2. WEATHER CONDITIONS DURING PS122/1 (MOASIC LEG1)

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Friday 20th September – Tuesday 24th September 2019

In the evening of the 20th September *Polarstern* started from Tromsø to the research cruise PS122, titled MOSAiC. Calm weather accompanied *Polarstern* through the fjords and the northern Norwegian Sea. We passed the Barents Sea and the Kara Sea free of ice. In the late 24th September *Polarstern* approached to the northern tip of the archipelago of Severnaya Zemlya. During those first few days of the cruise we sailed on the edge of intense low pressure areas over northwestern Siberia. Increasing winds veered from south to easterly directions. From the late 22nd September average winds at 6 to 7 Bft were measured, for a short time even 8 Bft. The temperatures dropped from 5°C to 1°C. Cloudy conditions with some drizzle or snow dominated during the entire period. At first good visibilities were observed apart from precipitation, later often moderate visibilities occurred. On the 23rd and 24th September in response to strong to gale force winds the significant wave height increased temporarily up to 4 m.

Wednesday 25th September – Saturday 28th September 2019

Initially *Polarstern* passed the sea area close north of the archipelago of Severnaya Zemlya and arrived at the northern portions of the Laptev Sea. From now on we temporarily cruised through the sea ice. In the vicinity of the position of 80° north, 120° east we stayed for about two days for OBS recovery. The cruising area was situated between a low pressure system over northwestern Siberia and an anticyclone centered over the East Siberian Sea. Initially fresh to strong winds (5 to 6 Bft) blew from east to southeast, later moderate to fresh winds (4 to 5 Bft) from southeast to south. The air temperature dropped slightly from 0°C to -4°C. Cloudy conditions dominated. Occasionally light showers of snow or freezing drizzle hit *Polarstern*. Temporarily mist or fog patches appeared.

Sunday 29th September – Sunday 06th October 2019

During those days *Polarstern* cruised in the vicinity of 85° north and between 130° and 140° east. Relatively calm conditions with light to moderate winds (1 to 4 Bft) from northeasterly directions prevailed, but temporarily fresh to strong winds (5 to 6 Bft) were observed. The temperature range was from -4°C to -9°C. On the 5th October temperatures dropped to -13°C. Mist or fog patches with visibilities about 500 m appeared from time to time. Apart from fog or mist patches very good visibilities predominated.

Monday 07th October – Friday 11th October 2019

The working area at the floe and *Polarstern* were situated around 85° north, 135° east. Weather was influenced by a cyclonic system located north of the Queen Elisabeth Islands. At first westerly winds blew. The maximum average wind speed at 7 Bft was measured on the 8th October. After that decreasing winds turned to easterly directions for a while. On the 8th October temperatures reached -2°C. Later they dropped to -17°C. That time period was characterized by low level clouds, occasionally by light snowfall, and mist or fog patches. Apart from mist, fog or precipitation good visibilities were measured.

Saturday 12th October – Wednesday 17th October 2019

The influences of low pressure areas and weak high pressure ridges alternated. The working area was located close south of the 85th degree of northern latitude and between 130° and 140° east. Winds blew mostly at around 4 Bft and turned back from westerly to northerly directions. The air cooled further down. The temperature minimum of about -25°C was measured on 13th of October. Dominating good visibilities were briefly disturbed by mist or fog patches. Occasionally light snowfall was observed.

Thursday 18th October – Thursday 24th October 2019

An intense low pressure system developed southwest of the expedition area. On the 20th October the low pressure area was centered (< 985 hPa) over the northern Kara Sea. At the northern flank of the low pressure system a substantial pressure gradient established over the expedition area that was drifting near 85° north and between 135° and 130° east. In consequence of the pressure differences southerly to easterly winds blew at 6 or 7 Bft for a while. A temporary increase of the air temperatures brought a maximum of -7°C on the 22nd October. Low level clouds dominated accompanied with light snowfall. Mist or fog patches appeared at times.

Friday 25th October – Tuesday 29th October 2019

During those days *Polarstern* and the MOSAiC floe drifted northwestward between 85° and 86° north and 130° and 125° east, while a stable and intense high established over the central Arctic. The expedition area was situated on the edge of the high where moderate or fresh southeasterly to easterly winds (4 or 5 Bft) blew. Low level clouds and light snowfall or precipitating ice crystals were often observed. The sky cleared up temporarily. Short foggy periods occurred. Under cloudy conditions relatively high temperatures were measured. In the morning of the 29th October temperatures reached -12°C, the maximum in that time period. About -26°C was the minimum observed in the afternoon of the 27th October.

Wednesday 30th October – Thursday 07th November 2019

The working are was situated on the edge of the stable central Arctic anticyclone further on. *Polarstern* and the floe drifted close south of 86° north and between 125° and 116° east. Winds were blowing mostly moderate or fresh (4 to 5 Bft) from easterly directions. During clear sky phases temperatures dropped to values between -24°C and -27°C, while under clouds often -15°C to -20°C were measured. Longer periods with light snowfall or precipitation of ice crystals were noticed. Good visibilities dominated. Fog with visibilities lower than 1 km was observed for short times.

Friday 08th November – Thursday 14th November 2019

The weather conditions in our region (close to 86° north, 116° to 118° east) became more unsettled during that time period, as the center of the high pressure area shifted from the central Arctic towards Alaska. From the 8th to the 11th November a low moved from the New Siberian Islands to the Queen Elisabeth Islands. The MOSAiC working field was temporarily influenced by that low. Later a new intense anticyclone built over the eastern portions of the Laptev Sea. It shifted across the East Siberian Sea to the Beaufort Sea. Wind direction turned back from east to north. From the 11th November southerly winds established. Mostly 4 or 5 Bft were observed. On the 11th and 12th of November 6 to 7 Bft occurred for a longer period. At first the temperature range was -20°C to -30°C. At the end of the time temperatures climbed up to -13°C. Changes of cloudy periods and clear sky phases were noted. Precipitation of snow or ice crystals was often observed. In the presence of precipitation temporarily poor

visibilities occurred. In the morning of the 08th November fog with visibilities about 500 m appeared in the presence of an air temperature of -26°C.

Friday 15th November – Monday 18th November 2019

In those days the expedition area was situated close to 86° north, 120° east. It was affected by an intense low. It moved from northern Greenland across the North Pole to the Laptev Sea. Winds increased significantly. In the evening of the 15th November fresh winds (5 Bft) were observed. About 24 hours later measurements showed gale force winds (8 to 9 Bft). At first winds blew from west or southwest. On the 17th November the wind direction turned to north. After a temporary decrease, in the night and the morning of the 18th November wind speed reached a second maximum at 8 to 9 Bft. Temperatures changed rapidly. The maximum at -5°C was measured shortly after midnight in the 17th of November. A few hours later the minimum of -20°C was recorded. Frequently light snowfall associated with poor visibilities occurred. For a short time freezing fog appeared.

Tuesday 19th November – Friday 22nd November 2019

Polarstern and the MOSAiC floe still drifted in the vicinity of 86° north, 120° east. From the area of Greenland a further cyclone moved across the Pole to the region of Severnaya Zemlya. That low was less intense as its predecessor. Winds veered from westerly to northerly directions. In the night of the 20th November the maximum average wind speed was observed. It came to 6 Bft. Later gentle or moderate winds (3 or 4 Bft) blew often. In front of the low a new wave of relatively mild air was advected into the expedition area. On the 19th of November a maximum of -6°C was measured. Later temperatures between -15°C and -23°C were observed. The weather was characterized by the presence of clouds. Temporarily light snowfall and fog patches caused visibilities lower than 5 km, for short periods lower than 1 km.

Saturday 23rd November – Tuesday 26th November 2019

A new intense low moved from the region of Svalbard to the northeast. Before it arrived at the MOSAiC area it turned to the south towards the Kara Sea. The expedition area was situated close to 86° north, 120° east. After a short calm period in the morning of the 23rd of November southerly winds increased significantly. In the following night wind speed at 7 Bft was measured. Later decreasing winds turned back to easterly directions. The temperature range was -15°C to -28°C, with the lowest values measured at the end of the period. Precipitation of snow or ice crystals was often observed. Temporarily poor visibilities lower than 5 km appeared.

Wednesday 27th November – Saturday 30th November 2019

The expedition area was situated close to 86° north and between 118° and 112° east. The large scale weather situation was characterized on the one hand by a low pressure zone extended from the Beaufort Sea to the Laptev Sea and on the other hand by a high that drifted from the area north of the Canadian Arctic Island to the east. Between those pressure systems weak troughs and ridges propagated across the expedition area and caused slightly unsettled weather. At first moderate (4 Bft) later fresh to strong (5 to 6 Bft) winds blew. They turned back from southeast to northwest. Air temperatures between -21°C and -32°C were measured. The minimum appeared in the early 28th November, the maximum in the evening of the same day. Weather alternated between longer clear periods and cloudy episodes with light precipitation. Short-term phases with poor visibilities occurred.

Sunday 01st December – Thursday 05th December 2019

The expedition area was influenced by an intense high pressure zone extending from Siberia to the East Siberian Sea. A new high pressure center formed in the vicinity of the New Siberian Islands. The pressure difference between the high pressure zone and a cyclonic area stretching from Greenland to the Barents Sea was remarkable. It resulted in a strong southwesterly airflow over the MOSAiC floe. Temporarily a relatively mild air was carried into the expedition area. At first temperatures at about -27°C were measured. They rose up to -15°C observed on the 4th December. Winds turned back from northwest to southwest. They increased significantly. On the 3rd December average wind speed reached 7 to 8 Bft. During the next two days winds at 6 or 7 Bft were often measured. Longer lasting snowfall or blowing snow with poor visibilities occurred. Temporarily visibilities lower than 300 m were observed.

Friday 06th December – Friday 13th December 2019

An anticyclone shifted from the area north of the New Siberian Islands to the Beaufort Sea. Initially the MOSAiC expedition area was situated on the edge of an associated high pressure ridge that extended across the North Pole to East Greenland. Later from the Laptev Sea a new ridge approached to the MOSAiC expedition area. The counterpart of the high pressure was a low pressure zone extending from North Europe to Northwest Siberia and to the adjacent sea areas. At times a trough spread to the Pole and influenced the MOSAiC working area. *Polarstern* and the floe were situated in the vicinity of 120° east and close north of 86° north during those days. After a calm period on the 6th and 7th of December a southerly to southeasterly airflow freshened up. From the night of the 8th December often fresh or strong winds (5 to 6 Bft) were measured. At the end of the 11th of December winds calmed down. On the following day moderate northeasterly winds established. The typical temperature range was -27°C to -20°C. Maxima at -18°C were detected on 7th and 10th of December. Good visibilities dominated. On the 12th of December due to mist and fog patches at times visibilities deteriorate significantly. A minimum visibility about 100 m was measured. Light precipitation of ice crystals was often observed. On the 13th of December at noon Leg1 of MOSAiC ended.