

Improving Operational Use of Scanning Rain Radar Estimates with Vertically Pointing Radar



Luke Sutherland-Stacey *Weather Radar NZ* www.weatherradar.co.nz

Tom Joseph Mott MacDonald

Geoff Austin *Weather Radar NZ*

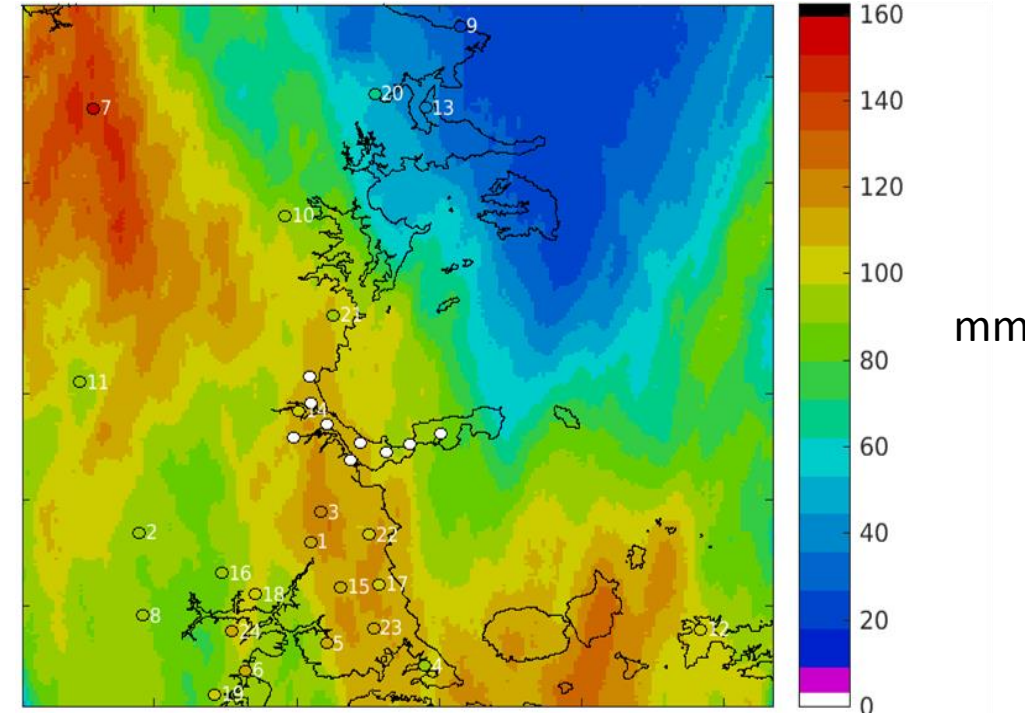
Ken Williams, Nick Brown, *Auckland Council Healthy Waters Department*



Scanning the atmosphere to do
useful stuff

Talk Overview

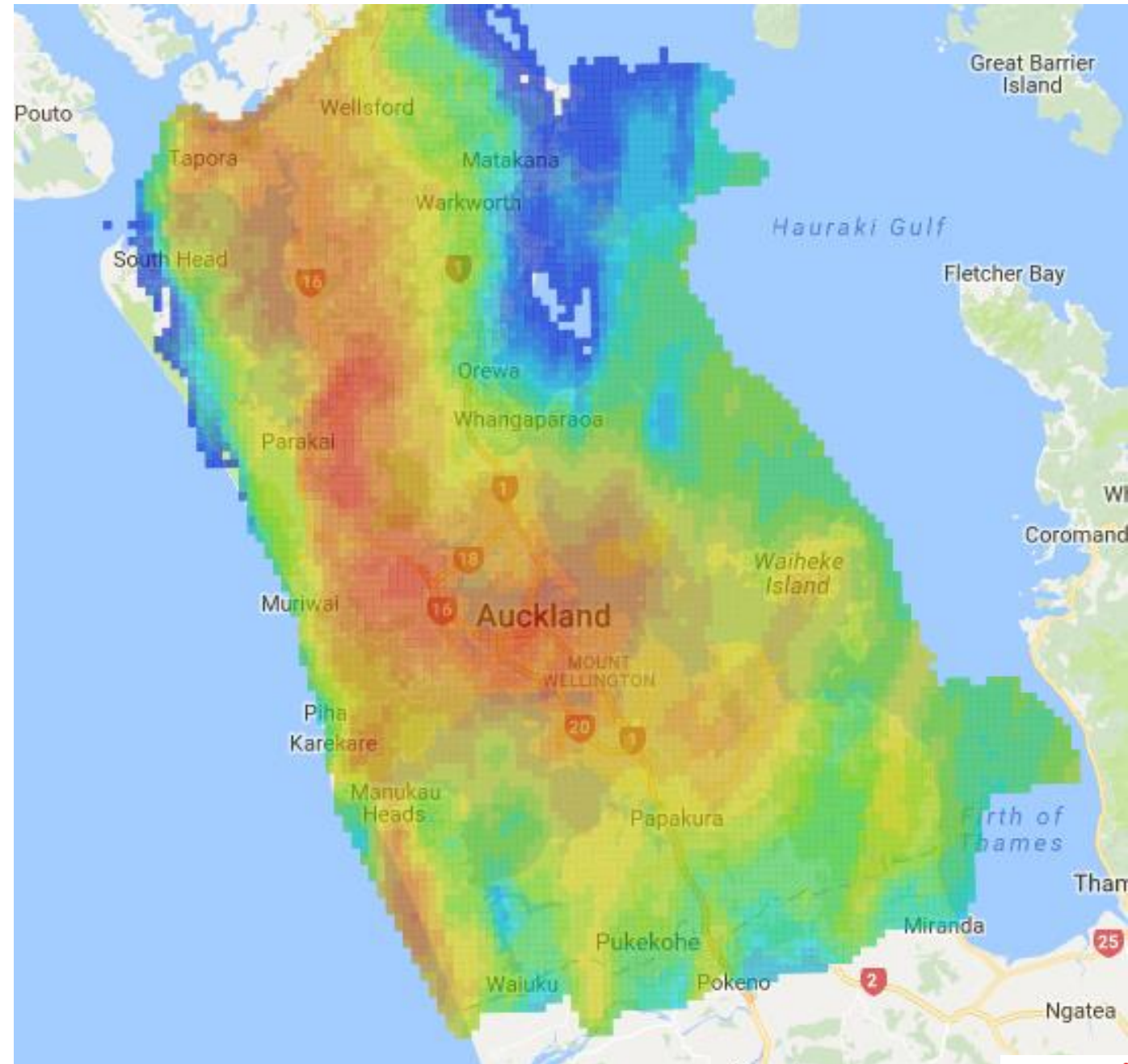
1. What we've done so far with Rain Radar
2. Motivation for better rainfall measurements
3. Technical Problem – Z-R Relationship, sampling scale
4. How does vertically pointing radar help?
5. What it means for Auckland Council.
6. What it means for other Councils in NZ.



1. What We've Done So Far....

‘Like, So Last Year!’

- Live stream Metservice Rain Radar to online platform
- ‘Corrected’ radar depth accumulation from gauge based bias adjustment
- Convert to ARI
- As real time as the gauge network is



2. What We Want to Do...



We'd like to predict events like this

Forecasting...



Uncertainty increases every time we extrapolate

Flood Forecasting

**Numerical Weather Prediction (90
minutes – 6 hours)**

**Radar 'now casting'
(0-90 minutes)**

Real time radar

Reducing Uncertainty in Base Data

*Confidence
in data*

*Situational
Awareness*

High resolution
localised radar?

High

Best

Real time VPR
corrected?

Increased

Better

Climatic average
VPR corrected

**Same
(but faster)**

Good

Gauge corrected
radar

Reduced

Increased

Rain Gauges

High

Low

3. Technical Problem

- Z-R Relationship
- Sampling Scale

4. How does Vertical Pointing Radar (VPR) help?

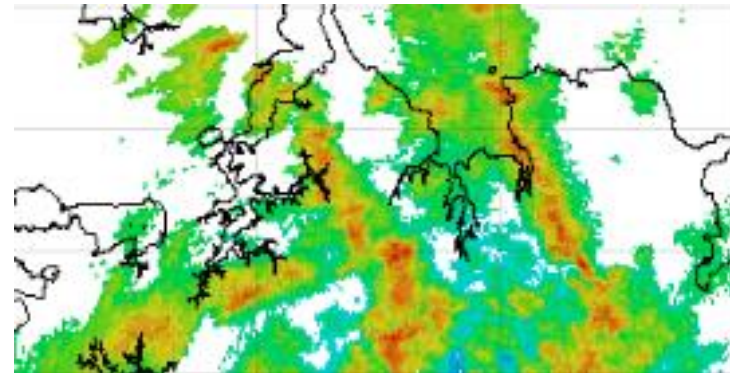
Caution.

How did we get there? - more QC.

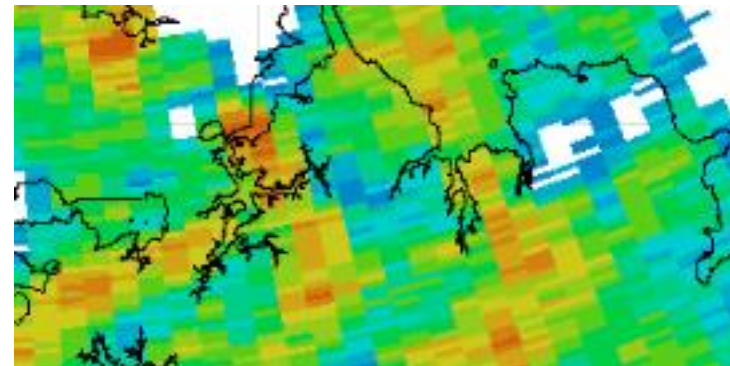
Requires very careful calibration of the NZ Metservice radar

Difficult to compare radar with rain gauges because of the

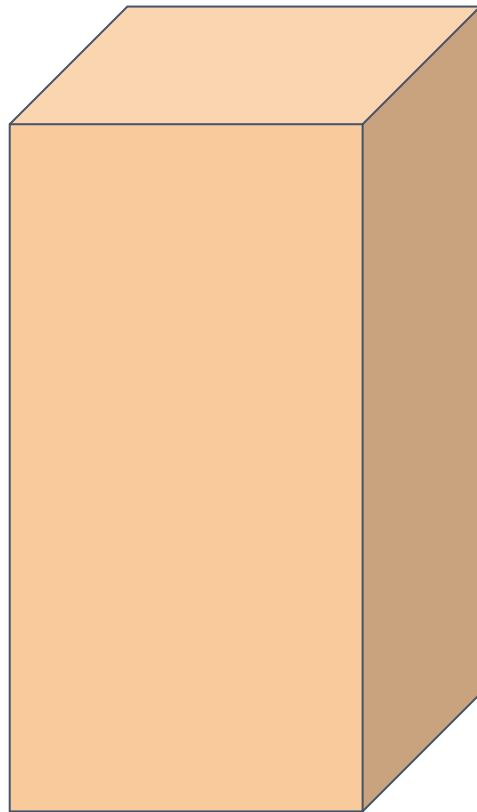
Sampling Scale Problem.



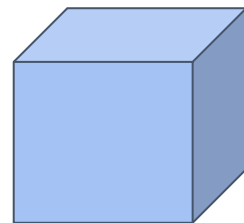
Local X-band
100x100x pixels,
every 20 sec



Local X-band
125x1000x pixels
every 7.5 minutes



C-band Radar Sampling
Volume
~125x1000x1000m

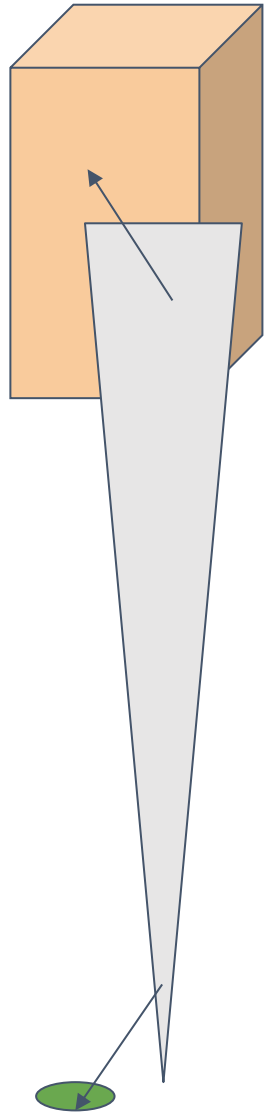


X-band Radar Sampling
Volume
~100x100x100m

Rain Gauge Sampling Area
20cm dia., not within either
volume, and possibly not
even under the volume



How did we get there? - QC.



Calibrate the VPR by comparison with a co-located rain gauge,

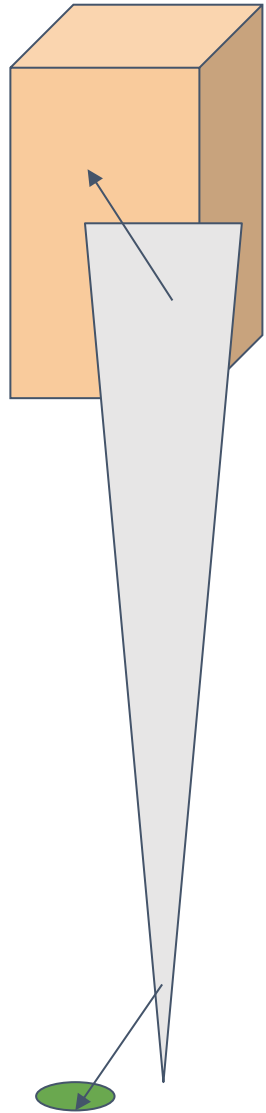
Calibrate the C-band radar by comparison with the coincident VPR measurements



Requires very careful calibration of the NZ Metservice radar

Easier to compare C-band radar, and rain gauges with Vertically pointing radar.

How did we get there? - QC.

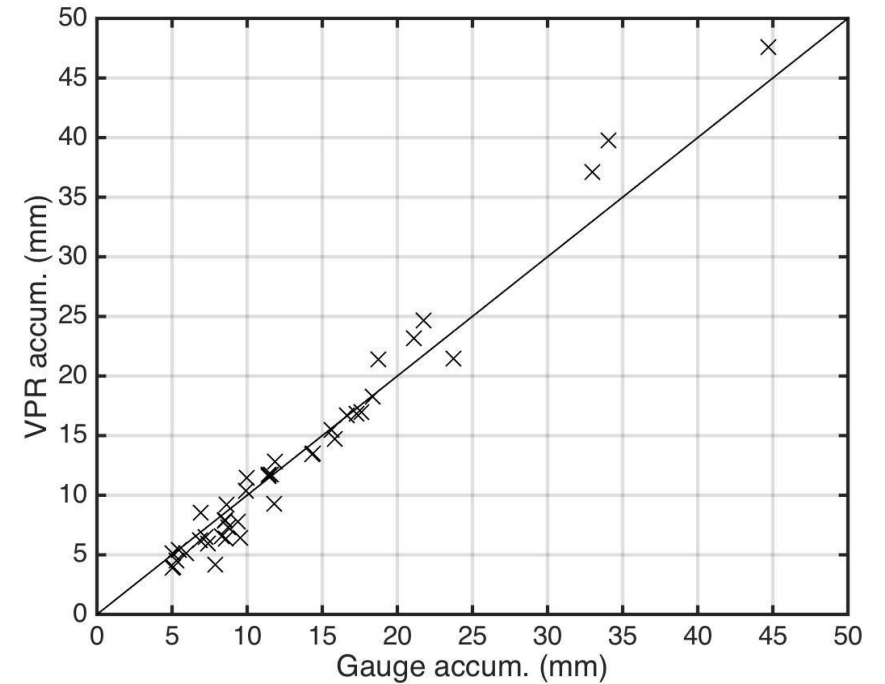
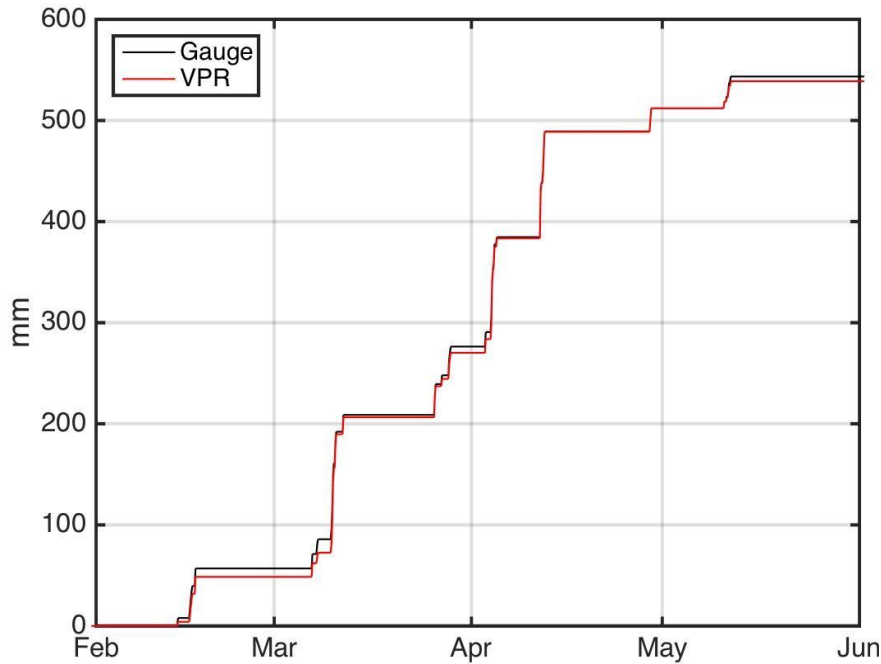


Calibrate the VPR by comparison with a co-located rain gauge,

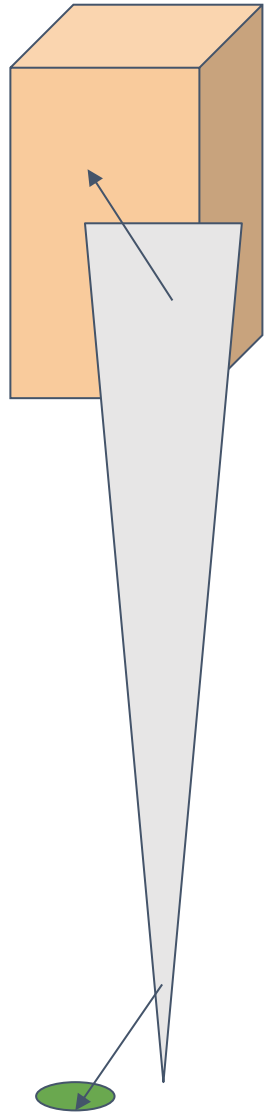
Calibrate the C-band radar by comparison with the coincident VPR measurements

Requires very careful calibration of the NZ Metservice radar

The correlation between VPR and gauge measurements is excellent.



How did we get there? - QC.

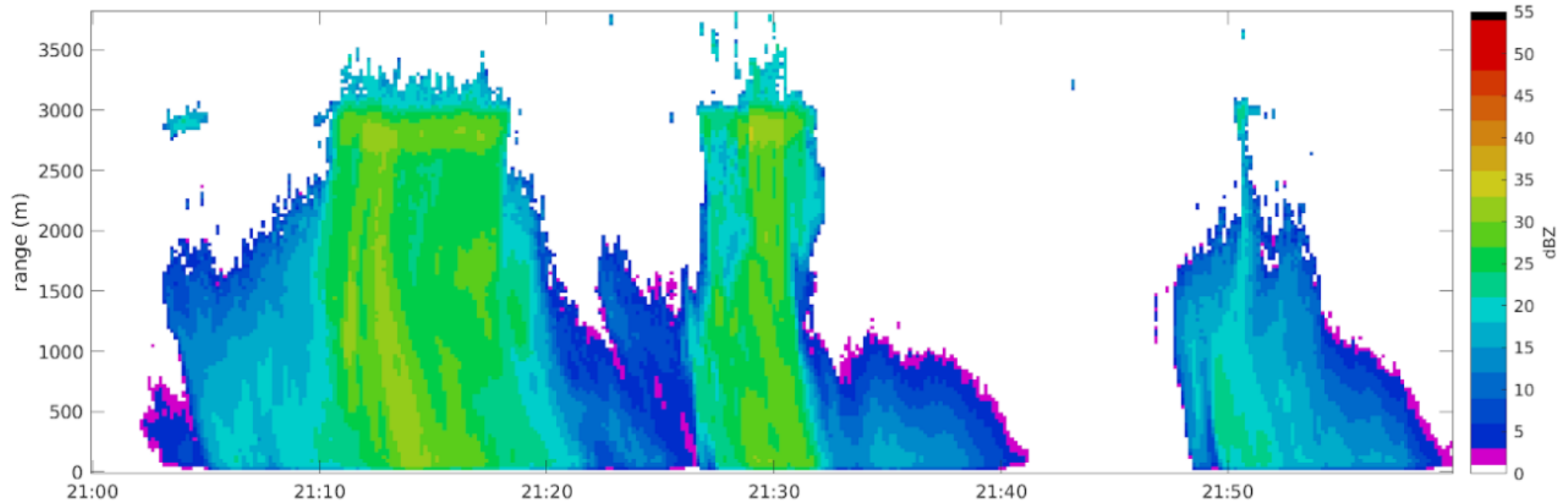


Calibrate the VPR by comparison with a co-located rain gauge,

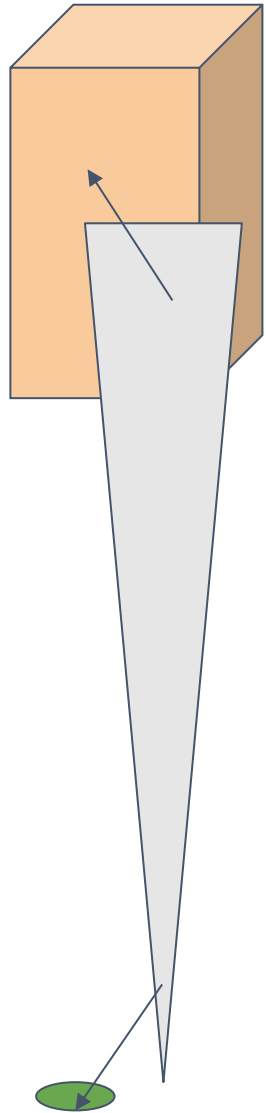
Calibrate the C-band radar by comparison with the coincident VPR measurements

Requires very careful calibration of the NZ Metservice radar

Vertically Pointing Radar addresses the differences in the measurements at the ground and aloft,



How did we get there? - QC.

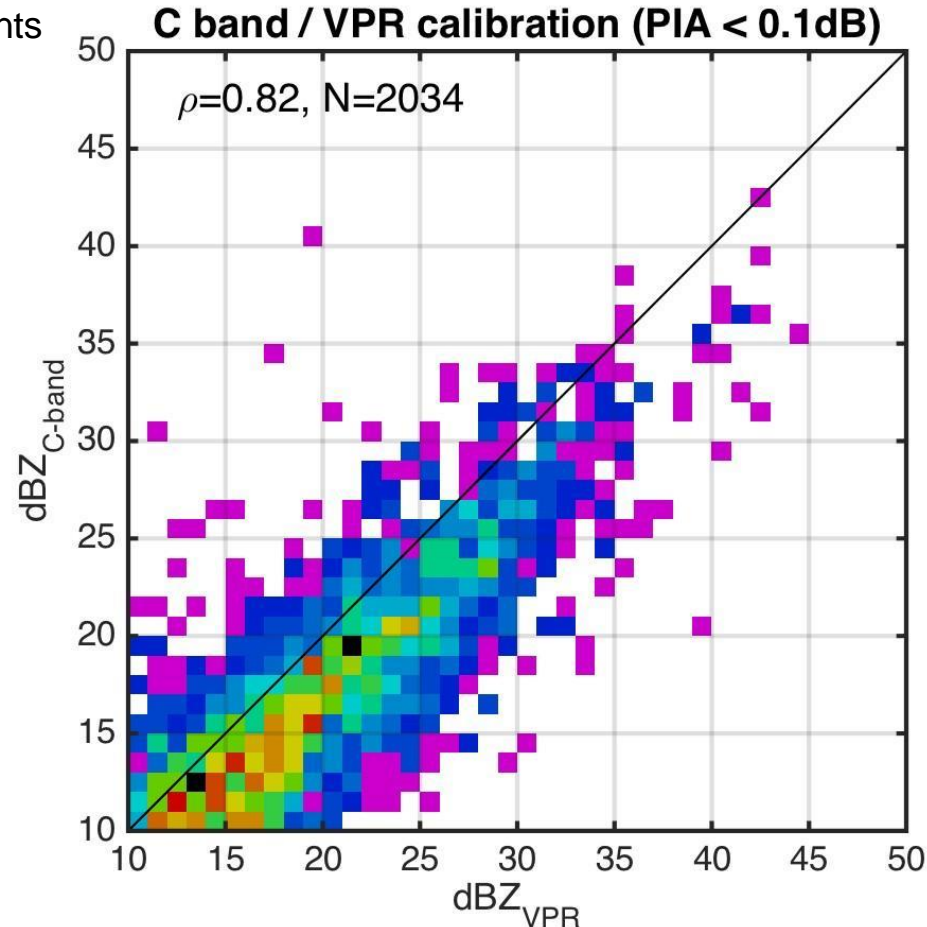


Calibrate the VPR by comparison with a co-located rain gauge,

Calibrate the C-band radar by comparison with the coincident VPR measurements

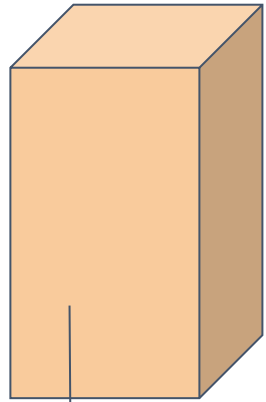
Requires very careful calibration of the NZ Metservice radar

Vertically Pointing Radar addresses the differences in the measurements at the ground and aloft,



allowing for meaningful comparisons with the Metservice Radar, and identification of calibration bias.

How did we get there? - QC.



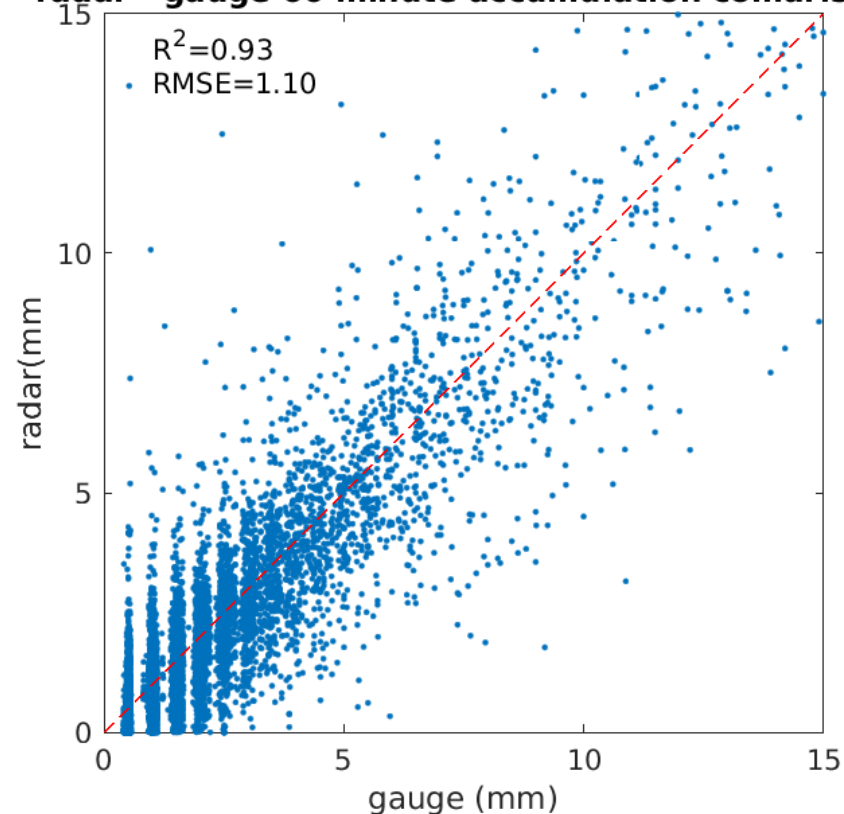
Calibrate the VPR by comparison with a co-located rain gauge,

Calibrate the C-band radar by comparison with the coincident VPR measurements

Requires very careful calibration of the NZ Metservice radar

Proper calibration of the C-band radar results in better gauge correction results - remember there is large uncertainty associated with the Sampling scale problem and we haven't actually resolved this!

radar - gauge 60 minute accumulation comarison



5. What does it mean for Auckland Council?

Customer Benefits

- * Auckland Emergency Management
- * Stormwater Operations
- * Watercare Operations
- * Better facts and figures for customers
- * Helping our customers understand and prepare for events

Addressing uncertainty at the base level



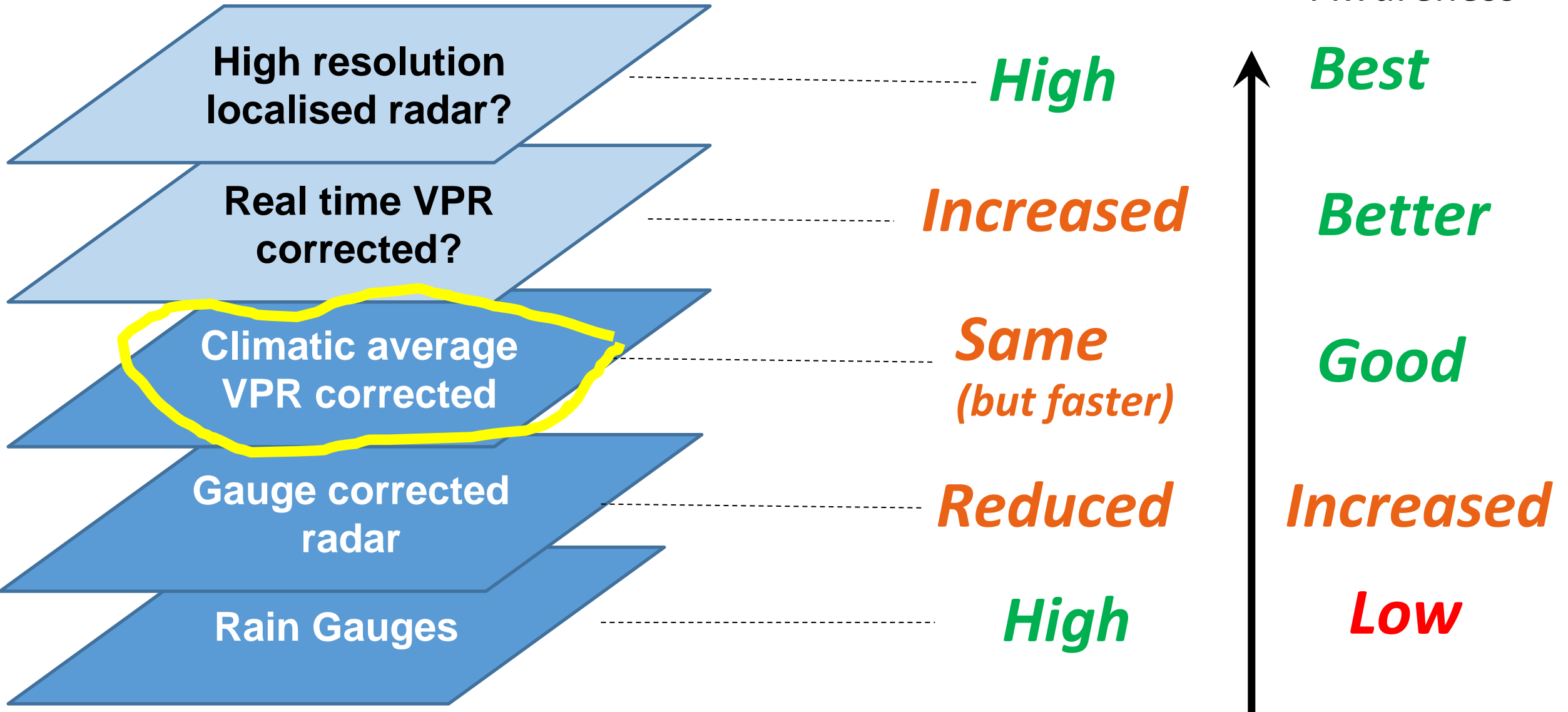
Flood Forecasting

Numerical Weather Prediction (90 minutes – 6 hours)

Radar 'now casting'
(0-90 minutes)

Real time radar

A significant step...



- Next steps for Auckland Council:

We are identifying improvements in rain estimates from radar.

Now we need to try and better identify the uncertainty.

We're using something that existed in academia, and operationalizing it with real benefit.

5. For other Councils

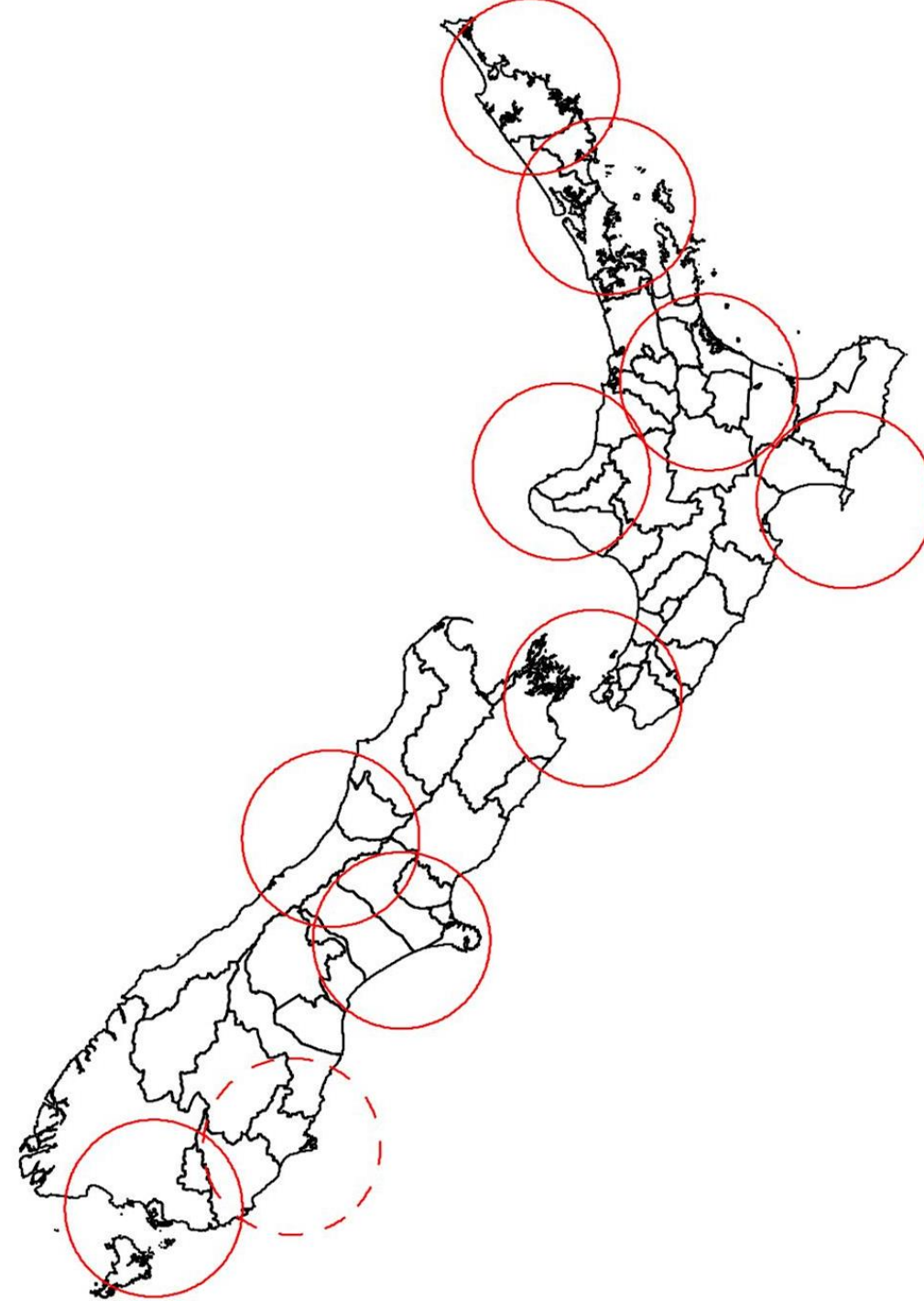
For other Councils...

Significant radar network exists.

Radar is not a silver bullet – coverage and geographic limitations.

It is useful. VPR can help overcome some limitations

There's still a lot of work needed for the ultimate goal of forecasting with some certainty.



Questions, but only simple ones please. I'm not the guy with the PhD here.