Supplement of

How does the ice sheet surface mass balance relate to snowfall? Insights from a ground-based precipitation radar in East Antarctica

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Abstract. Supplementary material to "How does the ice sheet surface mass balance relate to snowfall? Insights from a ground-based precipitation radar in East Antarctica" as submitted to The Cryosphere.

Variable	Sensor	Range	Accuracy
Air temperature	NTC thermistor	-60° C to +40° C	< 0.1° C
Snow temperature	NTC thermistor	-60° C to +40° C	< 0.1° C
Relative humidity	Sensitrion SHT35	0 - 100 %	1.5 %
Shortwave radiation	Kipp & Zonen CNR4	0 - 2000 Wm^{-2}	< 5 %
Longwave radiation	Kipp & Zonen CNR4	0 - 2000 Wm^{-2}	< 10 %
Wind speed	R.M. Young Company Wind monitor 05103	0 - 60 ms^{-1}	0.3 ms^{-1}
Wind direction	R.M. Young Company Wind monitor 05103	0 - 359 °	3°
Snow Height	MaxBotix HRXL MaxSonar WRS	0.5 - 5.0 m	0.001 m
Pressure	Freescale Xtrinsic MPL3115A2	20 - 110 kPa	0.4 kPa

Table S1. The new AWS instrument specifications. All measurements are taken 2 meters above the surface.
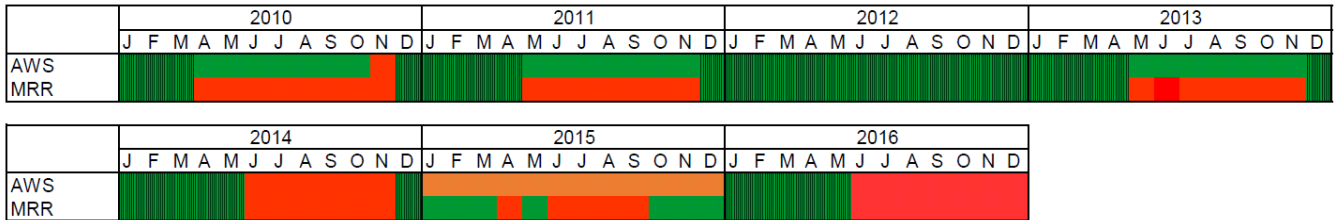
Figure S1. Months at which data is available for at least 80 % of the time (denoted by green). Other months are denoted in red. Orange months denote data is available, but the quality is doubtful. Only shaded time periods are taken into account in the analysis.
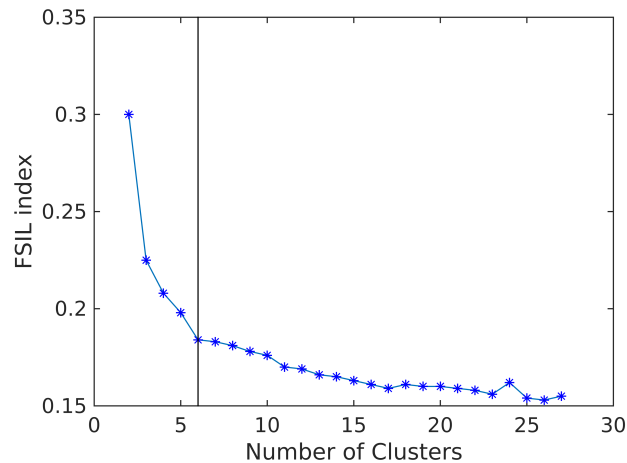
Figure S2. Fast Silhouette Index denoting the skill of the circulation pattern classification algorithm. Lower values denote higher skill. The local optimum at a total number of six circulation patterns is indicated by the black vertical line.

S1 Circulation climatology

In this section, a detailed description of each circulation pattern denoted in Fig. 3 in the main text individually is given.

During circulation pattern 1 the station is under the influence of an anticyclone. Two low-pressure systems are visible west and east of Dronning Maud Land, nicely visualising the Antarctic circumpolar trough. As this anticyclone dominates over the region around the PE station, the region experiences relatively calm conditions. Airflow originates mainly from dry inland areas, limiting the amount of moisture transported towards Dronning Maud Land. As such, no precipitation is expected during this type of circulation pattern.

In circulation pattern 2 the cyclone northwest of Dronning Maud Land has moved slightly to the east, visualising the west-to-east movement of the Antarctic circumpolar trough. Air turns clockwise around cyclones, directing air masses from oceanic areas towards the AIS. These marine air masses have the potential to take up moisture and transport it to the AIS. Most of the resulting precipitation / snowfall is formed at the coastal areas of Dronning Maud Land, as winds are forced to rise against the Antarctic plateau (Fig. 1 in the main text). The movement of the precipitation system is clearly visible, including increased snowfall amounts along the coast (Fig. 3 in the main text). The cyclone is however located west of the prime meridian, limiting precipitation to the coastal areas west of the PE station.

During circulation pattern 3 the cyclone has moved more towards the east and is now located NNW of the PE station. The cyclone transports marine air and precipitation towards the PE station, following the same advection principle as stated above. Due to the coriolis force and friction, the surface winds have a strong eastern component at the PE station. A similar circulation is found in circulation pattern 4. However, as the cyclone moved even more towards the east, highest snowfall amounts are expected in the eastern part of Dronning Maud Land.

Circulation pattern 5 & 6 show a continuation in the movement of the cyclone towards the east. The system is now located northeast of the PE station and is moving away from Dronning Maud Land. The station is now mainly influence by the high-pressure core that extends to the north. This leads to similar calm conditions as found for circulation pattern 1. Therefore, the station experiences no precipitation and a katabatic wind regime originating from the mountain ranges in the south and the Antarctic plateau can manifest.