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Sea Ice Outlook: 2021 September Report

Released: 21 September 2021

Outlook Report

Executive Summary

This September Sea Ice Outlook (SIO) report is a new addition to the SIO season. It has been created in response to participant suggestions during the 2021 January SIO Contributors Forum (https://www.arcus.org/sipn/meetings/2021/contributors-workshop) to solicit forecasts initialized in late August or early September for September mean Arctic sea-ice extent. The September SIO report provides a brief summary of the forecasts. The more comprehensive, full post-season report will be published in spring 2022. We are pleased to have received 20 new forecasts for the September 2021 SIO for the pan-Arctic, seven for Alaska, and seven for the Antarctic. In addition, we received 11 submissions for the pan-Arctic sea-ice extent anomalies. Spatial forecasts were not requested but those that were received for September via the SIPN2 portal will be discussed in the post-season report. The SIPN2 Project Team (https://www.arcus.org/sipn/project-team) will host a post-season webinar and discussion on Monday, 11 October that will provide an overview of observed conditions during the 2021 Arctic sea-

ice retreat season, a summary of how the SIO contributor outlooks performed in comparison to the observed September monthly mean extent, and an overview of lessons learned from the SIPN2 project. This webinar will be in lieu of a written interim post-season report. The most recent observational conditions are not presented here for brevity and will be discussed at the October webinar. The median Arctic September Outlook is 4.39 million square kilometers, equal to the August median and higher than the median of the June and July forecasts for 2021. It is noteworthy that the spread in the forecasts increased for the September SIO compared to August 2021. The mean of the pan-Arctic anomaly forecast was largest for the September 2021 SIO with a mean of 0.39 million square kilometers, larger than forecast earlier in the summer of 2021 (June=+0.15, July=+0.21, and August=+0.26). For the Alaska region, the September 2021 SIO median forecast was 0.50 million square kilometers based on seven contributions. The 12 September contributions of September mean sea-ice extent anomaly range from -0.15 to +1.07 million square kilometers, with nine forecasts above and four below the contributors' baseline. For the Antarctic forecast, the pattern that has been observed in the previous round of forecasts remains, with a cluster of forecasts that use statistical approaches and several forecasts based on dynamical modeling.

This September Sea Ice Outlook report was developed by lead author Uma Bhatt, University of Alaska Fairbanks (Executive Summary, Overview, Discussions of Arctic Regional Sea-Ice Extent, and Arctic Sea-Ice Extent Anomalies) with contributions from François Massonnet, Université catholique de Louvain (Antarctic Contributions Discussion); Matthew Fisher, NSIDC (figures); Betsy Turner-Bogren and Lisa Sheffield Guy, ARCUS (report coordination and editing); and the rest of the SIPN2 Project Team.

Note: The Sea Ice Outlook provides an open process for those who are interested in Arctic sea-ice, to share predictions and ideas; the Outlook is not an operational forecast.

See: September Call for Contributions (https://www.arcus.org/sipn/sea-ice-outlook/2021/september/call).

Editor's Note: The hyperlinked captions in several figures below provide access to a high-resolution version of the image.

Overview

The September Outlook is based on a total of 36 forecasts (**Figure 1**), of which 20 are new September submissions and 16 outlooks are repeated from prior months per contributor request and/or permission (For details, see: Contributor Full Report PDFs below). The median September Outlook value for the September 2021 sea-ice extent is 4.39 million square kilometers, with quartile values of 4.1 and 4.7 million square kilometers. Of the 36 contributions in September 2021, nine are based on dynamical models, 15 are based on statistical methods, four are based on heuristic approaches (qualitative analyses), and eight used machine learning-based or other (ML/Other) methods. The median of SIO contributor forecasts increased from June to September: 4.37 million square kilometers in June, 4.36 million square kilometers in July, 4.39 million square kilometers in August, and 4.39 million square kilometers in September. For reference, the preliminary observed average 1–19 September 2021 Arctic sea-ice extent is 5.45 million square kilometers.

The forecast spread shown for each method (**Figure 2**) displays an increase for the ML/Other, statistical, and dynamical models in September compared to August. The median values vary among methods used in the September 2021 Outlook and are (in million square kilometers for all): 4.57 for the statistical, 4.1 for the dynamical, 4.28 for the heuristic, and 4.49 for ML/Other.

Figure 3 compiles each group's 2021 submissions from June through September with the 2020 mean September Arctic ice extent shown for reference. The majority of the individual forecasts for all months fell above the observed 2020 September mean sea-ice extent, and all but four (only one was a new September forecast) of the September 2021 forecasts were above the 2020 observed value of 4.0 million square kilometers.

(https://www.arcus.org/files/sio/32446/2021_sio_sept_fig_1_sept_2021_pan_arctic_extent_by_contributor.png)

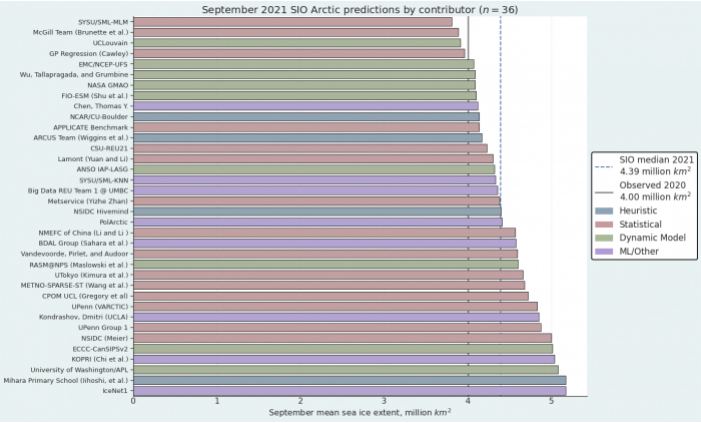

Figure 1. Distribution of the 36 SIO contributions for September estimates of the September 2021 monthly mean pan-Arctic sea-ice extent. These include 20 outlooks updated for the September report and 16 outlooks repeated from prior monthly reports per contributor request and permission, for details, see: Contributor Full Report PDFs below. Public/citizen contributions: Vandevoorde, Pirlet, and Audoor; Chen; Mihara Primary School; and ARCUS Team. Figure courtesy of Matthew Fisher, NSIDC.
(https://www.arcus.org/files/sio/32446/2021_sio_sept_fig_1_sept_2021_pan_arctic_extent_by_contributor.png)

(https://www.arcus.org/files/sio/32446/2021_sio_sept_fig_1_sept_2021_pan_arctic_extent_by_contributor.png)

(https://www.arcus.org/files/sio/32446/2021_sio_sept_fig_2_sept_2021_pan_arctic_extent_by_method.png)

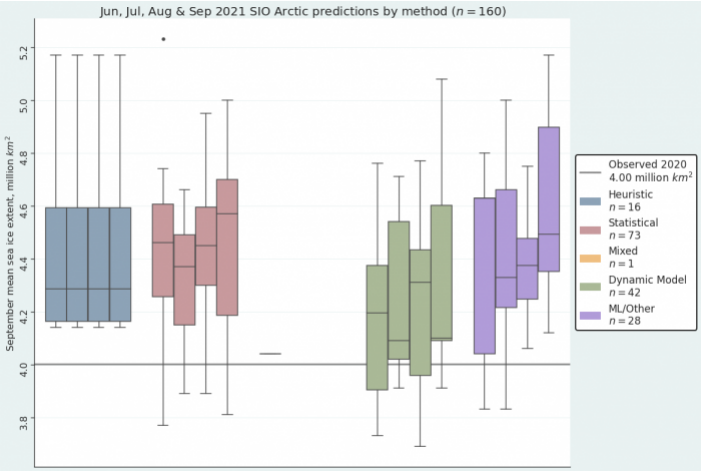

Figure 2. September 2021 pan-Arctic Sea Ice Outlook submissions, sorted by method. The individual boxes for each method represent, from left to right, June, July, August, and September. The value of the single submission that used a Mixed Method in their June contribution is represented by the flat line segment. The September median of each method (from left to right) is 4.29 (Heuristic), 4.57 (Statistical), 4.04 (Mixed, single entry), 4.1 (Dynamical), and 4.49 (ML/Other). Note that for ML/Other, the June 50th and 75th percentile values are both 4.63 so the two lines overlap. Figure courtesy of Matthew Fisher, NSIDC.
(https://www.arcus.org/files/sio/32446/2021_sio_sept_fig_2_sept_2021_pan_arctic_extent_by_method.png)

(https://www.arcus.org/files/sio/32446/2021_sio_sept_fig_2_sept_2021_pan_arctic_extent_by_method.png)

About box plots

(https://www.arcus.org/files/sio/32446/2021_sio_sept_fig_3_2020_jjas_comparison18sept2021.png)

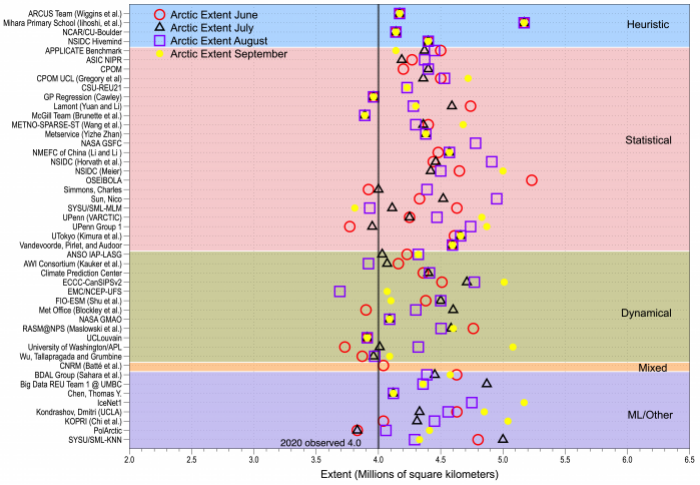

Figure 3. Outlook contributions by group from June (red circles), July (black triangles), August (purple squares) and September (yellow dots) are organized by general type of method. Overlapping symbols (e.g., for all four heuristic submissions) reflect the reuse of initial submissions in subsequent monthly reports. The 2020 observed September sea-ice is shown by the grey line. Figure courtesy of Uma Bhatt.
(https://www.arcus.org/files/sio/32446/2021_sio_sept_fig_3_2020_jjas_comparison18sept2021.png)

(https://www.arcus.org/files/sio/32446/2021_sio_sept_fig_3_2020_jjas_comparison18sept2021.png)

Alaska Regional Sea-Ice Extent

For the Alaska region, the September 2021 SIO median forecast was 0.50 million square kilometers based on seven contributions. This is lower than the June through August median forecasts of 0.67, 0.51, and 0.62 million square kilometers, respectively. The three dynamical model predictions ranged from 0.41 to 0.64 million square kilometers with a mean of 0.52 square kilometers (**Figure 4**). The three statistical model predictions ranged from 0.31 to 0.64 million square kilometers and had a mean of 0.48 million square kilometers. One machine learning-based prediction was submitted with a prediction of 0.81 million square kilometers. The September spread (**Figure 5**) is larger in the statistical models in the September Outlook compared to the August 2021 SIO. In contrast, the spread is larger in the August 2021 SIO compared to September for the dynamical models. The medians of the statistical and dynamical models decreased between June and September SIOs. The ML/Other forecast 0.62 million square kilometers for the August SIO and increased to 0.81 million square kilometers for the September SIO. For reference, the preliminary observed average 1–19 September 2021 sea-ice extent in the Beaufort and Chukchi seas is 0.83 million square kilometers.

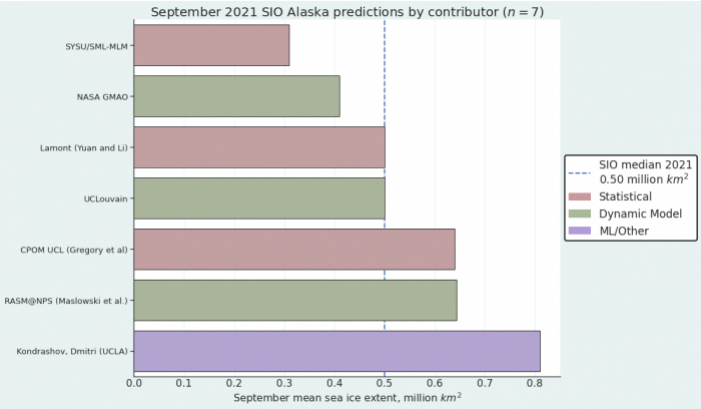

Figure 4. Distribution of SIO estimates, by contributor, of mean September 2021 Alaska Regional sea-ice extent. Figure courtesy of Matthew Fisher, NSIDC.

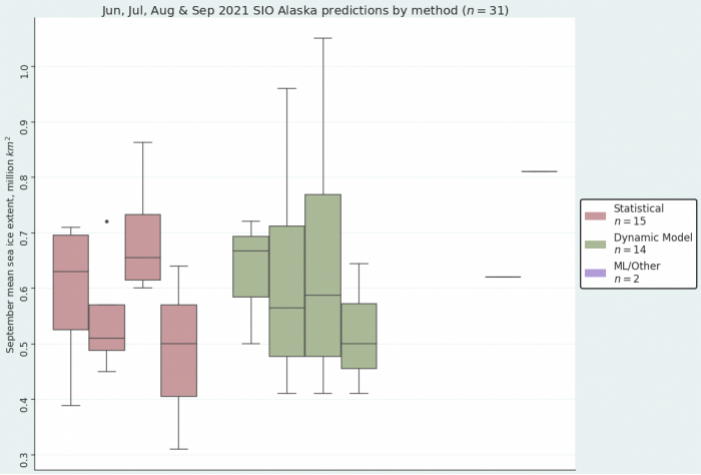

Figure 5. September 2021 Alaska Region Sea Ice Outlook submissions, sorted by method (Note, the one ML/Other submission is represented by a flat line on the left side). Figure courtesy of Matthew Fisher, NSIDC.

Arctic Sea Ice Extent Anomalies

The pan-Arctic sea-ice extent anomaly is the departure of the contributors' September extent Outlook relative to the contributors' baseline trend. The 12 September contributions of September mean sea-ice extent anomaly range from -0.15 to +1.07 million square kilometers, with nine forecasts above and three below the contributors' baseline (**Figure 6**). The September SIO anomaly forecast has a standard deviation of 0.38 million square kilometers, which can be contrasted for small spreads in earlier forecasts for the 2021 SIO reports (i.e., the standard deviation in August was 0.25, July was 0.27, and June was 0.29 million square kilometers). The mean of the anomaly forecasts increased with each forecast of the summer 2021 SIO season (June=+0.15, July=+0.21, August=+0.26, and September=+0.39).

(https://www.arcus.org/files/sio/32446/2021_sio_sept_fig_6_sie_anomaly_vert_.png)

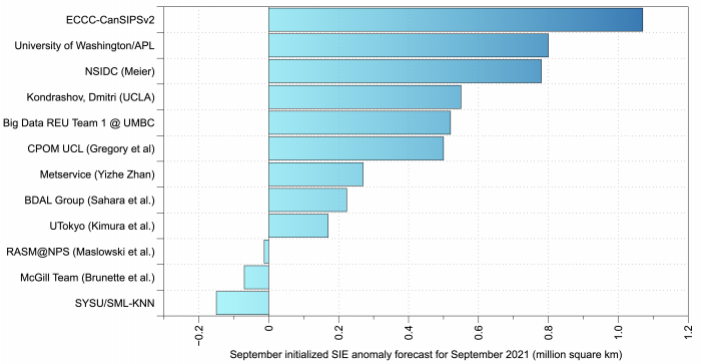

Figure 6. September SIO forecast for 2021 September mean sea-ice extent anomaly in millions of square kilometers. Figure courtesy of Uma Bhatt.

(https://www.arcus.org/files/sio/32446/2021_sio_sept_fig_6_sie_anomaly_vert_.png)

(https://www.arcus.org/files/sio/32446/2021_sio_sept_fig_6_sie_anomaly_vert_.png)

Antarctic Contributions

For this new round of September-based outlooks, six updates were provided from the previous outlook (a seventh outlook uses the values of June). The pattern that has been observed in the previous round of forecasts remains, with a cluster of forecasts that use statistical approaches and several forecasts based on dynamical modeling. Because of the short lead time, it is likely that the actual September mean sea-ice extent will be closer to the mean of the statistical group than of the mean of the other group.

(https://www.arcus.org/files/sio/32446/2021_sio_sept_fig_7_antarctic_sea_ice_extent.png)

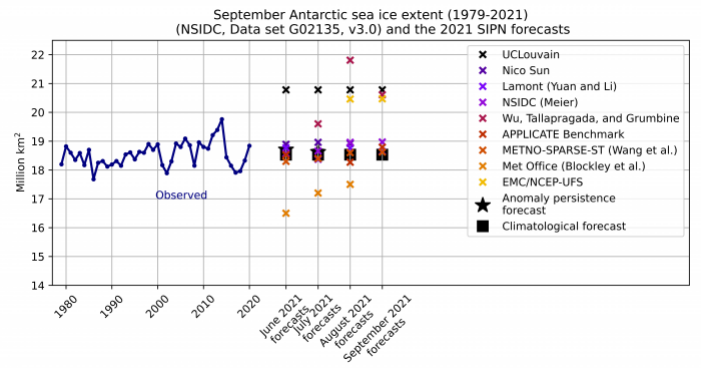

Figure 7. September Antarctic sea ice extent predictions and observed extent from 1979 through 2020. Figure courtesy of François Massonnet.
(https://www.arcus.org/files/sio/32446/2021_sio_sept_fig_7_antarctic_sea_ice_extent.png)

(https://www.arcus.org/files/sio/32446/2021_sio_sept_fig_7_antarctic_sea_ice_extent.png)

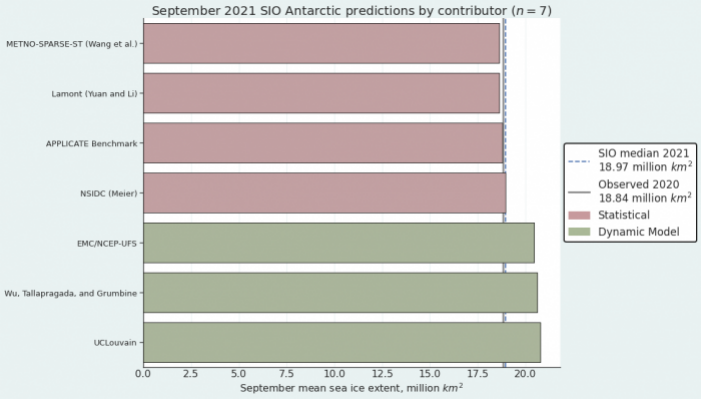

Figure 8. Distribution of SIO estimates, by contributor, for August estimates of September 2021 Antarctic sea-ice extent. Figure courtesy of Matthew Fisher, NSIDC.

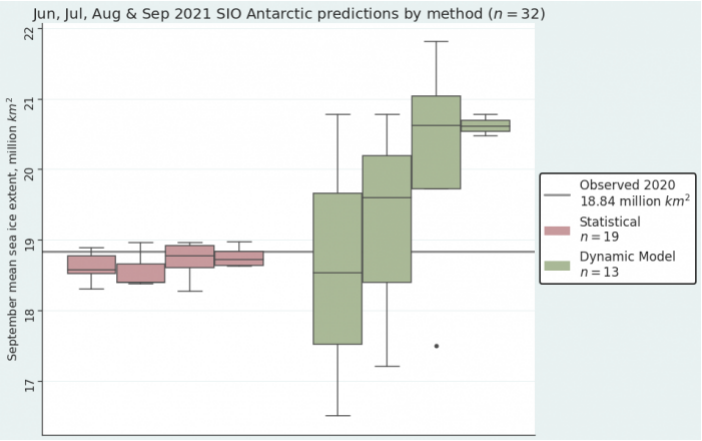

Figure 9. September 2021 Antarctic Region Sea Ice Outlook submissions, sorted by method. Figure courtesy of Matthew Fisher, NSIDC.

Contributor Full Report PDFs

Attachment

ANSO IAP-LASG (Repeated Submission from 2021 August Report)
(https://www.arcus.org/files/sio/32446/anso_iap_lasg_repeated_submission_from_2021august_report.pdf) 51.78 KB

APPLICATE Benchmark (NEW Submission to 2021 September Report)
(https://www.arcus.org/files/sio/32446/applicate_benchmark_new_submission_to_2021_september_report.pdf) 48.73 KB

ARCUS Team (Wiggins et al.) (Repeated Submission from 2021 June Report)
(https://www.arcus.org/files/sio/32446/arcus_team_wiggins_et_al_repeated_submission_from_2021june_report.pdf) 49.5 KB

BDAL Group (Sahara et al.) (NEW Submission to 2021 September Report)
(https://www.arcus.org/files/sio/32446/bdal_group_sahara_et_al_new_submission_to_2021_september_report.pdf) 50.38 KB

Attachment

Big Data REU Team 1 @ UMBC (Repeated Submission from 2021 August Report)
(https://www.arcus.org/files/sio/32446/big_data_reu_team_1_at_umbc_repeated_submission_from_2021august_report.pdf)
51.51 KB

Chen, Thomas Y. (Repeated Submission from 2021 July Report)
(https://www.arcus.org/files/sio/32446/chen_thomas_y_repeated_submission_from_2021july_report.pdf) 49.68 KB

CPOM UCL (Gregory et al.) (NEW Submission to 2021 September Report)
(https://www.arcus.org/files/sio/32446/cpom_ucl_gregory_et_al_new_submission_to_2021_september_report.pdf) 50.75 KB

CSU-REU21 (Repeated Submission from 2021 August Report)
(https://www.arcus.org/files/sio/32446/csu_reu21_repeated_submission_from_2021august_report.pdf) 54.72 KB

ECCC-CanSIPSv2 (NEW Submission to 2021 September Report)
(https://www.arcus.org/files/sio/32446/eccc_cansipsv2_new_submission_to_2021_september_report.pdf) 53.17 KB

EMC/NCEP-UFS (NEW Submission to 2021 September Report)
(https://www.arcus.org/files/sio/32446/emc_ncep_ufs_2021_new_submission_to_2021_september_report.pdf) 50.17 KB

FIO-ESM (Shu et al.) (NEW Submission to 2021 September Report)
(https://www.arcus.org/files/sio/32446/fio_esm_shu_et_al_new_submission_to_2021_september_report.pdf) 50.19 KB

GP Regression (Cawley) (Repeated Submission from 2021 June Report)
(https://www.arcus.org/files/sio/32446/gp_regression_cawley_repeated_submission_from_2021june_report.pdf) 50.17 KB

IceNet1 (NEW Submission to 2021 September Report)
(https://www.arcus.org/files/sio/32446/icenet1_2021_new_submission_to_2021_september_report.pdf) 51.18 KB

Kondrashov, Dmitri (UCLA) (NEW Submission to 2021 September Report)
(https://www.arcus.org/files/sio/32446/kondrashov_dmitri_ucla_new_submission_to_2021_september_report.pdf) 49.78 KB

KOPRI (Chi et al.) (NEW Submission to 2021 September Report)
(https://www.arcus.org/files/sio/32446/kopri_chi_et_al_2021_new_submission_to_2021_september_report.pdf) 50.72 KB

KOPRI (Chi et al.) (2021 September Supporting Document)
(https://www.arcus.org/files/sio/32446/kopri_chi_et_al_2021_september_report_supporting_material.pdf) 418.36 KB

Lamont (Yuan and Li) (NEW Submission to 2021 September Report)
(https://www.arcus.org/files/sio/32446/lamont_yuan_and_li_new_submission_to_2021_september_report.pdf) 52.95 KB

McGill Team (Brunette et al.) (Repeated Submission from 2021 July Report)
(https://www.arcus.org/files/sio/32446/mcgill_team_brunette_et_al_repeated_submission_from_2021july_report.pdf) 53.93 KB

METNO-SPARSE-ST (Wang et al.) (NEW Submission to 2021 September Report)
(https://www.arcus.org/files/sio/32446/metno_sparse_st_wang_et_al_new_submission_to_2021_september_report.pdf)
47.96 KB

Metservice (Yizhe Zhan) (Repeated Submission from 2021 July Report)
(https://www.arcus.org/files/sio/32446/metservice_yizhe_zhan_repeated_submission_from_2021july_report.pdf) 50.93 KB

Mihara Primary School (Iihoshi, et al.) (Repeated Submission from 2021 June Report)
(https://www.arcus.org/files/sio/32446/mihara_primary_school_iihoshi_et_al_repeated_submission_from_2021june_report.pdf)
49.52 KB

NASA GMAO (Repeated Submission from 2021July Report)
(https://www.arcus.org/files/sio/32446/nasa_gmao_2021_repeated_submission_from_2021july_report.pdf) 54.15 KB

NCAR/CU-Boulder (Repeated Submission from 2021 June Report)
(https://www.arcus.org/files/sio/32446/ncar_cu_boulder_repeated_submission_from_2021june_report.pdf) 50.51 KB

NMEFC of China (Li and Li) (Repeated Submission from 2021 July Report)
(https://www.arcus.org/files/sio/32446/nmefc_of_china_li_and_li_repeated_submission_from_2021july_report.pdf) 49.61 KB

NSIDC Hivemind (Repeated Submission from 2021 June Report)
(https://www.arcus.org/files/sio/32446/nsidc_hivemind_repeated_submission_from_2021june_report.pdf) 48.99 KB

NSIDC (Meier) (NEW Submission to 2021 September Report)
(https://www.arcus.org/files/sio/32446/nsidc_meier_new_submission_to_2021_september_report.pdf) 51.99 KB

PolArctic (NEW Submission to 2021 September Report)
(https://www.arcus.org/files/sio/32446/polarctic_2021_new_submission_to_2021_september_report.pdf) 50.05 KB

RASM@NPS (Maslowski et al.) (NEW Submission to 2021 September Report)
(https://www.arcus.org/files/sio/32446/rasm_at_nps_maslowski_et_al_new_submission_to_2021_september_report.pdf)
56.11 KB

RASM@NPS (Maslowski et al.) (2021 September Supporting Document)
(https://www.arcus.org/files/sio/32446/rasm_september2021_sio_supporting.pdf) 1007.74 KB

SYSU/SML-KNN (NEW Submission to 2021 September Report)
(https://www.arcus.org/files/sio/32446/sysu_sml_knn_new_submission_to_2021_september_report.pdf) 51.16 KB

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SYSU/SML-MLM (NEW Submission to 2021 September Report) (https://www.arcus.org/files/sio/32446/sysu_sml_mlm_new_submission_to_2021_september_report.pdf) 50.84 KB
UCLouvain (Repeated Submission from 2021 June Report) (https://www.arcus.org/files/sio/32446/uclouvain_repeated_submission_from_2021june_report.pdf) 50.87 KB
University of Washington/APL (NEW Submission to 2021 September Report) (https://www.arcus.org/files/sio/32446/university_of_washington_apl_new_submission_to_2021_september_report.pdf) 50.79 KB
UPenn Group 1 (NEW Submission to 2021 September Report) (https://www.arcus.org/files/sio/32446/upenn_group_1_new_submission_to_2021_september_report.pdf) 51.24 KB
UPenn (VARCTIC) (NEW Submission to 2021 September Report) (https://www.arcus.org/files/sio/32446/upenn_varctic_new_submission_to_2021_september_report.pdf) 52.21 KB
UTokyo (Kimura et al.) (Repeated Submission from 2021 August Report) (https://www.arcus.org/files/sio/32446/utokyo_kimura_et_al_2021_repeated_submission_from_2021august_report.pdf) 50.1 KB
Vandevoorde, Pirlet, and Audoor (Repeated Submission from 2021 June Report) (https://www.arcus.org/files/sio/32446/vandevoorde_pirlet_and_audoor_repeated_submission_from_2021june_report.pdf) 49.12 KB
Wu, Tallapragada, and Grumbine (NEW Submission to 2021 September Report) (https://www.arcus.org/files/sio/32446/wu_tallapragada_and_grumbine_new_submission_to_2021_september_report.pdf) 49.33 KB

Credits
This report was developed by the SIPN2 Leadership Team (https://www.arcus.org/sipn/project-team)

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SIPN

2023: September Report (/sipn/sea-ice-outlook/2023/september)

2023: September Call for Sea Ice Outlook (/sipn/sea-ice-outlook/2023/september/call)

2023: August Report (/sipn/sea-ice-outlook/2023/august)

2023: August Call for Sea Ice Outlook (/sipn/sea-ice-outlook/2023/august/call)

2023: July Report (/sipn/sea-ice-outlook/2023/july)

2023: July Call for Sea Ice Outlook (/sipn/sea-ice-outlook/2023/july/call)

2023: June Report (/sipn/sea-ice-outlook/2023/june)

2023: June Call for Sea Ice Outlook (/sipn/sea-ice-outlook/2023/june/call)

2022: Post-Season Report (/sipn/sea-ice-outlook/2022/interim-post-season)

2022: September Report (/sipn/sea-ice-outlook/2022/september)

2022: August Report (/sipn/sea-ice-outlook/2022/august)

2022: July Report (/sipn/sea-ice-outlook/2022/july)

2022: July Call for Sea Ice Outlook (/sipn/sea-ice-outlook/2022/july/call)

2022: June Report (/sipn/sea-ice-outlook/2022/june)

2022: June Call for Sea Ice Outlook (/sipn/sea-ice-outlook/2022/june/call)

2021: Post-Season Report (/sipn/sea-ice-outlook/2021/post-season)

2021: September Report (/sipn/sea-ice-outlook/2021/september)

2021: September Call for Sea Ice Outlook (/sipn/sea-ice-outlook/2021/september/call)

2021: August Report (/sipn/sea-ice-outlook/2021/august)

2021: August Call for Sea Ice Outlook (/sipn/sea-ice-outlook/2021/august/call)

2021: July Report (/sipn/sea-ice-outlook/2021/july)

2021: July Call for Sea Ice Outlook (/sipn/sea-ice-outlook/2021/july/call)

2021: June Report (/sipn/sea-ice-outlook/2021/june)

2021: June Call for Sea Ice Outlook (/sipn/sea-ice-outlook/2021/june/call)

2020: Post-Season Report (/sipn/sea-ice-outlook/2020/post-season)

2020: Interim Post-Season Report (/sipn/sea-ice-outlook/2020/interim-post-season)

2020: August Report (/sipn/sea-ice-outlook/2020/august)

2020: August Call for Sea Ice Outlook (/sipn/sea-ice-outlook/2020/august/call)

2020: July Report (/sipn/sea-ice-outlook/2020/july)

2020: July Call for Sea Ice Outlook (/sipn/sea-ice-outlook/2020/july/call)

2020: June Report (/sipn/sea-ice-outlook/2020/june)

2020: June Call for Sea Ice Outlook (/sipn/sea-ice-outlook/2020/june/call)

2019: Post-Season Report (/sipn/sea-ice-outlook/2020/post-season-0)

2019: Interim Post-Season Report (/sipn/sea-ice-outlook/2019/interim-post-season)

2019: August Report (/sipn/sea-ice-outlook/2019/august)

2019: July Report (/sipn/sea-ice-outlook/2019/july)

2019: June Report (/sipn/sea-ice-outlook/2019/june)

2018: Post-Season Report (/sipn/sea-ice-outlook/2018/post-season)

2018: Interim Post-Season Report (/sipn/sea-ice-outlook/2018/interim-post-season)

2018: August Report (/sipn/sea-ice-outlook/2018/august)

2018: July Report (/sipn/sea-ice-outlook/2018/july)

2018: June Report (/sipn/sea-ice-outlook/2018/june)

2017: Post-Season Report (/sipn/sea-ice-outlook/2017/post-season)

2017: August Report (/sipn/sea-ice-outlook/2017/august)

2017: July Report (/sipn/sea-ice-outlook/2017/july)

2017: June Report (/sipn/sea-ice-outlook/2017/june)

2016: Post-Season Report (/sipn/sea-ice-outlook/2016/post-season)

2016: August Report (/sipn/sea-ice-outlook/2016/august)

2016: July Report (/sipn/sea-ice-outlook/2016/july)

2016: June Report (/sipn/sea-ice-outlook/2016/june)

2015: Post-Season Report (/sipn/sea-ice-outlook/2015/post-season)

2015: DRAFT Post-Season Report (/sipn/sea-ice-outlook/2015/summary-draft)

2015: August Report (/sipn/sea-ice-outlook/2015/august)

2015: July Report (/sipn/sea-ice-outlook/2015/july)

2015: June Report (/sipn/sea-ice-outlook/2015/june)

2014: Post-Season Report (/sipn/sea-ice-outlook/2014/post-season)

2014: DRAFT Post-Season Report (/sipn/sea-ice-outlook/2014/summary-draft)

2014: August Report (/sipn/sea-ice-outlook/2014/august)

2014: August Call for Sea Ice Outlook (/sipn/sea-ice-outlook/2014/august/call)

2014: July Report (/sipn/sea-ice-outlook/2014/july)

2014: July Call for Sea Ice Outlook (/sipn/sea-ice-outlook/2014/july/call)

2014: June Report (/sipn/sea-ice-outlook/2014/june)

2014: June Call for Sea Ice Outlook (/sipn/sea-ice-outlook/2014/june/call)

2013: Post-Season Report (/sipn/sea-ice-outlook/2013/post-season)

2013: July Report (/sipn/sea-ice-outlook/2013/july)

2013: June Report (/sipn/sea-ice-outlook/2013/june)

2012: Post-Season Report (/sipn/sea-ice-outlook/2012/post-season-0)

2012: August Report (/sipn/sea-ice-outlook/2012/august)

2012: July Report (/sipn/sea-ice-outlook/2012/july)

2012: June Report (/sipn/sea-ice-outlook/2012/june)

2011: Post-Season Report (/sipn/sea-ice-outlook/2012/post-season)

2011: September Report (/sipn/sea-ice-outlook/2011/september)

2011: August Report (/sipn/sea-ice-outlook/2011/august)

2011: July Report (/sipn/sea-ice-outlook/2011/july)

2011: June Report (/sipn/sea-ice-outlook/2011/june)

2010: Post-Season Report (/sipn/sea-ice-outlook/2010/post-season)

2010: August Report (/sipn/sea-ice-outlook/2010/august)

2010: July Report (/sipn/sea-ice-outlook/2010/july)

2010: June Report (/sipn/sea-ice-outlook/2010/june)

2009: Summary Report (/sipn/sea-ice-outlook/2009/post-season)

2009: Early September Update (/sipn/sea-ice-outlook/2009/september)

2009: August Report (/sipn/sea-ice-outlook/2009/august)

2009: July Report (/sipn/sea-ice-outlook/2009/july)

2009: June Report (/sipn/sea-ice-outlook/2009/june)

2008: Summary Report (/sipn/sea-ice-outlook/2008/post-season)

2008: July Report (/sipn/sea-ice-outlook/2008/july)

2008: June Report (/sipn/sea-ice-outlook/2008/june)

2008: May Report (/sipn/sea-ice-outlook/2008/may)

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(http://www.nsf.gov/div/index.jsp?div=PLR)

(https://www.onr.navy.mil/)

(http://www.noaa.gov)

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