The Argentinian Meteorological Radar, real time RFI digital filter operational data quality impact analysis

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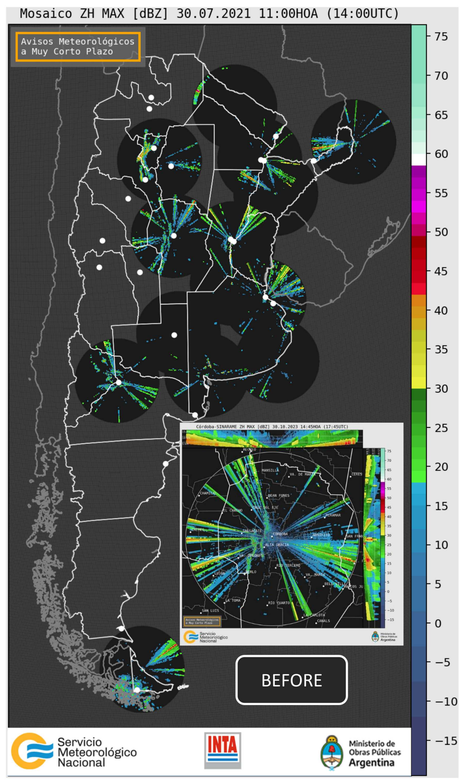
RMA-C320

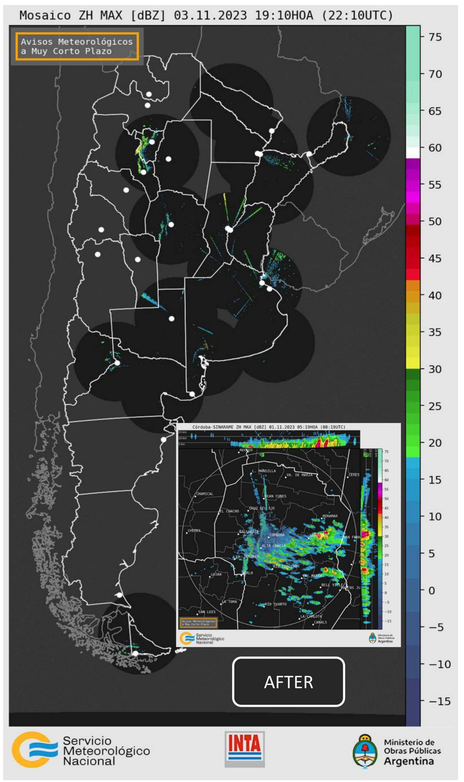
1. INTRODUCTION

- C-band radars operate in the same frequency band as wireless technology such as local area telecommunication networks and surveillance cameras, therefore all radars in Argentina's network of weather radars, *Sistema Nacional de Radares Meteorológicos* (***SINARAME***) are affected by *Radio Frequency Interference* (***RFI***), with some sites exhibiting severe *RFI* contamination.
- Different mitigation alternatives were explored, with limited success, such as:
  - –Tuning the radar on different operating channels within the band reserved for weather radars (5600 to 5650 MHz).
  - –Installation of narrowband analog filters at the input of the receivers.
- And others more effective but quite expensive to implement and sustain in the long term, such as:
  - –Hunting down interference sources and requesting that they be modified to work outside the reserved band.
- The best approach, so far, has been the commissioning of a real time *RFI* digital filter in all *SINARAME RMA* radars.



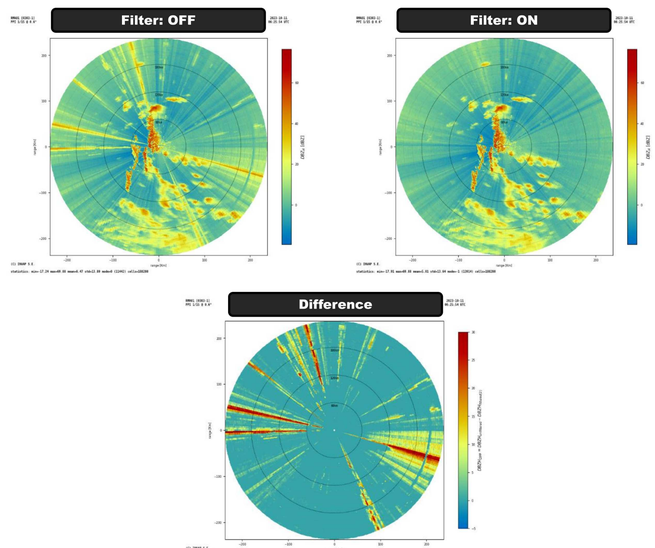
5. REMARKS AND CONCLUSIONS

- The activation of the *RFI* filter on all operational *SINARAME RMA* radars **significantly improved data quality**.
- *RFI* contamination is greatly reduced while echoes of interest remain mostly unaffected for all the studied cases after matching the filter parameters to the scanning strategy and an appropriate level of probability of false alarm (filtering aggressiveness) selection.
- The radar composite is available to the community at Argentina's National Weather Service portal: https://www.smn.gob.ar/radar
- All the involved institutions are actively evaluating the data quality of the radars of the *SINARAME* network.
- A second iteration of the configuration tuning process is planned to adjust filter performance based on feedback from end users.
- Filtering algorithm improvements are under consideration.

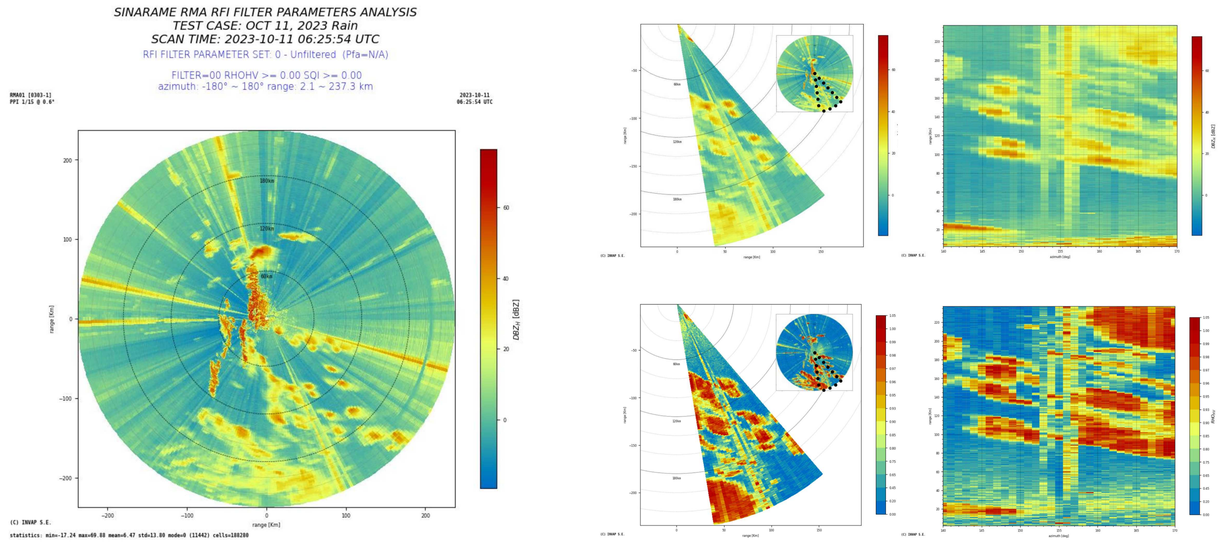


2. METHODOLOGY

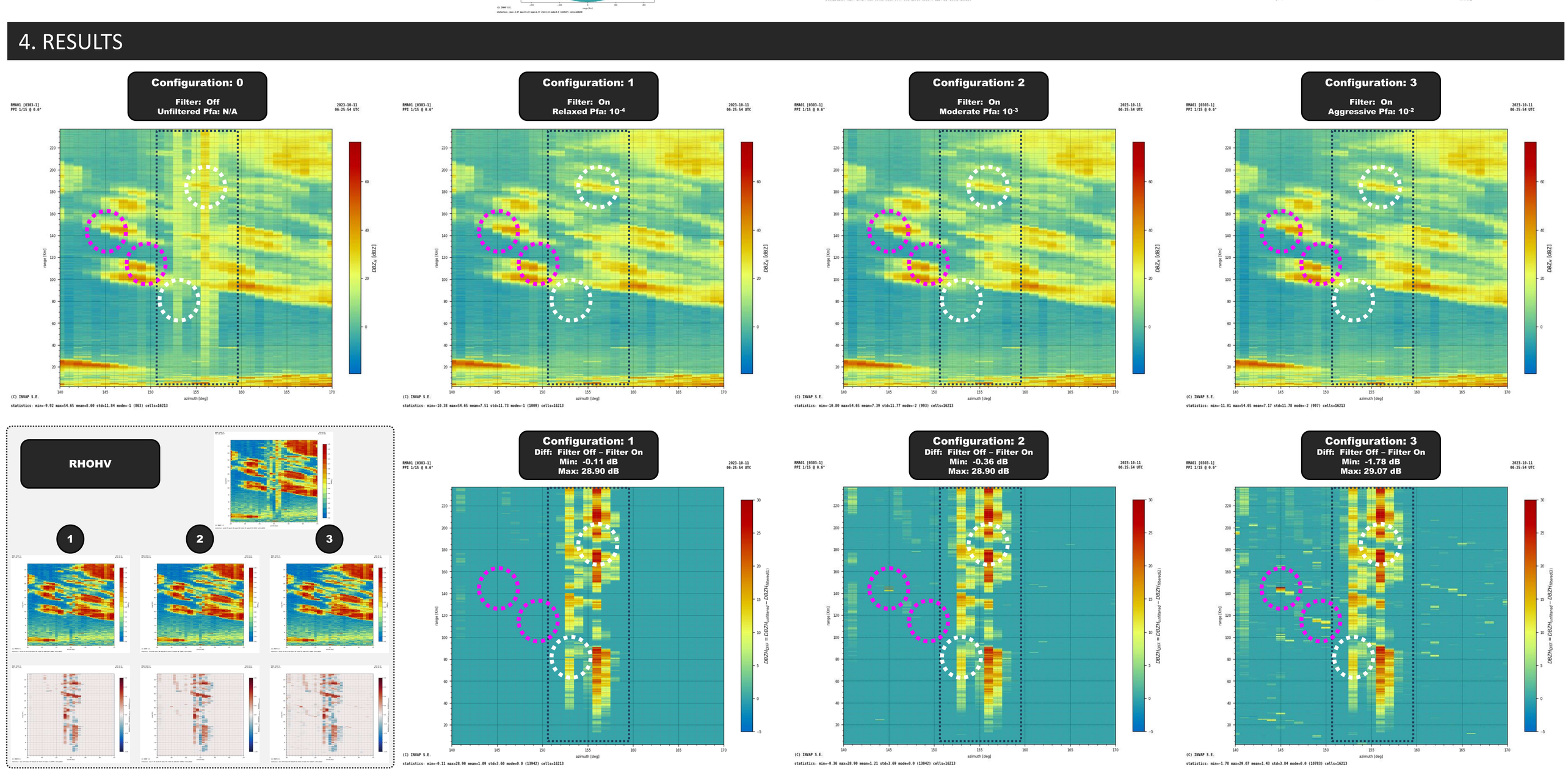
- A collection of several hours of I/Q data recorded at different *RMA* sites were processed to study the *RFI* filter performance under **different weather conditions** and **levels of RFI contamination**.
- Different sets of values for the RFI filter parameters were tested, with increasing levels of **filtering aggressiveness** ranging from relaxed to extreme.
- Cell to cell **arithmetic difference** was calculated.



3. DATA - RAIN TEST CASE



4. RESULTS



6. ACKNOWLEDGEMENTS

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- *Secretaría de Infraestructura y Política Hídrica*, the institution that manages and provides funds for the *SINARAME* project.
- *Servicio Meteorológico Nacional*, Argentina's National Meteorological Service and the principal user of the network data.
- *Facultad de Matemática, Astronomía, Física y Computación* from *Universidad Nacional de Córdoba*.

Ministerio de Obras Públicas Argentina
Secretaría de Infraestructura y Política Hídrica
Servicio Meteorológico Nacional Argentina
FAMAF Facultad de Matemática, Astronomía, Física y Computación
UNC Universidad Nacional de Córdoba

The following open source projects/tools/libraries were used in this work:

- Van Rossum, G., & Drake Jr, F. L. (1995). "Python reference manual". Centrum voor Wiskunde en Informatica Amsterdam.
- Harris, C.R., Millman, K.J., van der Walt, S.J. et al. (2020). "Array programming with NumPy". Nature 585, 357–362. DOI: 10.1038/s41586-020-2649-2.
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