973 | NA |
| 1. Retriever | 1780 | 20 |
| 1. Big 95 debris flow | 2000 | ~ [10 - 15] |
| 1. Nyk | 2200 | ~[40-50] |
| 1. Traenadjupet | 9100 | ~ 50 |
| 1. Laurentian Fan (external levee) | 14000 | ~ 5 |
| 1. Sahara | 48000 | ~ 30 |
| 1. Storegga | 95000 | 25 (Micallef et al 2007) |

**Table 1DS** Summary of the total aerial extent of the landslides showing spreading morphology, and the percentage of spreading coverage. The landslides are organized in progressive order, the numbering does not reflect the ID of the DB Subspread but the increasing order based on their aerial extent.

|  |  |  |  |
| --- | --- | --- | --- |
| **Slide** | **Groups of slopes** | | |
| **≤1°** | **[1<x≤3]°** | **>3°** |
| **2.** Klamath River delta | **4.** Spreading in the Gulf of Lion | **1.** Storegga |
| **5.** Mississippi River Delta | **6.** Goleta | **3.** smaller scale mass movements on the continental slope |
| **9.** Kitimat fjord debris flow | **7.** Gaviota | **17.** Finneidfjord |
| **15.** Block composite | **8**. Traenadjupet | **18.** Big 95 Debris Flow |
| **16.** Retriever | **10.** Mass movements in St Pierre Valley and Eastern Valley, | **19**. Tuaheni |
| **16.** MN | **11.** Ana (Evissa Complex) | **32.** SAR-27 |
| **20.** Tampen | **11.** Joan (Evissa Complex) |  |
| **21.** Sahara | **11.** Nuna (Evissa Complex) |
| **26.** Laurentian Fan (external levees) | **11.** Jersi (Evissa Complex) |
| **29.** Quaternary mass movements along the continental slope of the Black Sea | **22.** Malta |
|  | **23.**Hinlopen |
| **25.** Licosa |
| **28.**Capo Vaticano |
| **31.** Wide slump along the upper slope of the Canadian Arctic |
| **TOT COUNTING** | **10** | **14** | **6** |

**Table 2DS** Groups of slopes identified in our DB and divided within the major slope thresholds, the numbering of each landslide refers to the ID with which each landslide is recorded in the DB ‘SubSpread’.

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| Slide | Skempton Ratio (x10 -3) |
| 1. Storegga | 0.05 |
| 1. Traenadjupet | 0.5 |
| 1. Small MTD offshore Norway, S2 | 1.75 |
| 1. Klamath River Delta | 2.0 |
| 1. Laurentian Fan (external levee) | 3.0 |
| 1. Small MTDs offshore Norway, S1 | 3.6 |
| 1. Goleta (western lobe) | 4.3 |
| 1. SAR-27 | 4.7 |
| 1. Goleta (eastern lobe) | 5.3 |
| 1. Kitimat fjord debris flow | 6.0 |
| 1. Goleta (central lobe) | 6.5 |

**Table 3DS** Values of the Skempton Ratio (Skempton and Hutchinson 1969). The Skempton ratio is calculated using the thickness and the length of each landslide. As shown in Table 2, not all entries were characterized by both parameters, therefore it was possible to obtain the Skempton Ratio just for 12 records. The numbering is not referring to the database ID for each slide but it is a progressive, increasing numbering for listing the slide in the table and show the differences. Note the Goleta landslide is subdivided in three sectors and the calculation was reported for each of them (Greene et al 2006).

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| --- | --- | --- | --- | --- | --- |
| Spearman’s correlation ρ | | | | | |
|  | **Slope** | **Length** | **Area** | **Thickness** | **Skempton ratio** |
| Slope | 1 |  |  |  | **0.027** (n =10);  p-value 0.46;  t-value 0.08;  df =8 |
| Length | **-0.49** (n=20)  p value 0.013;  t-value 2.41; df=18 | 1 |  |  |  |
| Area | **-0.31** (n=25);  p-value 0.012;  t-value 1.58;  df = 23 | **0.87** (n=20);  p-value 0.000;  t-value 7.8;  df =18 | 1 |  |  |
| Thickness | **0.07** (n=17);  p value 0.38:  t-value 0.31; df=15 | **0.30** (n=11);  p-value 0.19;  t-value 0.94;  df=9 | **0.35** (n=15);  p-value 0.1;  t-value 1.35  df=13; | 1 |  |
| Skempton  ratio |  |  |  |  | 1 |

**Table 4DS** Spearman’s correlation for the following parameters: slope, length, area and thickness

Micallef, A., et al. (2007). "Morphology and mechanics of submarine spreading: a case study from the Storegga slide." Journal of Geophysical Research **112**: F03023.

Skempton, A. W. and J. Hutchinson (1969). Stability of natural slopes and embankment foundations. 7th International Conference on Soil Mechanics and Foundation Engineering (Mexico).