

THERMAL FRONTS OF THE CHUKCHI SEA

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Introduction.

In summer the Arctic marginal seas become ice-free, allowing satellite observations of ocean fronts to take place. We used the Pathfinder 1985-1996 SST dataset to study the Arctic Ocean thermal fronts, detected in all of the marginal seas. Here we present some results from the Chukchi Sea that show the great potential of the Pathfinder data processed with advanced algorithms for front detection and cloud screening.

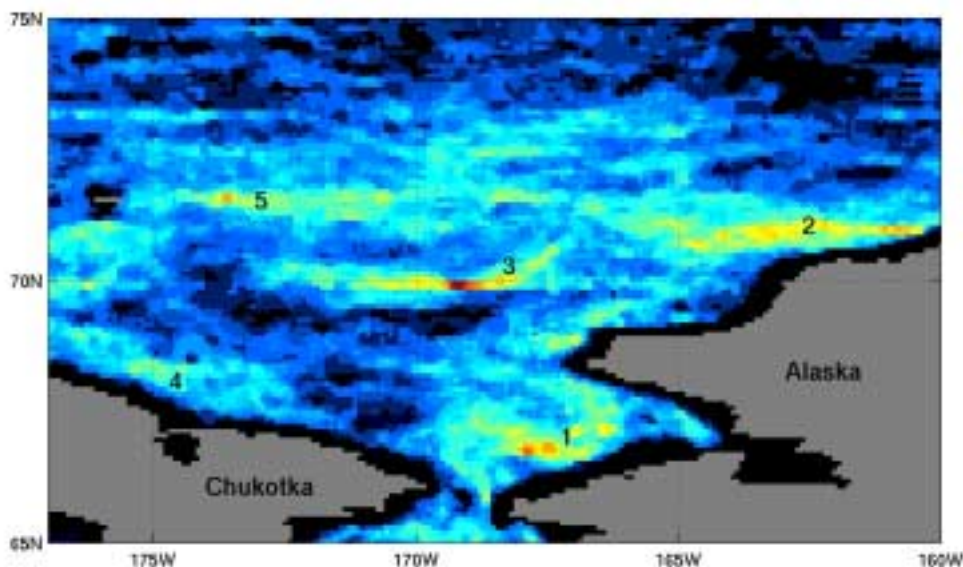


Fig.1. Long-term August frontal probabilities (Pathfinder SST data, 1985-96)

Data and Method

The original SST data are obtained twice a day from the AVHRR sensors on the NOAA/NASA satellites. The Pathfinder global 9-km resolution SST fields are available from JPL. The SST fields were declouded and SST fronts were objectively derived, by using two algorithms developed at the University of Rhode Island (Cayula and Cornillon, 1995, 1996). To date, we have processed the entire Pathfinder dataset from 1985-1996 (8364 twice-daily SST fields). Two types of maps are presented below: *frontal probability maps* (Fig. 1 and 2) and a *frontal composite map* (Fig. 3). The *probability maps* show the pixel-based frequency F of fronts normalized on cloudiness: For each pixel, $F=N/C$, where N is the number of times the given pixel contained a front, and C is the number of times the pixel was cloud-free. Thus, the

probability (frequency) maps are best suited for displaying the most stable fronts (e.g. Hickox et al., 2000). Some fronts, however, meander vigorously, thus defying their presentation with probability maps, in which case *composite maps* are mostly helpful that portray all the fronts detected in synoptic SST fields within a given time period.

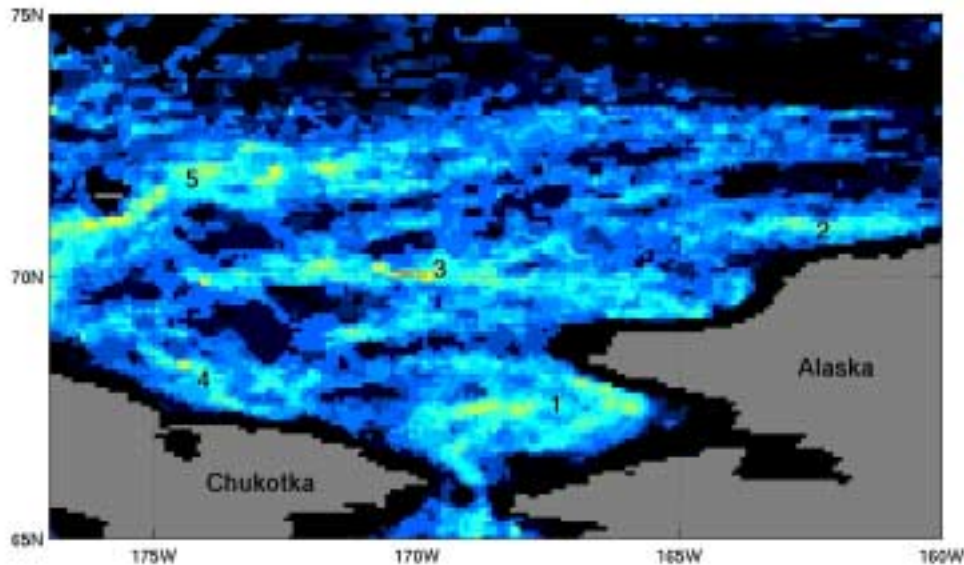


Fig.2. Long-term September frontal probabilities (Pathfinder SST data, 1985-96)

Results

The long-term (1985-1996) August and September frontal probability maps (Fig. 1 and 2) show a number of features in the Chukchi Sea at the peak of summer. Some of the features are easily identifiable, whereas others might represent newly found fronts (a caveat: based on satellite data alone, the below interpretations are tentative). Front 1 corresponds to the Bering Strait inflow that makes a quasi-stationary incursion into Kotsebu Sound. Farther north, front 2 extends zonally toward Point Barrow. This front might be an eastward extension of front 3 or 4 (Fig. 3). Front 3 is the most robust; the front's stability is accounted for by the strict topographic control: The front hugs the steep southern flank of Herald Shoal. Front 4 is associated with the Chukotkan segment of the Siberian Coastal Current, SCC, mapped by Weingartner et al. (1999) whose in situ dataset included CTD sections occupied during the same month (September 1995) as the satellite data used in Figure 3. Front 5 is best defined in September (Fig. 2 and 3) when it emerges as a northeastward extension of the SCC that veers offshore around Wrangel Island to pass through Herald Valley, then continues eastward at $\sim 72^{\circ}\text{N}$ north of Herald Shoal, as shown by Weingartner et al. (1999). An intriguing discrepancy between our results and Weingartner et al. (1999) is that front 5 in Fig. 3 veers offshore immediately downstream of Long Strait, not in the southern Chukchi Sea as shown in the SCC schematic by Weingartner et al. (1999, Fig.1). The reason for this discordance is unclear. Past Herald Valley, front 5 is roughly parallel to, and

located ~100 km south of the edge of sea ice cover, according to the NASA September 1995 sea ice data available from NSIDC.

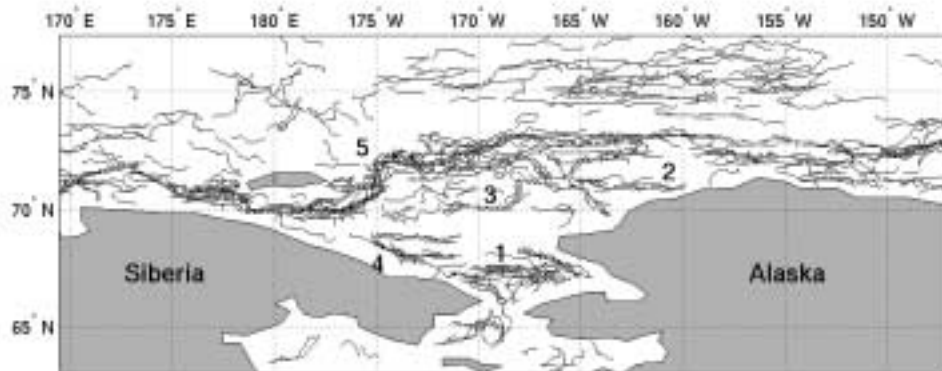


Fig.3. September 1995 SST fronts from Pathfinder data

Acknowledgments

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References

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