

NIC ARIFS Seasonal Outlook: Summary for 2010 Arctic Summer Season

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Overview

The 2010 Sea Ice Minimum, as declared by NSIDC, occurred on September 19, 2010, with a value of 4.60 million km². A false minimum was seen earlier in the month on September 10 at 4.76 million km². This represents the third lowest Arctic sea ice extent, after 2007 and 2008, although the 2008 value of 4.59 million km² essentially makes 2008 and 2010 a statistical tie in the numerical value of sea ice extent. However, spatially the distribution of ice was somewhat different, with a tongue of ice extending from the center of the Arctic toward Wrangell Island in 2010 and smaller protrusions into the Beaufort and Laptev Seas.

Model Performance

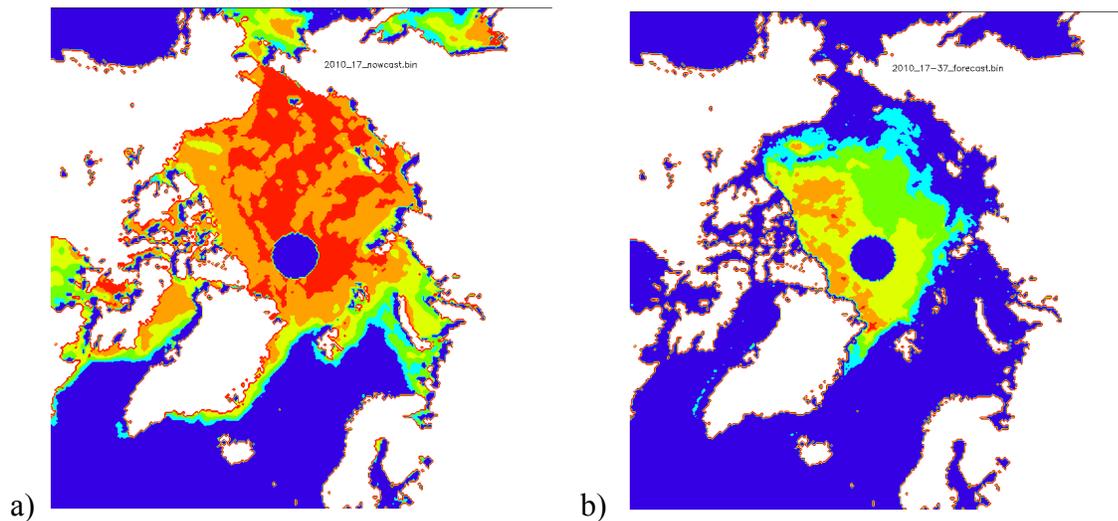
For the first time, the National Ice Center used a statistical forcing model rather than applying heuristic rules to the ice depending on the WMO egg codes at the time of forecast. The ARIFS (Arctic Region Ice Forecast System) code, developed by Sheldon Drobot and Charles Fowler at University of Colorado, was adapted to make use of ice concentration data and NCEP 2-meter air temperature and sea level pressure. For this year, SSM/I data was used rather than NIC charts; however future work will involve digitizing the charts and incorporating the model. Because of the use of SSM/I data, there was the usual “pole hole” at the North Pole due to lack of satellite coverage. Moreover, the model does not yet have the capability to predict ice conditions in the Canadian Archipelago. While the latter problem could have been addressed, we kept the model the same throughout the summer so that there would be a consistency in model forecasts.

The three forecasts for week 37, based on week 17, week 25, and week 31 data, their initial conditions, and the actual conditions for week 37 and week 38 of 2010 in the Arctic are shown in figure 1.

Although we used mid-September (week 37) as the target for the forecasts, the actual minimum occurred this year in week 38, so both are shown. ARIFS only produces forecasts on a weekly basis, consistent with the NIC’s weekly ice charts, and because of its lack of forecasting capability in the Canadian Archipelago, has an unknown low bias. The pole hole was corrected for using assumptions of 100%, 50%, and 0% ice concentration, but since this study is concerned only with the extent of sea ice, the actual concentration of ice within the pole hole is irrelevant unless there is none. Unlike NSIDC and other groups, NIC follows the WMO sea ice definitions and defines its ice edge at 10% ice concentration, while noting that areas with 0-10% ice concentration, while denoted as “open water”, may contain some ice.

From the figures, it is apparent that no one forecast captures the actual conditions in week 37/38 correctly. Instead, they hint at actual conditions, such as the Wrangell Island ice tongue, but do not capture the retreat of the ice in the Beaufort and Kara Seas. We note that the model performs better in some regions – the ice edge along the Atlantic side of the Arctic is consistent through the forecasts. A drawback of this model is that is completely statistically based. For a given predictor week (17, 25, 31) and predictand week (37), the model looks at the 10 previous years to develop a relationship between a point and every other point in the domain. However, if something has never happened, it would be impossible for this model to accurately predict it. That is to say, if the model were run for 2007, it would not have forecast the record minimum because those conditions had never been observed before. In the current situation, where we are still unsure if the Arctic is settling in to a new normal or is still in a state of decline, this method may not be robust enough to predict such extrema.

Nevertheless, for the purposes of NIC and its main stakeholders, the US Navy and US Coast Guard, it should provide enough information to give a general idea of where the ice will be at the end of the summer, and allow for situational awareness and readiness and allocation of resources in terms of search and rescue and national defense. It is likely that these light ice conditions will persist, or even continue to decline, making the Arctic Ocean viable shipping route in the summer, opening it to development of natural resources, and also eco-tourism. Like the other Arctic nations (Canada, Denmark/Greenland, Norway, and Russia), the U.S. must establish and maintain a presence in the Arctic and be ready to respond in the case of an emergency, whether it be an oil spill, a cruise ship, a cargo ship, or some hostile action.



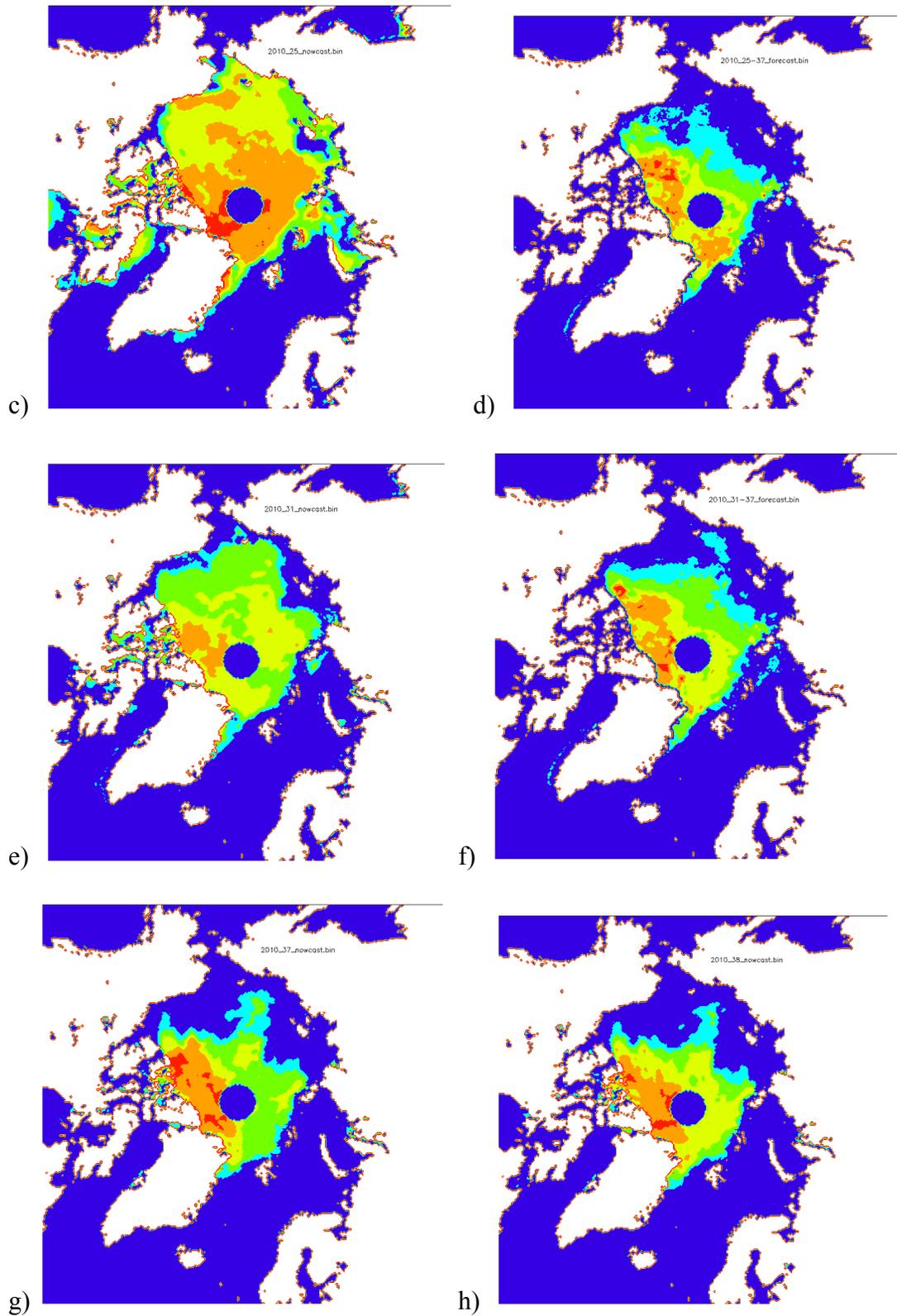


Figure 1: (a) Observed conditions of sea ice for week 17, (b) Forecast conditions for week 37 based on week 17 conditions, (c) Observed conditions for week 25, (d) Forecast conditions for

week 37 based on week 25 conditions, (e) Observed conditions for week 31, (f) Forecast conditions for week 37 based on week 31 conditions, (g) Observed conditions for week 37, (h) Observed conditions for week 38.