6.14 COMBINING WEATHER RADAR SYSTEMS TO IMPROVE REAL TIME RAINFALL ESTIMATION FOR URBAN FLOOD MONITORING AND PREDICTION

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Weather radar base moments including especially polarimetric moments are used for classification The occurrence of high rainfall in Auckland, New Zealand sometimes leads to urban flooding events and waste water treatment problems. Auckland is a challenging city from a stormwater management perspective, as the urban area is rather large but sparsely developed, having a population of some 1.5million spread over 1000 km^2. Our research is directed to improving the real-time estimation of rainfall over cities and to produce immediate Average Return Interval (ARI) maps and forecasts using radar nowcasting in support of Auckland City's stormwater and wastewater management.

The existing national C-band radar network, operated by the NZMet Service, is currently processed operationally for Auckland Council to generate accumulation maps using a fixed Z-R relationship. The nearest radar the central business district of Auckland City is some 70 km distant and partly beam blocked, adversely contributing to the quality of the real time rainfall data. Gauge calibration, while effective at generating unbiased accumulation maps, has proved problematic in real-time as some of the gauge data can take longer than 1 hour to be available and sometimes fails to be reported completely. The gauge adjusted radar data is therefore not useful for understanding unfolding urban flooding, or indeed as input to nowcasting.

To address this situation, the city has tested using a vertically pointing Doppler radar (MRR-2 Metek GmbH), calibrated with tipping bucket rain gauge(s) setup and maintained to WMO standards, at a location 30 km from the C-band radar (in the direction of the City). From the 1+ year dataset we determined that the Auckland C-band radar has a bias of -3.1dBZ and identified a climatological of Z-R relationship of Z=250R1.4, rather than the operational 200R1.6 assumed in the network. We also found that using the VPR in real time we could successfully diagnose significant C Band radar radome wetting attenuation events.

Applying the experimentally determined Z-R climatology or real-time Z-R, along with correcting for the reflectivity biases, resulted in operationally useful skill, with negligible lag, for detection and alarming of short-duration, high intensity events exceeding 5, 10 and 20 year ARI thresholds over the northern and central parts of the city. The well know range related limitations of C-band radars tend to negate improvements at longer range over the southern part of the region.

Even with the careful calibration of the C-band radar, range effects degrade results in South Auckland. For some time we have been using two small X band

radars to give high space time resolution rainfall information in regions not well served by the C band system. We have reported on these results earlier but we are now attempting to combine all three radar systems to give a better real time estimate of the operationally significant urban rainfall events in Auckland.

The real-time VPR corrected accumulation maps will be ingested into the STEPS nowcasting model. For the real-time rainfall estimation and nowcasting of extreme events we have found that the well-calibrated combined radar measurement available immediately is far more useful operationally than the gauge corrected product available too late.