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Synoptic climatological study on precipitation in the Hokuriku District of Central Japan associated with the cold air outbreak in early winter (With Comparison to that in midwinter for the 1983/1984 winter)

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In midwinter, heavy snowfall events are often brought in the Japan Sea side of the Japan Islands by the organized convective snowfall systems in the cold air outbreak situations. However, although the air temperature around the Japan Islands is still rather higher from November to early December ("early winter"), the "wintertime pressure pattern" often appears due to the considerable development of the Siberian high already in that season. Since the seasonal cycle in East Asia shows great variety with many rapid seasonal transitions influenced by the Asian monsoon system, detailed comparison of the daily precipitation climatology and the relating atmospheric processes in the cold air outbreak situations between early winter and midwinter would give us an interesting information for comprehending the overall aspects of such seasonal cycle there. Thus the present study firstly examined the daily precipitation climatology mainly at Takada, as an example for Hokuriku District, during the early to mid- winter of 1970/71 to 2009/10. Then the detailed analyses were made for the 1983/1984 winter (one of the coldest winters during that period) based on the operational meteorological data by JMA, including the ocean buoy data in the southern part of the Japan Sea for evaluating the sensible and the latent heat fluxes from the sea (referred to as SH and LH, respectively).
The total precipitation at Takada in early winter was as large as in midwinter, although it was brought mainly not as snow but as rain. Such large climatological value was mainly reflected by the precipitation in the "wintertime pressure pattern" with large contribution of the days with more than 30 mm/day. Interestingly, mean daily precipitation in the "wintertime pressure pattern" in early winter was greater than in midwinter. It is noted that such features were generally found even in the latter half of the analysis period when the warmer winter years appeared more frequently than in the former half.
According to the case study for 1983/84 winter, although the "wintertime pressure pattern" appeared rather frequently already from early November, each event of that pattern tended to persist only a several days. In addition, the organization of the shallow convective clouds in the cold air outbreak situation as often found in midwinter was not clearly observed. However, strong cold air advection in early winter as in midwinter over the warm underlying sea, at least in the mature stage of each "wintertime pressure situation", seems to enable the extremely huge amount of LH and the equivalently intense SH to that in midwinter, resulting in the large daily precipitation there through the enhancement of the air mass transformation process over the Japan Sea.