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# Regional and National Weather Radar Priorities and Requirements – Region V

### SUMMARY

This document provides information on Regional and National Weather Radar Priorities and Requirements in Regional Association V (South-West Pacific).

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# Current status of the RA-V Weather Radar Network

There are currently at least 124 operational Weather Radars within RA-V, managed by: Australia (61), Indonesia (40), Malaysia (12), New Zealand (9) and Singapore (2). Within the Regional Association, Fiji, New Caledonia, the Philippines and Brunei also operate Weather Radars.

The Australian Weather Radar network is extremely heterogeneous, with a mixture of S and C bands, magnetron and klystron transmitters, varying beamwidths and equipment of varying ages. All operational radars are currently single-polarisation.

The Indonesian Weather Radar network consists of 36 single-polarisation C-band radars, 3 dual-polarised X band radars and 1 single-polarised X-band radar. Indonesia’s radars are designed by a range of manufactures. An additional 3 X-band, dual-polarised radars are operated by the Indonesian Air Force.

Malaysia operate 12 Weather Radars, which are a mixture of C and S band, from several manufacturers. Two radars are dual-polarisation, while the rest are single polarisation.

The New Zealand Weather Radar network consists of 12 C-band radars, of which 4 are dual-polarisation.

The Singapore Weather Radar Network consists of two dual-polarisation radars; one S band, one C band.

Other National Meteorological Agencies operate weather radars within the region, but detailed information was not available at time of writing.

# Current Applications of Weather Radar Data

Within RA-V, Weather Radar data is used as a tool in its own right to aid forecasters in the monitoring and prediction of severe weather and the issuing of severe weather warnings, and also for forecasting of marine and aviation weather, including wind shear detection. Most countries within the region have data available in some form for the public, as well as providing industry-specific products and services.

Weather Radar data is used is a principle input into various Nowcasting products, especially QPE and thunderstorm tracking. QPE is considered a critical radar-derived product, as it provides a “real world” translation of radar data with far-reaching applications from agriculture to hydrology and flood forecasting.

Despite the variety of different radar types and configurations, there are a number of composite products from both within a country (e.g. National mosaics) and across multiple countries (e.g. RA-II, RA-V mosaics).

# Future Priorities for RA-V Weather Radar Networks

With the exception of Singapore, all RA-V countries operate a mixture of single- and dual-polarisation radars. A consistent priority is that radars should be upgraded to dual polarisation in the future. Moving to dual-polarisation radars provides that advantage of allowing more accurate target identification and clutter removal, which considerably improves the quality of the radar data and allows for much more accurate products, especially QPE. Many countries operate radars with beamwidths up to 2°, and upgrading to 1° in the future is seen as highly desirable. An increase in the quality and reliability of radar data lends itself to the ability to reliably ingest radar observations into NWP models, which may lead to improved forecasts.

At least Australia, Malaysia and New Zealand are considering network expansion in the future to improve overall radar coverage. New Zealand planning to install a new radar near Dunedin within the next two years, and will review the possibility of installing an X-band gap-filling network, to improve coverage around otherwise unmonitored areas, in the future.

Without exception, improved data quality is desired for the future, and this is generally considered to follow from modernisation and improvement of radar technology (e.g. smaller beamwidth, dual polarisation). Improved quality of Nowcast products, especially QPE, is highly desired, both by improving the quality of the radar observations (e.g. improved calibration, target classification through dual polarisation) and through the improvement and expansion of ground networks (e.g. rain gauges, disdrometers).

As well as QPE, other blended products are either currently being developed or planned for development. These include radar/satellite (Himawari-8) products as well as integration of radar, wind and aerosol (lidar) measurements. New products will allow for new, or improved, applications such as using radar and satellite products for air traffic control.

Intra- and inter-regional collaboration will also be critical in the future of weather radar products. Mosaics of radar data over South East Asia are already being produced through RA-II and RA-V collaboration. Techniques for monitoring the calibration and status of radars using other instruments (e.g. GPM, rain gauges, radar remote monitoring systems) are currently in use or being developed both individually and through collaboration. Increasing the collaborative effort on these products will allow for a greater improvement, and for lesser effort, of the quality of weather radar data and derived products within RA-V and beyond.

# Issues and Limitations for Weather Radar Operation

There are a number of issues facing operating weather radar networks in the future, most of which are common to all countries within the region, and indeed the rest of the world.

The first is budget. There is an increasing pressure to do more with less, and obtaining funding to maintain, sustain and upgrade radars is increasingly difficult. Radars can be expensive to maintain, especially when the networks are heterogeneous and may not have a large number of common spare parts. Operating a network of identical, or nearly identical, radars provides efficiencies in the maintenance of the network, however the cost of replacing an entire network of radars (e.g. 40 radars in Indonesia, or 61 in Australia) is considerable. With all members of RA-V planning to upgrade their radars in the future, the availability of funding will likely dictate how and when these upgrades occur.

The availability of spare parts, especially for older systems, can be limited. Parts can become obsolete, and may require complex engineering solutions to provide alternatives. Ideally, this should be handled at the manufacturer level, but older radars may no longer be manufacturer-supported, especially when they are require to be operated beyond their planned lifetime.

Expertise is another commodity that is considered increasingly scarce. The availability of radar specialists, either for maintenance and support, or development of radar products, is thought to become increasingly limited in the future. A reduction in the availability of radar expertise, coupled with the increased maintenance complexity of dual-polarisation radars may lead to poor quality radar data in the future. This is an area where collaboration with other members is critical to developing and maintaining capacity.

The availability of sites on which to locate a radar is another issue which may become problematic in the future. Siting a weather radar can be a complex task, and providing good quality radar data and coverage of an area while avoiding clutter (e.g. from wind turbines, cities, mountains, etc.) while also avoiding high costs (e.g. site leasing, power and communications costs) compounds the challenge.

Critical to the operation of any radar system is the protection of the radio frequencies used. Weather radar frequencies, especially at C and S bands are constantly under threat, either from telecommunications companies or from wireless LANs operating within the band. Once an interfering signal is present, the quality of the data suffers and it can be difficult to trace and remove the source of the interference, even using the local regulatory bodies. This issue impacts on all weather radar operates and highlights the importance of collaboration with external bodies (e.g. ITU) and other WMO bodies (e.g. SG-RFC).