

The Australian Wind Profiler Network and its role in Numerical Weather Prediction

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The Australian Government Bureau of Meteorology completed the installation of a network of nine new wind profiling radars (WPRs) across Australia in 2017, and have commenced upgrading four more older profilers to the same standard, resulting in an operational network of 13 instruments. There are two WPR classes, with Boundary Layer (BL) Profilers in Ceduna, Mildura, Cairns, Coffs Harbour and Mackay, and Stratospheric Tropospheric (ST) Profilers in Halls Creek, Tennant Creek, Carnarvon and Longreach. The profilers to be upgraded are all BLs and are located at Sydney, Launceston, Canberra and East Sale. In addition to the operational Bureau network, ATRAD Pty Ltd, the University of Adelaide, the Australian Antarctic Division and Mt Isa Mines operate profilers in Adelaide, Davis Station in Antarctica, and Mt Isa, respectively, representing a network of 17 instruments across Australia. While Australia has had multiple research and operational profilers in the past, we believe the profiler coverage is now sufficiently dense as to call it the Australian Wind Profiler Network. The network has revealed both greater information gains on previously known phenomena, such as the frequency of low-level jets at Tennant Creek, and also previously unknown phenomena, such as a small temporal scale wave pattern at Ceduna, associated with the formation of the convective boundary layer. In addition to Australia, there are several other cohesive profiler networks such as those in Japan, China and Germany, and many other profilers of various types and frequencies across the globe.

Data from the Australian operational network are used directly by Bureau forecasters, and are broadcast on the GTS (see e.g. <http://www.eumetnet.eu/radar-wind-profilers>), and are currently being ingested into Australian and global Numerical Weather Prediction (NWP) models. The network is also used for research studies into areas such as precipitation. The Adelaide Airport site is of particular interest, as it is within the scanning footprint of the Buckland Park Weather Watch radar, which has recently been upgraded to dual polarisation. Profiler and weather watch retrievals of the rainfall drop size distribution can thus be compared and contrasted in the vertical column above the site, and the technique can potentially be applied at other profiler sites around Australia.

The impact of profiler data, or in fact any data, on NWP forecast skill is the subject of ongoing research and presents significant challenges. Data quality, timeliness of data delivery, frequency of observation and density of like measurements are among the variables contributing to the challenge. Criteria of data acceptance also vary across the major models, which leads to data acceptance in some models where it is rejected by others. Impact of the Australian profiler network on the Australian Community Climate and Earth-System Simulator (ACCESS) is currently being studied and has highlighted some interesting features and directions for future work. Beneficial forecast impacts are greatest from observations from the west coast of Australia and appear to have a seasonal dependence in the case of east coast observations. There also appears to be a dependence on height and wind direction. This talk will discuss the impact of wind profiler data on both Australian and global NWP, and examine some case studies such as precipitation retrievals, low level jet occurrences and the Ceduna wave pattern.

Keywords: Wind Profiler, Numerical Weather Prediction

