Update #1 for the Ross Sea and McMurdo Sound Seasonal Outlook 2020-2021
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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 [4].

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 and areas with less than 4/10ths sea ice.

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.

UPDATE

Current Conditions: As of December 15th, the fast ice still extends 7 nautical miles from the edge to the turning basin with a loss of approximately 0.5 nautical miles so far (Figure 1). Without an icebreaker to break this up in 2021 it will be interesting to see how the fast ice breaks up naturally.

Figure 1. Fast Ice situation in McMurdo Sound as of 15 December 2020. MODIS Image 12/15 2200Z.

Comparing the USNIC sea ice analysis from 17 December to the 15 DEC recession lines in the 2020-2021 Outlook created in mid-November shows that the Ross Sea polynya is approximately the same size and shape to the 15 DEC outlook with the largest discrepancy being the northern portion being overly wide. The sea ice edge on the other hand is quite different to reality. The outlook suggested that the 40% concentration ice edge would lie along 63-64^{o}S latitude. In reality, the 40% line is much closer to 66^{o}S showing an advanced level of retreat. In addition to that difference, there are also large areas of low concentration sea ice in the central Ross Sea near 170^{o}W longitude. It is a usual occurrence that the sea ice will loosen up in this region during the melt but this season the break up has opened up several large polynyas showing advanced melting and loosening in the pack.

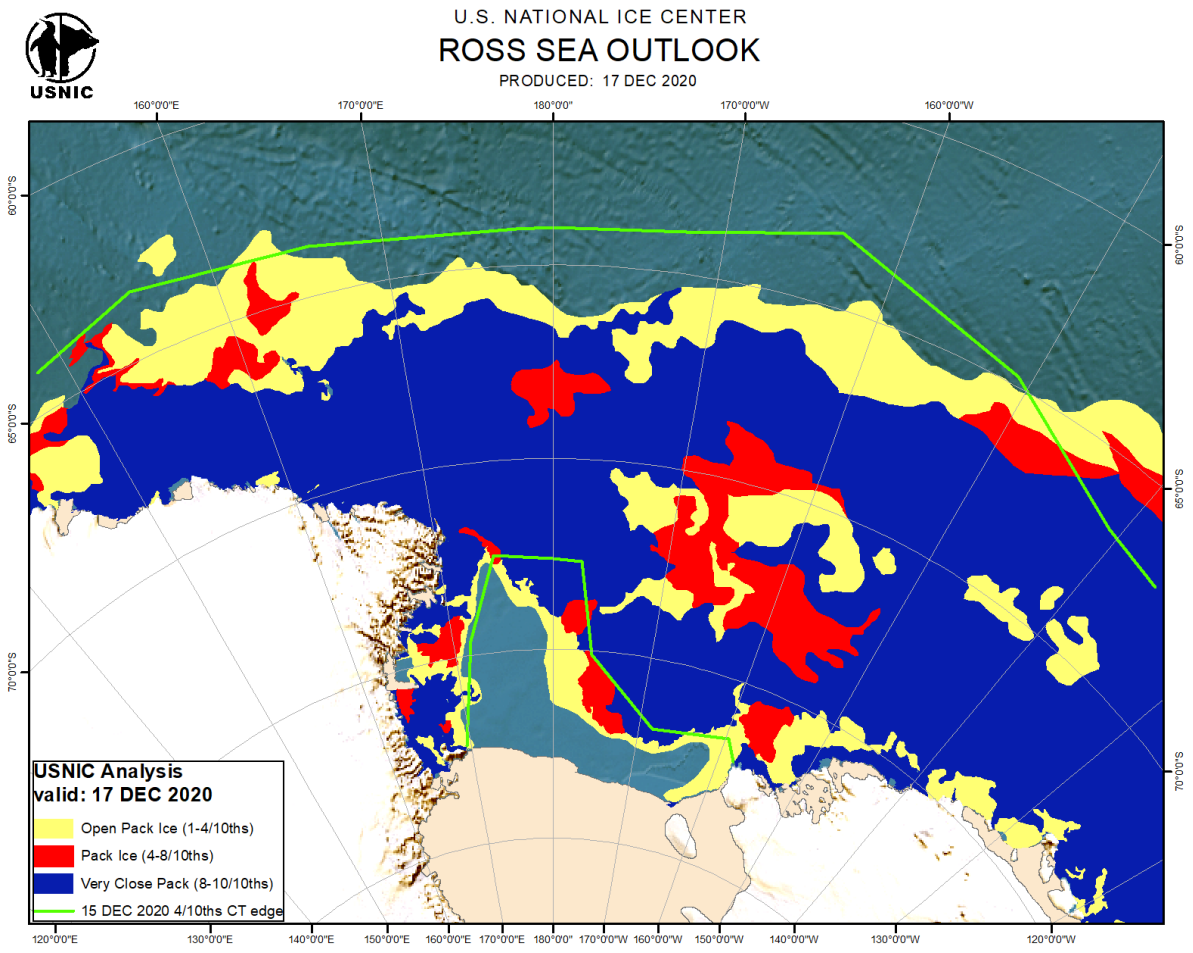

Figure 2. Ross Sea recession Outlook valid 15 Dec compared to USNIC hemispheric analysis valid 17 Dec.

Figures 3 through 5 look ahead, comparing the Navy Earth System Prediction Capability (ESPC) vs the USNIC Outlook. Figure 3 below, shows the Outlook and the ESPC model forecast valid 01 JAN 2021 where there are some large differences, particularly along the ice edge. As the 15 DEC validation showed, the outlook was too conservative in melting back the ice edge, and that pattern would seem to persist to the new year according to the model. The Ross Sea polynya shows an opposite problem where the outlook was too ambitious in pushing out the polynya to the north and east. The model suggests the polynya should look very similar to its current extent. Given this is a 17-day forecast, and the polynya is more similar to the climatological shape than the outlook the model may be more likely to validate at this time. Over the rest of the Ross Sea, the model does not show any signs of opening the channel anytime soon. It does appear to incorporate the polynyas in the pack ice in the eastern Ross Sea, but they're likely too far north.

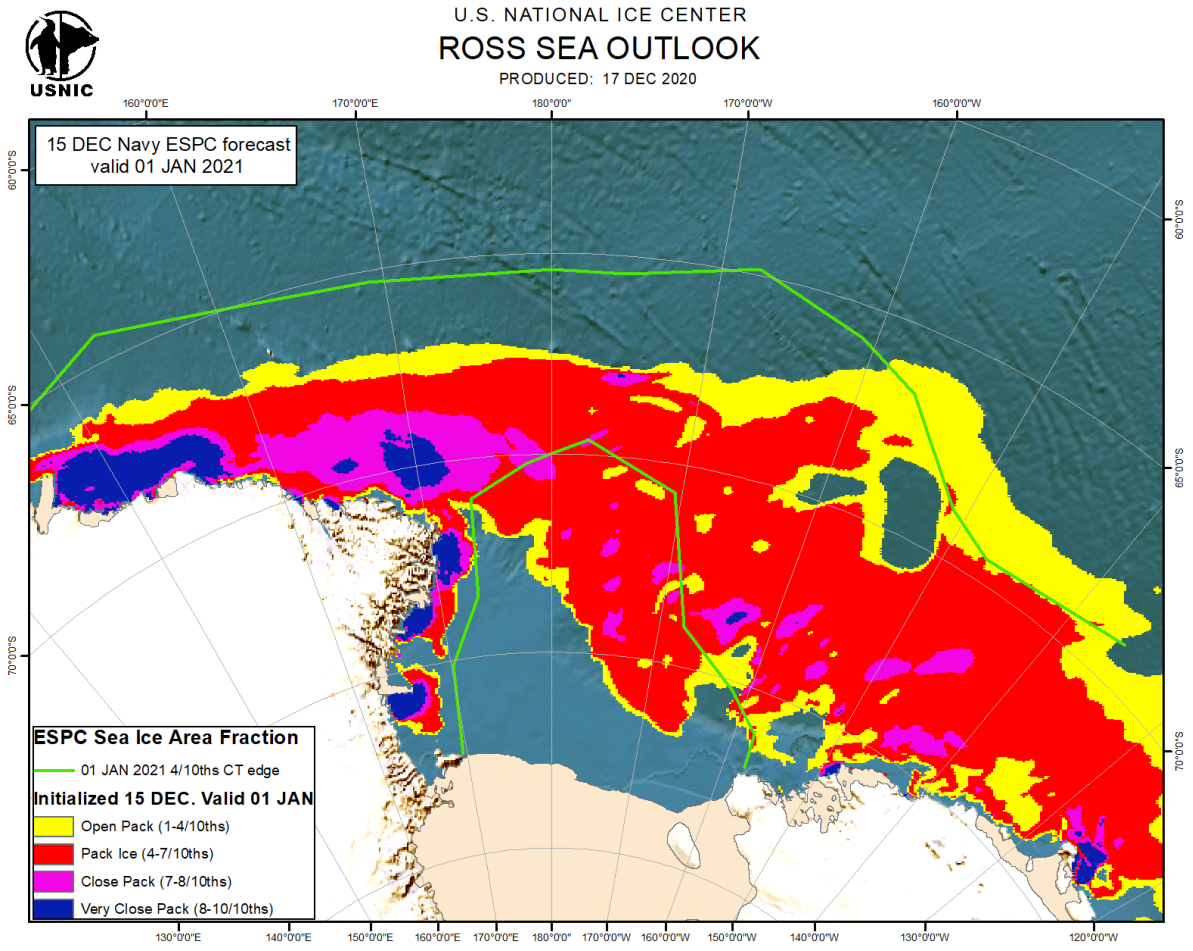

Figure 3. 01 Jan 2021 ESPC 17-day sea ice fraction forecast compared to 01 Jan 2020 USNIC Outlook (green line).

In Figure 4 (below), the discrepancy between the ESPC model and the outlook continues, where the outlook pushed the polynya and the ice edge farther out than the model. The most noticeable difference however may be that the model is calling a wide area in the central Ross Sea open to navigation whereas the outlook still has the area closed and not opening until around 20 JAN. While the model still maintains the advanced recession of the ice edge which occurred with the current 17 DEC analysis and the shape of the melt-out looks more natural, the sheer volume of ice melted over the first 2 weeks of January would be a lot, though possible.

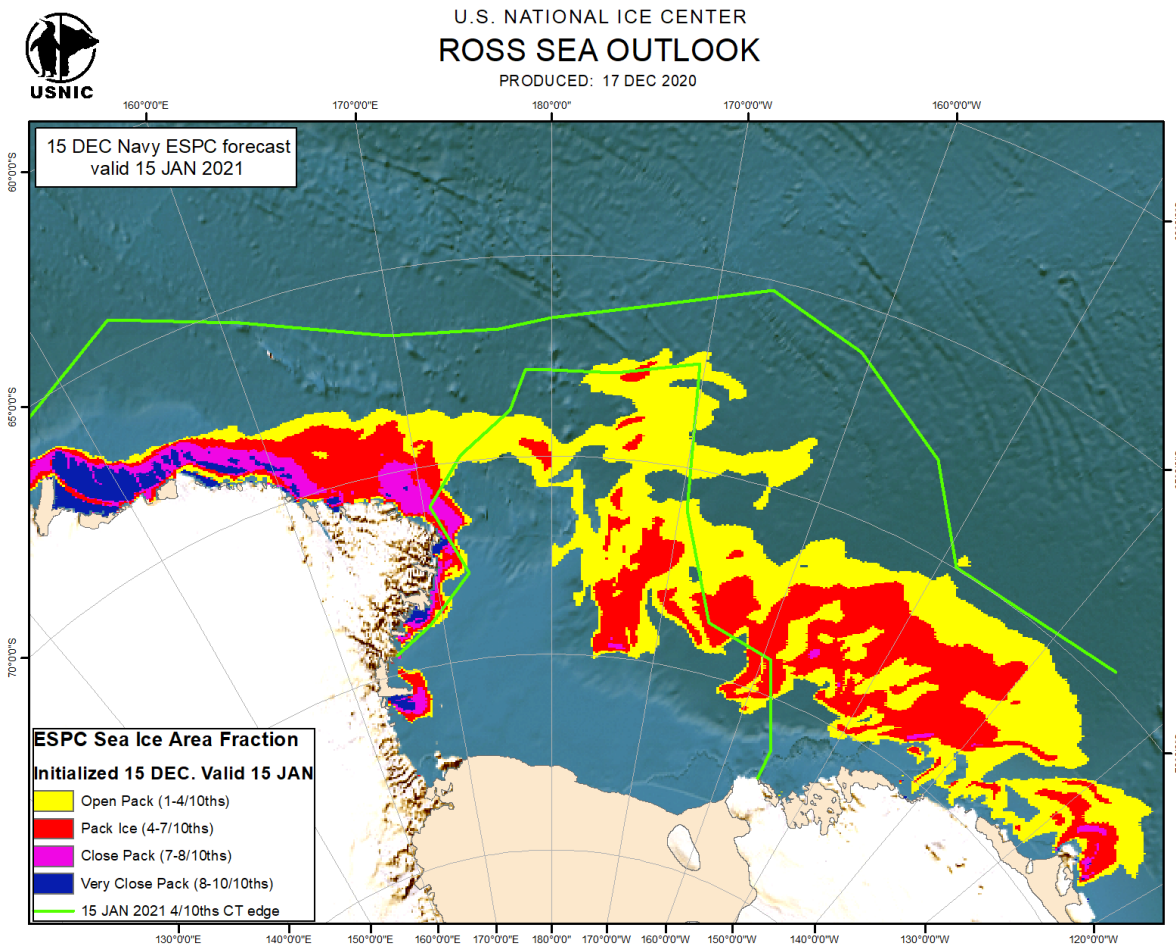

Figure 4. 15 Jan 2021 Navy ESPC 31-day sea ice fraction forecast compared to 15 JAN 2020 USNIC Outlook (green line).

Figure 5 (below) shows the USNIC Outlook for 01 FEB and the ESPC model forecast for 29 JAN 2021. The 45-day model doesn't go out quite as far as necessary in this case, however it doesn't really matter as the differences between the model and the outlook are more significant than a few days could correct. By this time, both forecasts show the shipping channel as wide open, but the model shows very little ice left at all. Only small pockets of 40-70% ice cover remain with a slightly larger area of 40% or less. There are higher concentrations in the western Ross west of Cape Adare, but significantly less than average and much less than the outlook. It would seem a bit early in the season to have so little ice left in the Ross Sea, although it would not be unprecedented. On the other hand the outlook probably leaves too much ice. One thing that seems consistent throughout these comparisons and the first validation analysis is that the outlook leaves significant ice cover a few hundred miles too far north. Sea ice that remains after the primary melt seems much more likely to be situated south of 70°S in the eastern Ross Sea. At the next outlook validation on 01 JAN we should have a much clearer idea whether the outlook will validate or if the open date will occur earlier than forecast as the ESPC model suggests.

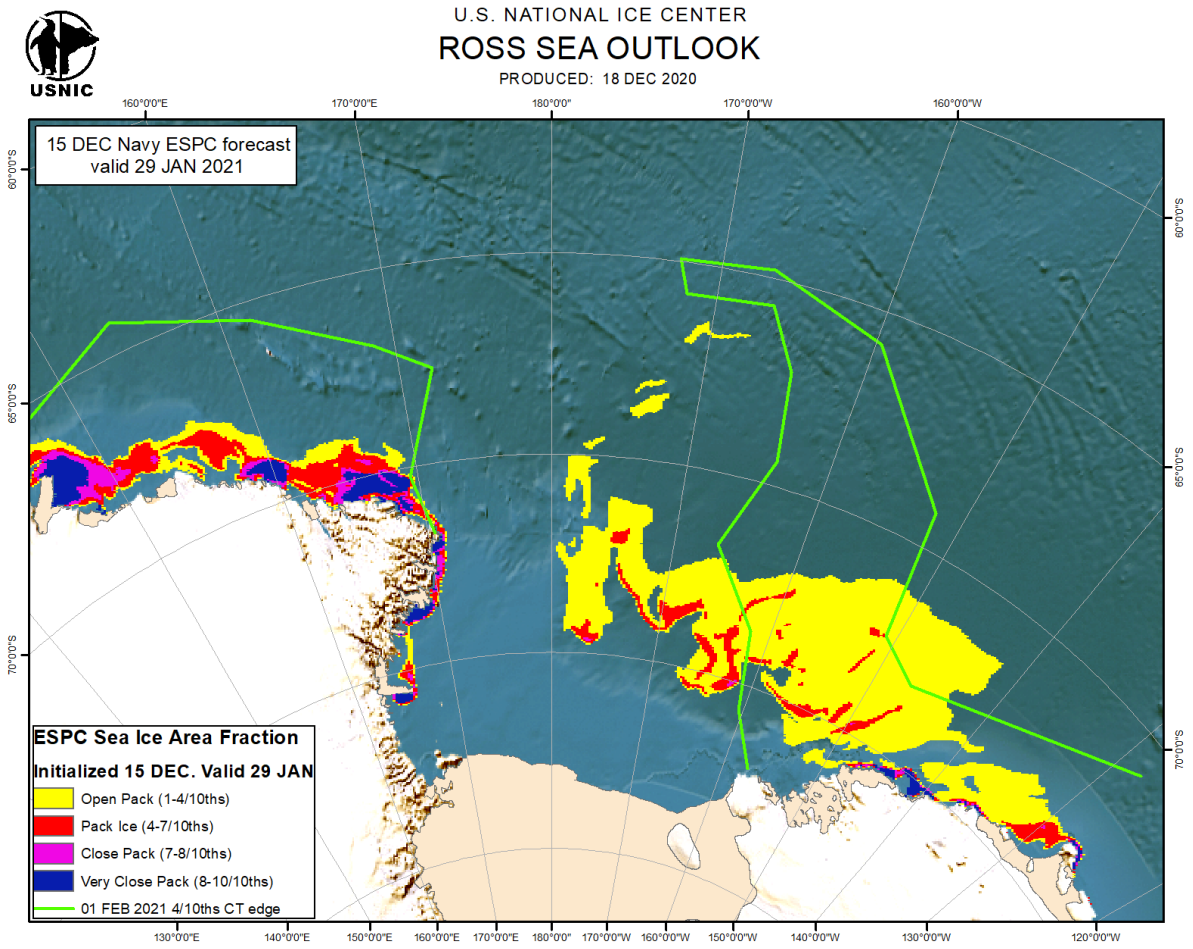

Figure 5. 29 JAN 2021 ESPC 45-day sea ice fraction forecast compared to 01 Feb 2021 NIC Outlook (green line).

REFERENCES

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