**Supplementary Material**

*Table S.1. Record of training and validation images, and images used in Figure 1.*

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Landsat Product ID** | **Acquisition Date** | **Sun Elevation** | **Cloud Cover** | **Study Site** | **Use** |
| LC08\_L1GT\_218111\_20200117\_20200128\_01\_T2 | 17/01/2020 | 29.9 | 14.2 | GVI | Fig.1 |
| LC08\_L1GT\_128111\_20190108\_20190130\_01\_T2 | 08/01/2019 | 31.5 | 0.01 | Amery | Fig.1 |
| LC08\_L1GT\_127110\_20190117\_20190131\_01\_T2 | 17/01/2019 | 31.1 | 0.0 | Amery | Fig.1 |
| LC08\_L1GT\_113106\_20200118\_20200128\_01\_T2 | 18/01/2020 | 35.5 | 26.1 | Shack | Fig.1 |
| LC08\_L1GT\_165110\_20200114\_20200127\_01\_T2 | 14/01/2020 | 31.7 | 1.7 | Nivlisen | Fig.1 |
| LC08\_L1GT\_166110\_20190219\_20190222\_01\_T2 | 19/02/2019 | 21.7 | 0.4 | Nivlisen | Fig.1 |
| LC08\_L1GT\_154110\_20170124\_20170311\_01\_T2 | 24/01/2017 | 29.3 | 4.9 | RoiB | Fig.1 |
| LC08\_L1GT\_154109\_20150204\_20170413\_01\_T2 | 04/02/2015 | 27.7 | 3.0 | RoiB | Fig.1 |
| LC08\_L1GT\_218110\_20200117\_20200128\_01\_T2 | 17/01/2020 | 31.1 | 0.0 | GVI | Fig.1 and Training |
| LC08\_L1GT\_218111\_20171226\_20180103\_01\_T2 | 26/12/2017 | 33.0 | 15.7 | GVI | Training |
| LC08\_L1GT\_128111\_20181223\_20181227\_01\_T2 | 23/12/2018 | 33.1 | 0.1 | Amery | Training |
| LC08\_L1GT\_127110\_20140204\_20170426\_01\_T2 | 04/02/2014 | 26.5 | 0.0 | Amery | Training |
| LC08\_L1GT\_112106\_20200228\_20200313\_01\_T2 | 28/02/2020 | 23.7 | 0.1 | Shack | Fig.1 and Training |
| LC08\_L1GT\_113106\_20180112\_20180119\_01\_T2 | 12/01/2018 | 36.6 | 0.5 | Shack | Training |
| LC08\_L1GT\_063113\_20140102\_20170427\_01\_T2 | 02/01/2014 | 30.0 | 1.6 | Nansen | Fig.1 and Training |
| LC08\_L1GT\_063113\_20170110\_20170311\_01\_T2 | 10/01/2017 | 28.7 | 10.2 | Nansen | Training |
| LC08\_L1GT\_062113\_20141111\_20170417\_01\_T2 | 11/11/2014 | 25.9 | 1.7 | Nansen | Fig.1 and Training |
| LC08\_L1GT\_061113\_20161109\_20170318\_01\_T2 | 09/11/2016 | 25.5 | 0.3 | Nansen | Fig.1 and Training |
| LC08\_L1GT\_166110\_20161227\_20170314\_01\_T2 | 27/12/2016 | 34.1 | 0.3 | Nivlisen | Training |
| LC08\_L1GT\_165110\_20180108\_20180119\_01\_T2 | 08/01/2018 | 32.7 | 9.9 | Nivlisen | Training |
| LC08\_L1GT\_154110\_20180111\_20180119\_01\_T2 | 11/01/2018 | 32.2 | 0.6 | RoiB | Training |
| LC08\_L1GT\_154109\_20140116\_20170426\_01\_T2 | 16/01/2014 | 32.5 | 15.7 | RoiB | Training |
| LC08\_L1GT\_219110\_20160113\_20170405\_01\_T2 | 13/01/2016 | 31.8 | 7.7 | GVI | Validation |
| LC08\_L1GT\_127111\_20190218\_20190222\_01\_T2 | 18/02/2019 | 20.9 | 0.9 | Amery | Validation |
| LC08\_L1GT\_112106\_20170203\_20170215\_01\_T2 | 03/02/2017 | 31.3 | 3.2 | Shack | Validation |
| LC08\_L1GT\_061113\_20141206\_20170416\_01\_T2 | 06/12/2014 | 30.4 | 8.3 | Nansen | Validation |
| LC08\_L1GT\_167110\_20180207\_20180221\_01\_T2 | 07/02/2018 | 25.5 | 1.4 | Nivlisen | Validation |
| LC08\_L1GT\_154110\_20150103\_20170415\_01\_T2 | 03/01/2015 | 33.4 | 3.5 | RoiB | Validation |

*Table S.2. A record of the data presented in Figure 5; detailing the scaled area of slush and ponded water for each 15-day period, the percentage of slush and ponded water relative to the total melt area for each 15-day period, and the AOI covered by each 15-day period.*

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Scaled Slush Area (m2)** | **Scaled Ponded Water Area (m2)** | **Total Water Area (m2)** | **Slush (%)** | **Ponded Water (%)** | **AOI Coverage (%)** |
| 30-Nov-13 | 2.7E+07 | 1.7E+07 | 4.4E+07 | 60.6 | 39.4 | 99.5 |
| 15-Dec-13 | 1.1E+08 | 3.5E+07 | 1.4E+08 | 75.8 | 24.2 | 74.2 |
| 30-Dec-13 | 4.5E+07 | 3.6E+07 | 8.1E+07 | 55.8 | 44.2 | 35.9 |
| 29-Jan-14 | 2.0E+09 | 4.9E+08 | 2.5E+09 | 80.4 | 19.6 | 64.9 |
| 15-Nov-14 | 3.1E+07 | 2.3E+07 | 5.4E+07 | 57.4 | 42.6 | 53.6 |
| 30-Nov-14 | 3.4E+07 | 3.1E+07 | 6.5E+07 | 51.8 | 48.2 | 65.4 |
| 15-Dec-14 | 1.6E+08 | 6.2E+07 | 2.2E+08 | 72.0 | 28.0 | 64.5 |
| 30-Dec-14 | 1.2E+09 | 1.6E+08 | 1.4E+09 | 88.4 | 11.6 | 97.7 |
| 14-Jan-15 | 1.3E+09 | 6.8E+08 | 2.0E+09 | 65.6 | 34.4 | 56.4 |
| 29-Jan-15 | 7.8E+07 | 5.9E+07 | 1.4E+08 | 56.9 | 43.1 | 69.4 |
| 13-Feb-15 | 4.7E+08 | 5.4E+08 | 1.0E+09 | 46.5 | 53.5 | 83.0 |
| 15-Nov-15 | 3.5E+07 | 8.6E+07 | 1.2E+08 | 29.2 | 70.8 | 36.2 |
| 30-Nov-15 | 5.7E+07 | 4.7E+07 | 1.0E+08 | 54.7 | 45.3 | 94.4 |
| 15-Dec-15 | 8.9E+07 | 9.6E+06 | 9.8E+07 | 90.2 | 9.8 | 99.9 |
| 30-Dec-15 | 1.2E+08 | 3.2E+07 | 1.5E+08 | 78.1 | 21.9 | 85.7 |
| 14-Jan-16 | 1.7E+08 | 6.6E+07 | 2.4E+08 | 72.6 | 27.4 | 71.4 |
| 29-Jan-16 | 3.5E+09 | 9.6E+08 | 4.5E+09 | 78.7 | 21.3 | 36.8 |
| 13-Feb-16 | 1.1E+07 | 3.4E+07 | 4.5E+07 | 24.5 | 75.5 | 36.7 |
| 28-Feb-16 | 9.3E+07 | 3.0E+08 | 3.9E+08 | 23.7 | 76.3 | 37.4 |
| 15-Nov-16 | 1.6E+07 | 3.8E+06 | 2.0E+07 | 81.3 | 18.7 | 94.0 |
| 30-Nov-16 | 4.6E+07 | 3.2E+07 | 7.8E+07 | 59.2 | 40.8 | 94.8 |
| 15-Dec-16 | 7.7E+07 | 8.8E+06 | 8.6E+07 | 89.7 | 10.3 | 98.6 |
| 30-Dec-16 | 5.6E+08 | 5.1E+07 | 6.1E+08 | 91.6 | 8.4 | 88.8 |
| 14-Jan-17 | 2.1E+09 | 6.9E+08 | 2.8E+09 | 75.2 | 24.8 | 57.7 |
| 29-Jan-17 | 3.5E+08 | 4.9E+08 | 8.4E+08 | 41.8 | 58.2 | 76.2 |
| 13-Feb-17 | 3.1E+09 | 1.9E+09 | 5.0E+09 | 61.7 | 38.3 | 38.2 |
| 28-Feb-17 | 1.5E+09 | 1.5E+09 | 3.0E+09 | 50.6 | 49.4 | 71.8 |
| 15-Nov-17 | 1.2E+07 | 7.1E+07 | 8.3E+07 | 14.2 | 85.8 | 21.4 |
| 30-Nov-17 | 9.4E+07 | 1.1E+08 | 2.0E+08 | 46.8 | 53.2 | 32.4 |
| 15-Dec-17 | 7.2E+06 | 5.2E+06 | 1.2E+07 | 57.8 | 42.2 | 90.0 |
| 30-Dec-17 | 1.0E+09 | 6.8E+07 | 1.1E+09 | 93.8 | 6.2 | 94.3 |
| 14-Jan-18 | 1.5E+09 | 8.7E+08 | 2.4E+09 | 63.5 | 36.5 | 74.4 |
| 29-Jan-18 | 2.6E+08 | 1.7E+08 | 4.4E+08 | 60.1 | 39.9 | 33.5 |
| 13-Feb-18 | 6.9E+08 | 6.5E+08 | 1.3E+09 | 51.4 | 48.6 | 29.8 |
| 28-Feb-18 | 4.8E+08 | 8.0E+08 | 1.3E+09 | 37.3 | 62.7 | 32.1 |
| 15-Nov-18 | 2.1E+07 | 1.2E+07 | 3.3E+07 | 64.5 | 35.5 | 96.7 |
| 30-Nov-18 | 2.2E+08 | 2.0E+08 | 4.3E+08 | 52.1 | 47.9 | 42.0 |
| 15-Dec-18 | 1.1E+08 | 2.1E+07 | 1.3E+08 | 83.8 | 16.2 | 98.5 |
| 30-Dec-18 | 7.9E+07 | 3.3E+07 | 1.1E+08 | 70.8 | 29.2 | 72.1 |
| 29-Jan-19 | 5.7E+08 | 1.8E+08 | 7.5E+08 | 76.2 | 23.8 | 83.3 |
| 28-Feb-19 | 3.7E+08 | 2.9E+08 | 6.6E+08 | 56.2 | 43.8 | 66.2 |
| 15-Nov-19 | 1.4E+08 | 1.5E+08 | 2.9E+08 | 47.3 | 52.7 | 33.2 |
| 30-Nov-19 | 1.3E+08 | 4.9E+06 | 1.3E+08 | 96.3 | 3.7 | 89.1 |
| 15-Dec-19 | 2.7E+08 | 7.5E+07 | 3.4E+08 | 78.1 | 21.9 | 57.1 |
| 14-Jan-20 | 7.2E+08 | 2.2E+08 | 9.4E+08 | 76.4 | 23.6 | 71.1 |
| 29-Jan-20 | 1.1E+09 | 3.8E+08 | 1.5E+09 | 74.9 | 25.1 | 69.1 |
| 13-Feb-20 | 1.2E+09 | 5.9E+08 | 1.8E+09 | 66.7 | 33.3 | 60.1 |
| 28-Feb-20 | 1.6E+09 | 6.0E+08 | 2.2E+09 | 73.1 | 26.9 | 25.6 |



Figure S.1: Plot showing unscaled time series data for slush (green) and ponded water (blue) across the Roi Baudouin Ice Shelf. The grey bars give the percentage AOI coverage for each 15-day period investigated. The lines show the corresponding slush and ponded water area for each 15-day period. Note that any data with below 20% AOI coverage is not plotted. X axis labels mark 1 January for each year.