Australian Open Radar Dataset & WeatheX

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OPEN WEATHER RADAR
OPEN RADAR

NCI National Data Set Collection

Provide for non-commercial open access to the entire Australian weather radar dataset and a series of gridded projects including retrievals

Extensive QC and calibration, including the use of satellite radar

Approximate 40 million radar volumes, some sites have records extending 20+ years

Second largest public volumetric archive only to the US NEXRAD network

Australian weather radar network. White lines indicate coverage limits, blue markers show modern radars, grey markers show older radars
OVERVIEW

- Level 0: five separate volumetric rapic archives!
- **Level 1: Unified volumetric dataset (odim, hdf5)**
- Level 1a: Reflectivity calibrated dataset (meta)
- Level 1b:
  - PPI: + volumetric retrievals (netcdf)
  - Grid: + volumetric retrievals (netcdf)
- Level 2: 2D grids + grid retrievals (netcdf)

- Daily ingest (36 hrs) and generation of retrievals
- Dual Pol - soon (hopefully!)
- Built with in Python, Py-ART (Scott Collis)

For level 1 access email joshua.soderholm@monash.edu
RAPIC INGEST

Volumes separated into tilts

4 archives >1320 radar years

Repairing and rebuilding

- Missing metadata
- Correction of metadata
- Every ray checked for corruption (comms) (360 per tilt)
- Check for ray overflow
- Removal of merged tilts

Volumes rebuilt using metadata and converted to odim (hdf5)
SATELLITE CALIBRATION

GPM/TRMM: NASA satellite missions with scanning radar

Principle: Compare common volumes from the ground (GR) and satellite (PR) radars

Devil is in the details: Time difference, %filling of the grid, PR sensitivity, attenuation, frequency difference (C-band, S-band, Ku-band), number of samples etc

*Sweet spot for comparisons is light to moderate rain*

Volume matching in elevation (left) and range/azimuth (right) satellite and radar voxels. Provided by Rob Warren.
WHY BOTHER?

A 5 dBZ calibration error results in...

- Overestimate of MESH (hail) by 55%
  - e.g., mesh: 46 mm vs truth: 30 mm

- More than double the rain rate

Consequences for nowcasting -> climatology
RETRIEVALS USING PHASE 1 DATA: 2008 - 2017
First Australian Radar Training School
WEATHEX

Citizen Science of Extremes
Active and passive remote sensing cannot capture severe weather at the surface - while the fine spatial nature of severe weather limits in situ observations.

WeatheX enables citizen scientists to report hail size, wind damage, flooding and tornadoes.

This dataset provides critical verification for retrievals and a new meteorology platform for engaging the Australian community.
Demonstrations

Melbourne 7 November 2018

Brisbane 21 October 2018

Live report map
IN SITU LIMITATION

Observations of hail size distribution rely on in situ instruments with sample areas of 0.1 m$^2$ to 0.2 m$^2$. Distribution models are used in retrievals.

For many storms, hail can be sparse, in particular for regions of giant hail, severely limiting the effectiveness of these instruments.

Courier Mail Feb 12, 2018
REMOTE SENSING SOLUTION

Aerial Photography

- Sample Area: 2500+ m²
- Accuracy: ~3-5 mm

3D printed hailstones from US (IBHS) used to trail solution

- Trials at 8 m altitude retrieve hail size with 3-5 mm accuracy
- Capture of 50 x 50 m area within 3 minutes
- Automated size extraction using machine vision

Capture many thousands of hailstones = improved hail size distributions for radar retrievals
THANKS & QUESTIONS