Update #1 for the Ross Sea and McMurdo Sound Seasonal Outlook 2021-2022
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INTRODUCTION

The U. S. National Ice Center (USNIC) provides planning and real time operational support for the efforts of the United States Antarctic Program (USAP) through collaboration with National Science Foundation (NSF) and the U.S. Coast Guard (USCG). Specifically, this outlook is provided as environmental awareness to safely plan icebreaker operations in the McMurdo/Ross Sea channel and escort ice-strengthened tanker and ice-strengthened cargo ships to the pier at McMurdo Station, located at 77°51'S, 166°40'E.

In this specific outlook, the term "ice edge" is used to delineate the boundary between areas with greater than or equal to 4/10ths sea ice concentration and areas with less than 4/10ths sea ice concentration.

METHODOLOGY

Climatology: The rates of recession for the Ross Sea ice edge are predominately derived using an analog forecasting technique that relates historical observations of pre-season ice extent and thickness to the predicted severity of austral summer ice conditions. This analog data from climatological conditions is adjusted to reflect the expected impact of current meteorological and oceanographic conditions in the Ross Sea.

In the updates we show how the recession lines validate against the weekly analyses for the same time period, and using the the Navy Earth System Prediction Capability (ESPC) model's 45-day forecast [1] look ahead at how the model compares to the recession lines from the Outlook. This employs two different forecasting techniques to provide the most accurate open date for the Ross Sea.

UPDATE

Current Conditions: As of December 15, the fast ice still extends 36 nautical miles from the edge to the turning basin with a loss of only approximately 2 nautical miles since November 13 (Figure 1). The expected collapse of the outer 23 nautical miles has not happened yet, although satellite imagery shows the warmer temperatures and 24 hour solar insolation appear to have weakened the ice.

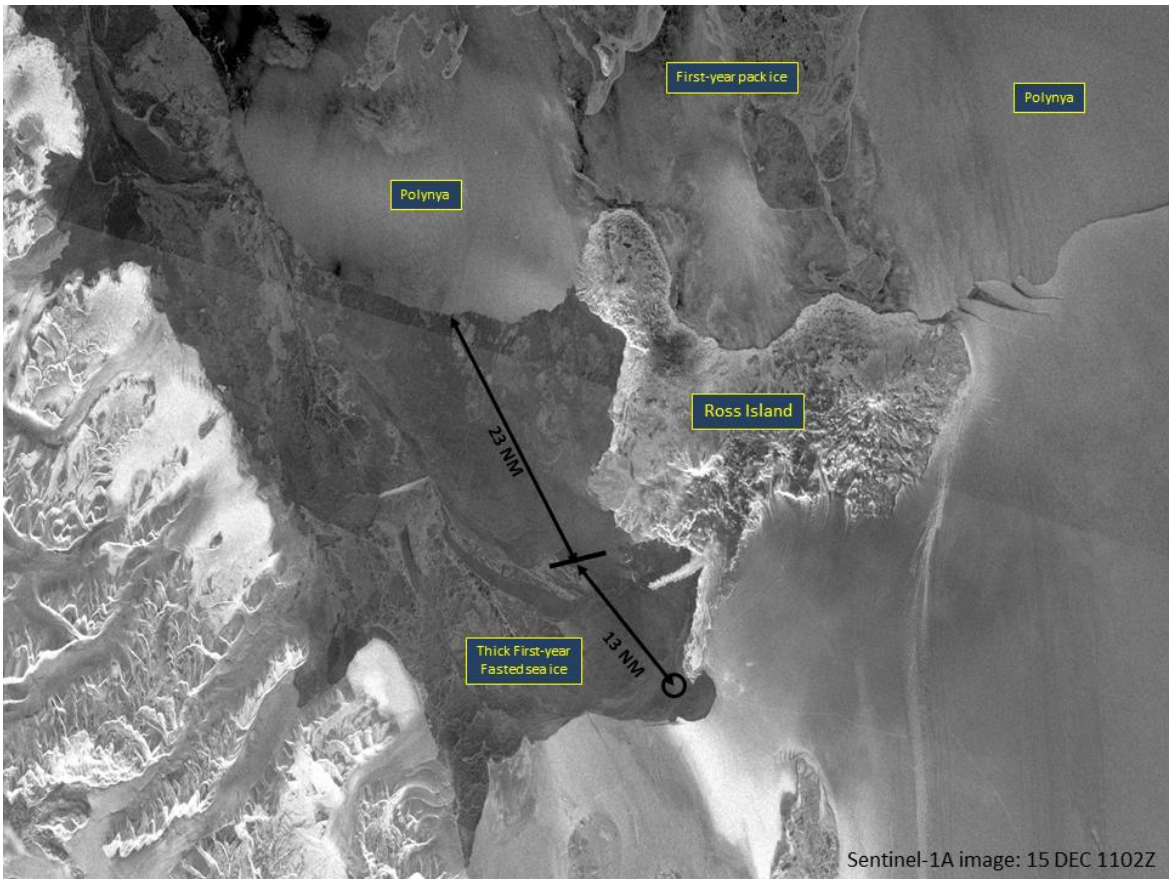

Figure 1. Fast Ice situation in McMurdo Sound as of 15 DEC 2021. Sentinel-1A Image 15 DEC 1102Z.

Comparing the USNIC sea ice analysis to the 15 December recession lines in the 2021-2022 Outlook (figure 2, below) shows that the melt at the ice edge occurred very close to forecast. The 4/10ths concentration has receded back to approximately 65°S or further so far. However, most of the sea ice remaining in the Ross Sea is considered very close pack ice and the melt will likely not make such quick progress over the next 2 weeks. The largest discrepancy with the outlook so far is the shape of the Ross Sea polynya. The north-south length is fairly close to reality, but the polynya is nearly double the forecasted width east to west. Iceberg B-50 remains well east of the expected operating area near 165°W, 65°S.

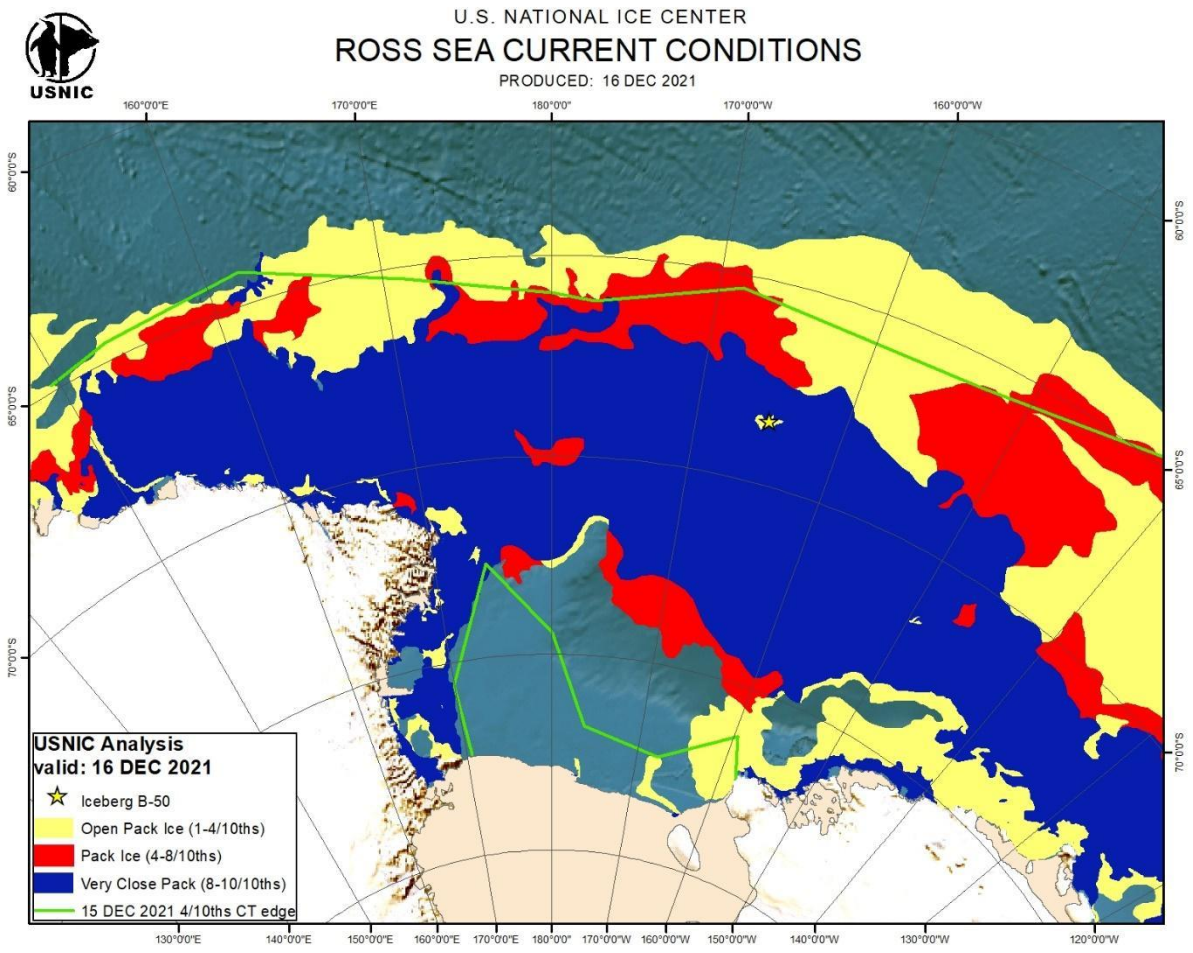

Figure 2. Ross Sea recession Outlook (green lines) valid 15 DEC compared to USNIC hemispheric analysis valid 16 Dec.

Figures 3 through 5 look ahead at how the melt is expected to continue, comparing ESPC vs the USNIC Outlook.

Figure 3 (below), shows the Outlook (green line) and the ESPC model forecast valid 01 JAN 2022. Some large differences have emerged in that the ESPC model pushed the bulk of the sea ice northward drastically expanding the Ross Sea polynya and keeping the sea ice edge out near 66°S across the whole region. This is an interesting pattern and as the validation above already showed, the ice has been pushing northward more than the Outlook expected. ESPC shows this trend continuing for the next two weeks. If you look past the specific placement of the ice, the area of ice coverage is very similar to the outlook recession lines leaving approximately 250 nautical miles of pack ice left to melt along 175°E longitude. Given the error in the Ross Sea polynya recession line we saw above and this forecast, the 01 January analysis will probably be in between the ESPC model and Outlook recession line.

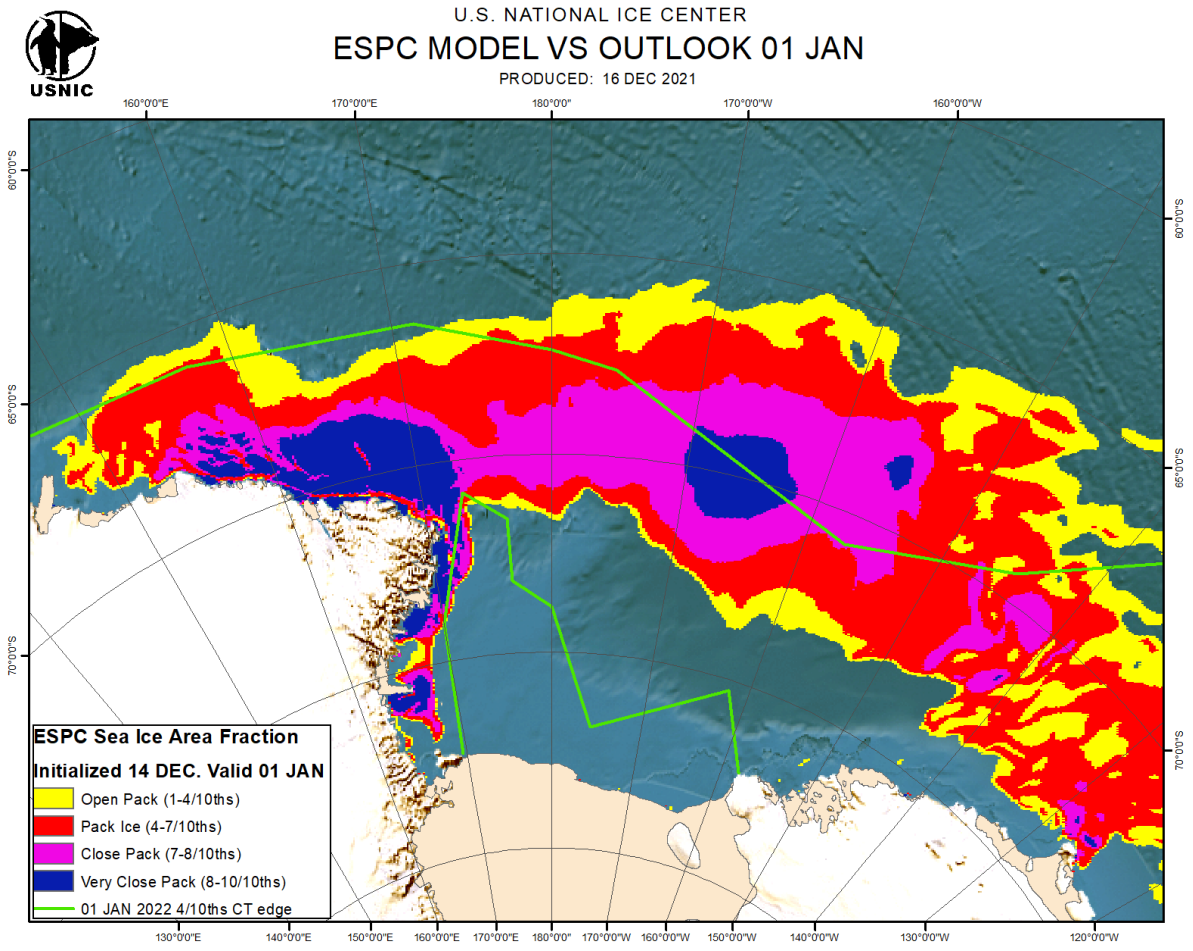

Figure 3. 01 JAN 2022 ESPC 17-day sea ice fraction forecast compared to 01 Jan 2020 USNIC Outlook (green lines).

In Figure 4 (below), the discrepancy between the ESPC model and the Outlook persists, particularly east of 170°E. However, to the west of 170°E, the agreement between the Outlook and ESPC model is remarkable considering the length of the forecast. This area is where the Deep Freeze operations traditionally occur, so we hope this situation holds. At this stage, the key difference between the Outlook and ESPC forecast may be that the model considers the Ross Sea already open to unescorted navigation, whereas in the Outlook we believe it will occur a few days later. Both the model and the Outlook forecasting an open date within a week of the actual opening would be a very positive situation. We will pay close attention to when the ice bridge finally breaks for navigational purposes.

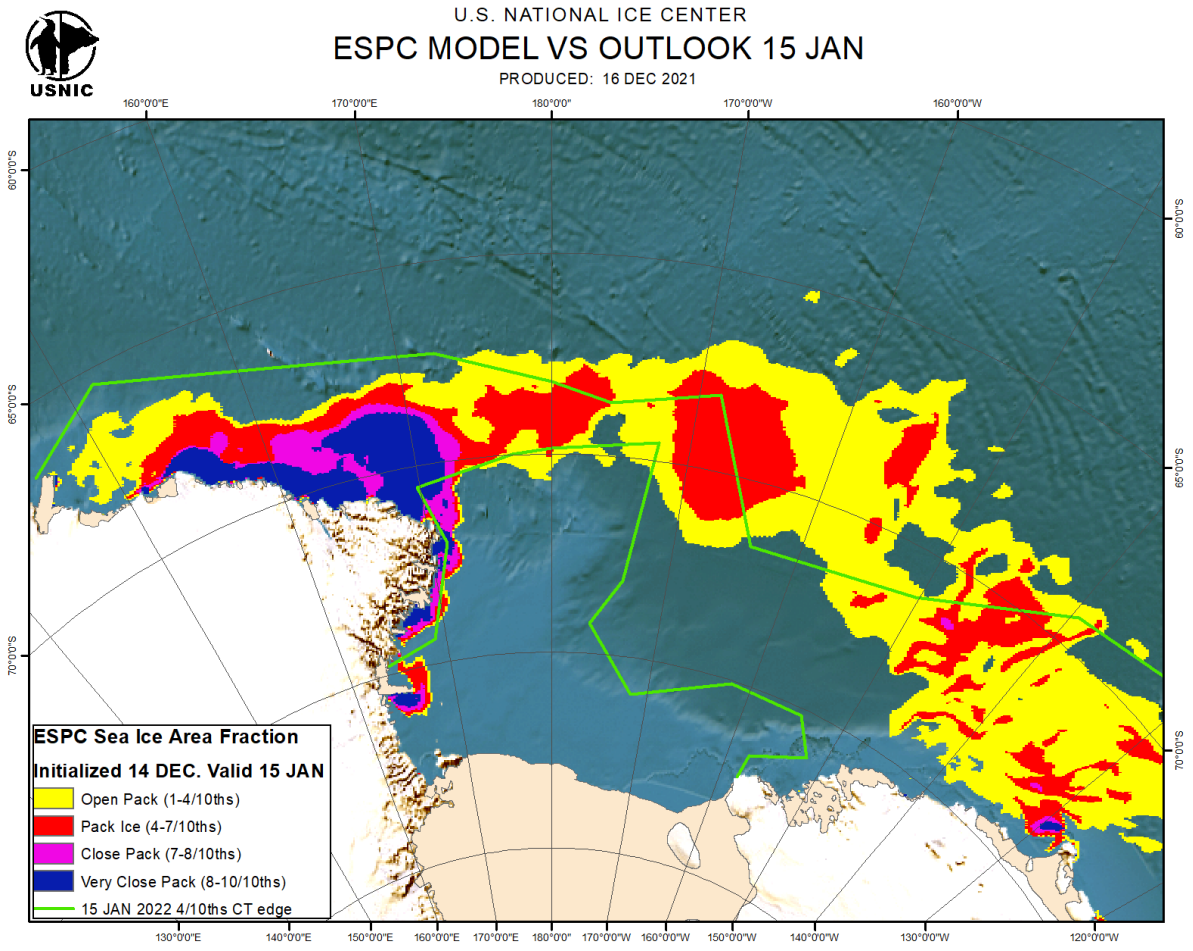

Figure 4. 15 JAN 2022 Navy ESPC 31-day sea ice fraction forecast compared to 15 JAN 2020 USNIC Outlook (green lines).

Figure 5 (below) shows the USNIC Outlook for 01 FEB and the ESPC model forecast for 28 JAN 2022. The 45-day model doesn't forecast out quite far enough in this case but it shouldn't matter as the Ross Sea is mostly sea ice free by this time. As indicated by both the model and the Outlook, the remaining sea ice should be concentrated along the coast north-west of Cape Adare, and in the east-central Ross Sea. Whatever sea ice is leftover in the eastern Ross Sea by the end of the melt, will usually form the bridge of old ice that influences the melt out for the 2022-2023 season.

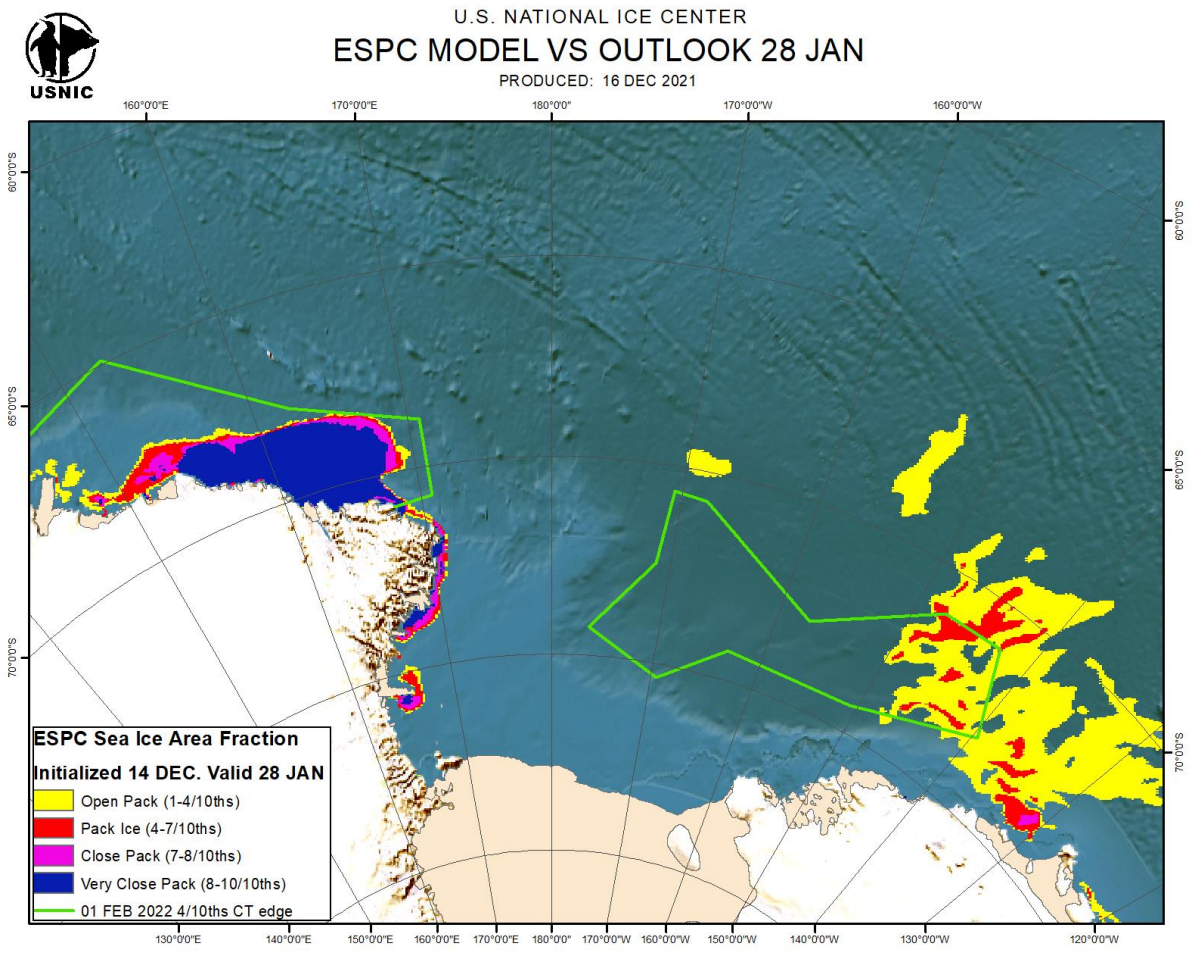

Figure 5. 28 JAN 2021 ESPC 45-day sea ice fraction forecast compared to 01 Feb 2021 NIC Outlook (green lines).

REFERENCES

[1] Metzger, E. J. et al., (2014), Operational Implementation Design for the Earth System Prediction Capability (ESPC): A First Look, Naval Research Laboratory, NRL/MR/7320—14-9498.