Nowcasting initiatives in Argentina

Cynthia Matsudo
and coauthors of ALERT.AR project

NMS Argentina

Servicio
Meteorológico
Nacional

Index
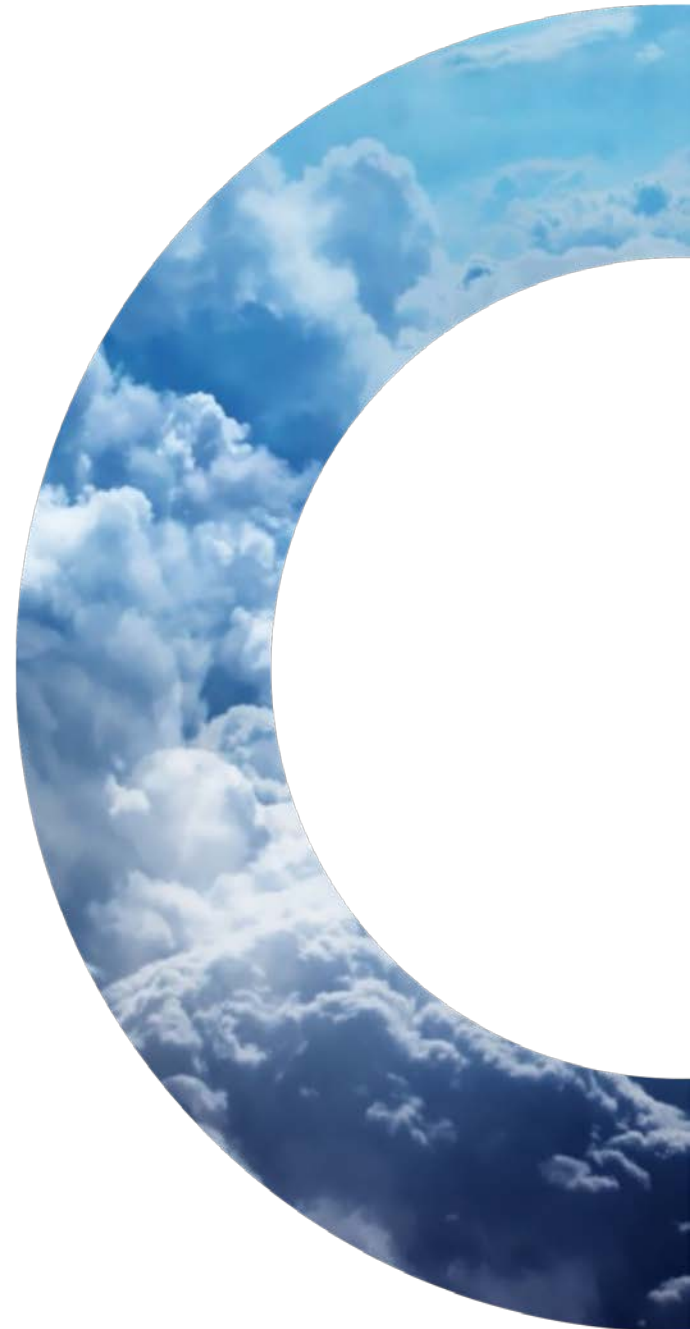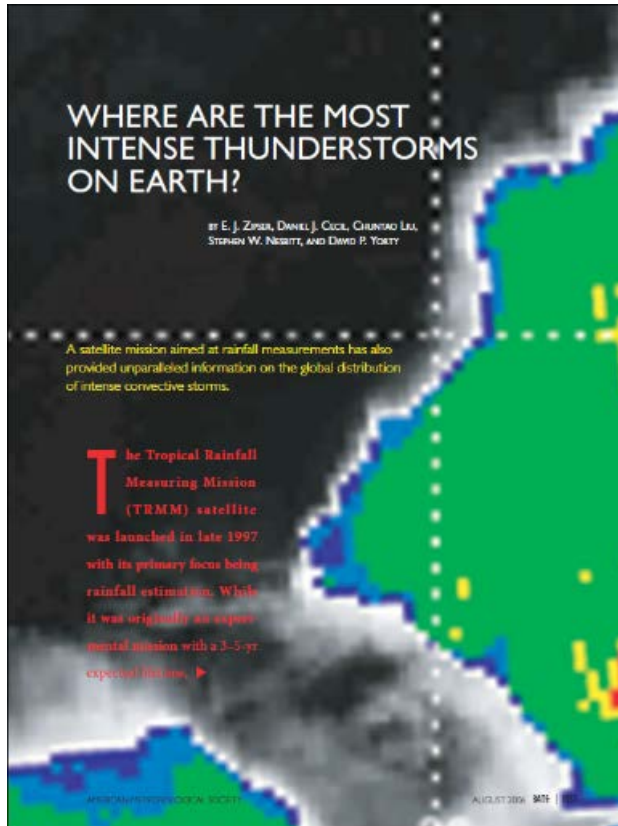
Why Nowcasting is relevant for the region?

Motivation

State of the art over the region

ALERT.AR project, current developments

Next steps - future developments

Operational implementation, field campaign

Zipser et al, 2006
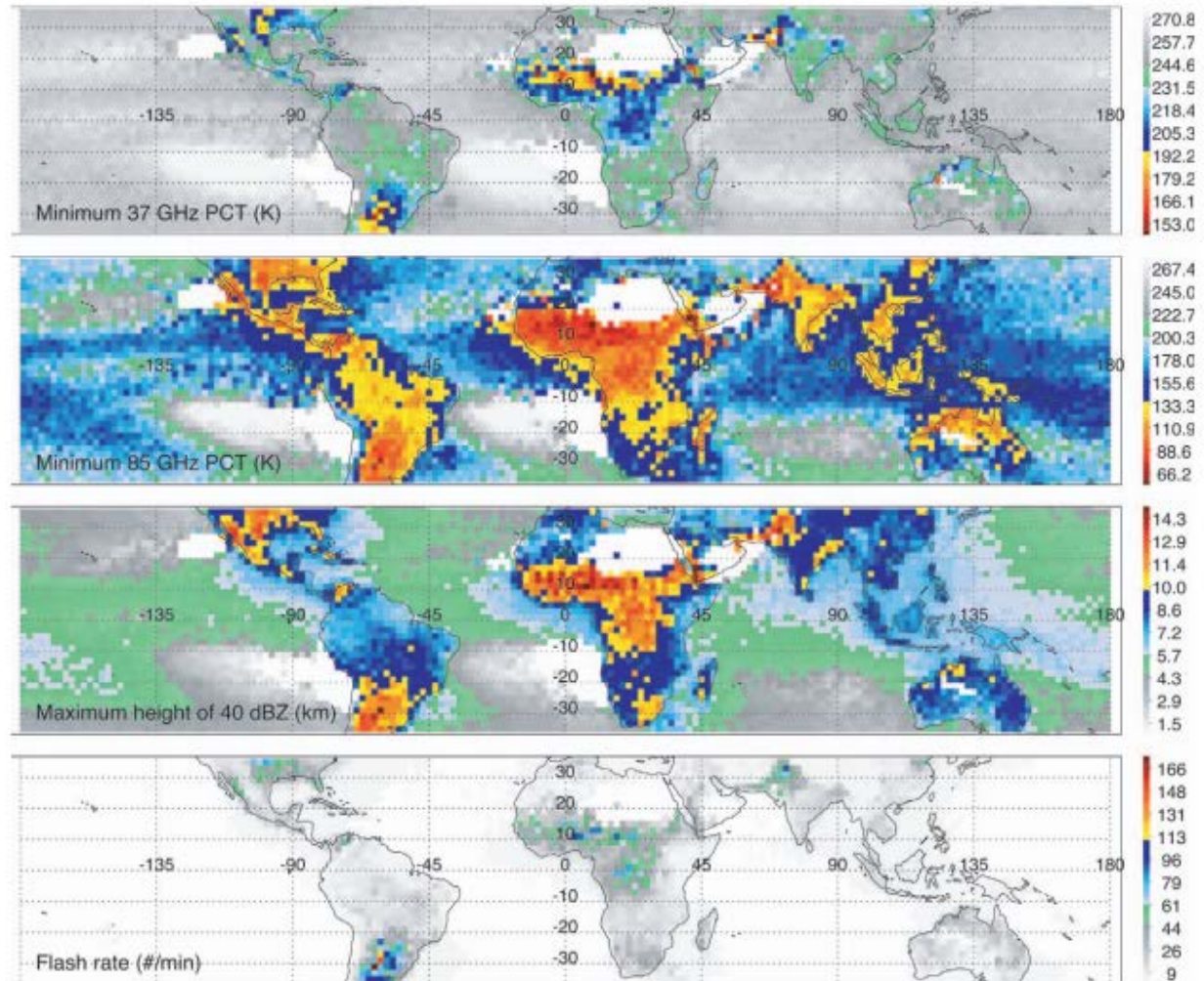
Why Nowcasting is relevant for the region?

Fig. 6b. As in Fig 6a, but most extreme 1%, leaving blank only boxes with less than 150 PFs.

Motivation

Argentina is crossed by multiple climates and weather conditions that generate HIWEs with strong impact on people and property

→ central and northeastern Argentina presents **climatic characteristics that allow the development of deep moist convection**

Development of nowcasting techniques is needed to improve HIWEs forecasts, Alerts and Watches

Population

Storms per year per (500 km)^2, for 4 overpasses/day
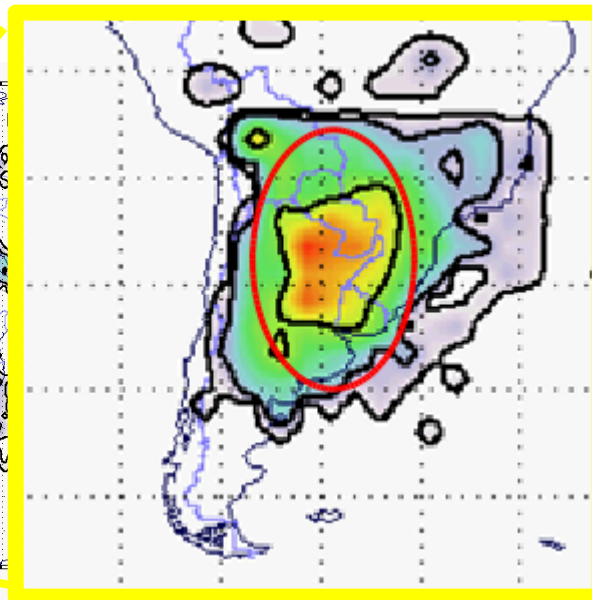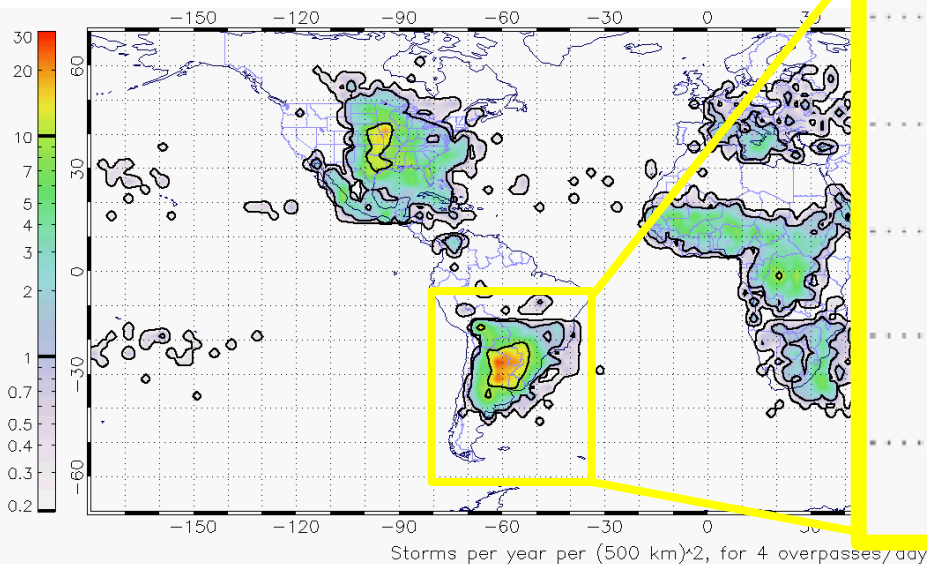
Severe hail storm frequency estimated from AMSR-E, following Cecil and Blankenship 2012

Persons per km²
- 0
- 1 - 4
- 5 - 24
- 25 - 249
- 250 - 999
- 1,000 +

Necessary step and a good incentive

Training Workshop on
NOWCASTING TECHNIQUES

Training Workshop on NOwcasting TEchniques: T-NOTE
Buenos Aires, August 5-16, 2013

Invited trainers:
Paul Joe
Rita Roberts
James Wilson
Isztar Zawadzki
Carlos Morales
Estelle de Coning
José García-Moya
Steven Goodman
Jenny Sun
Gustavo Cabrera

In cooperation with local and international trainers, T-NOTE helped:

● Building local capacity, to enhance a critical mass of trainers

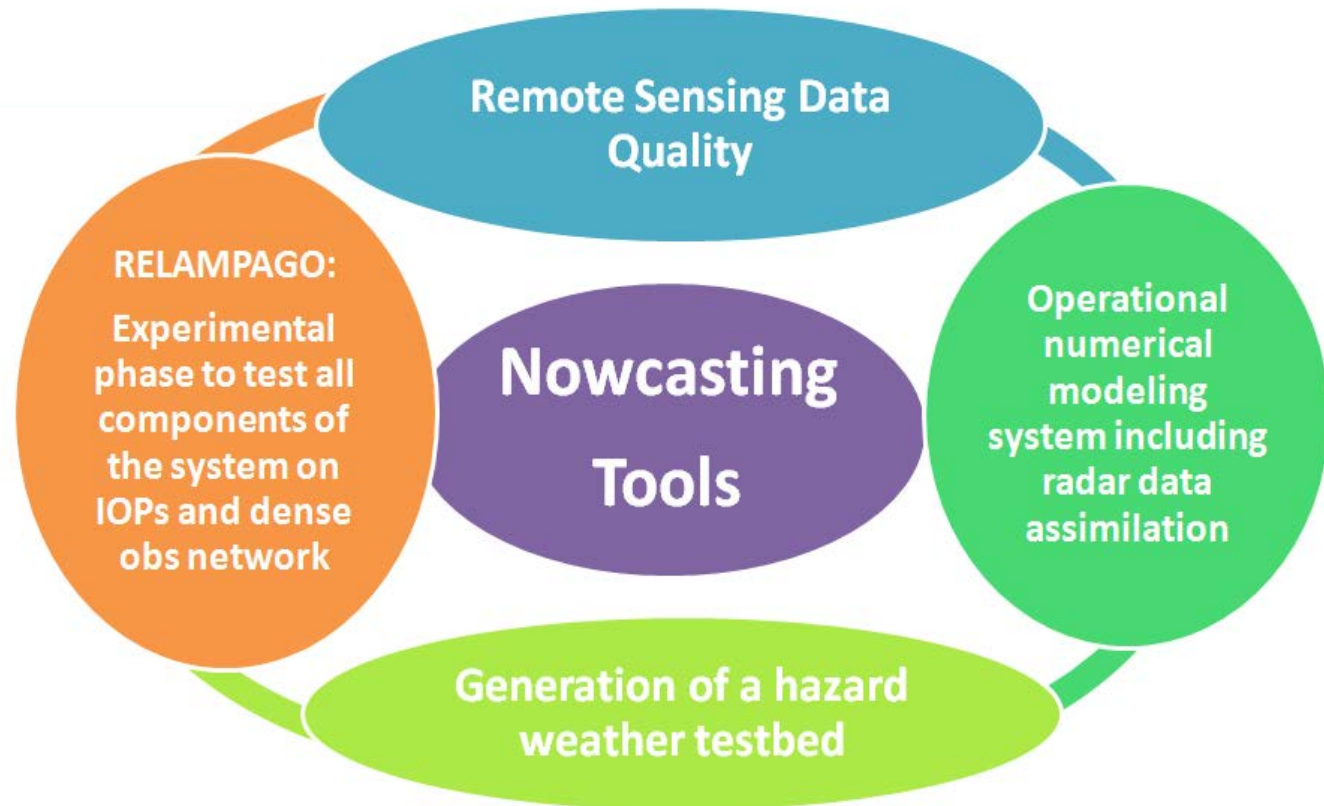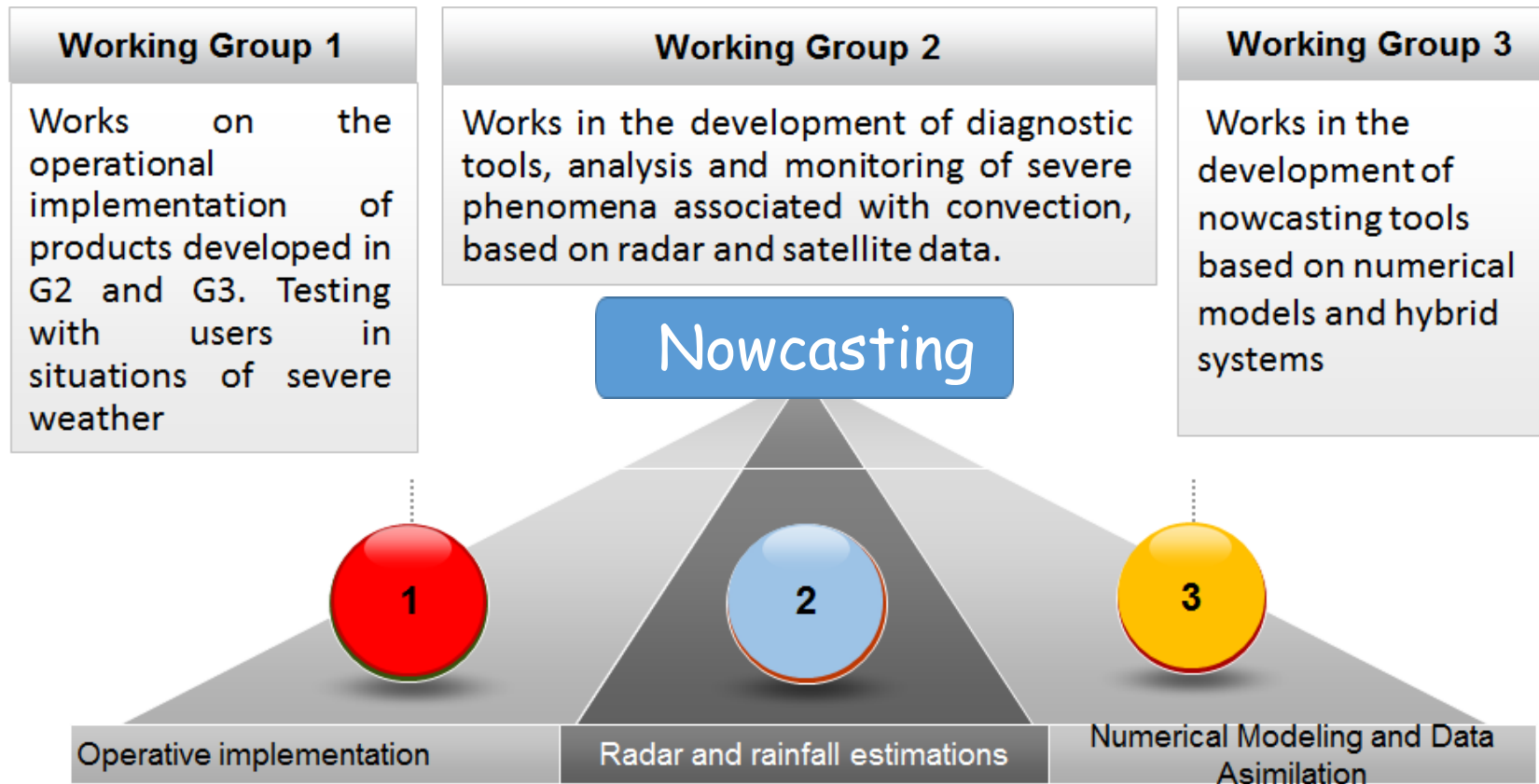● To increase the interaction with potential users of nowcasting tools
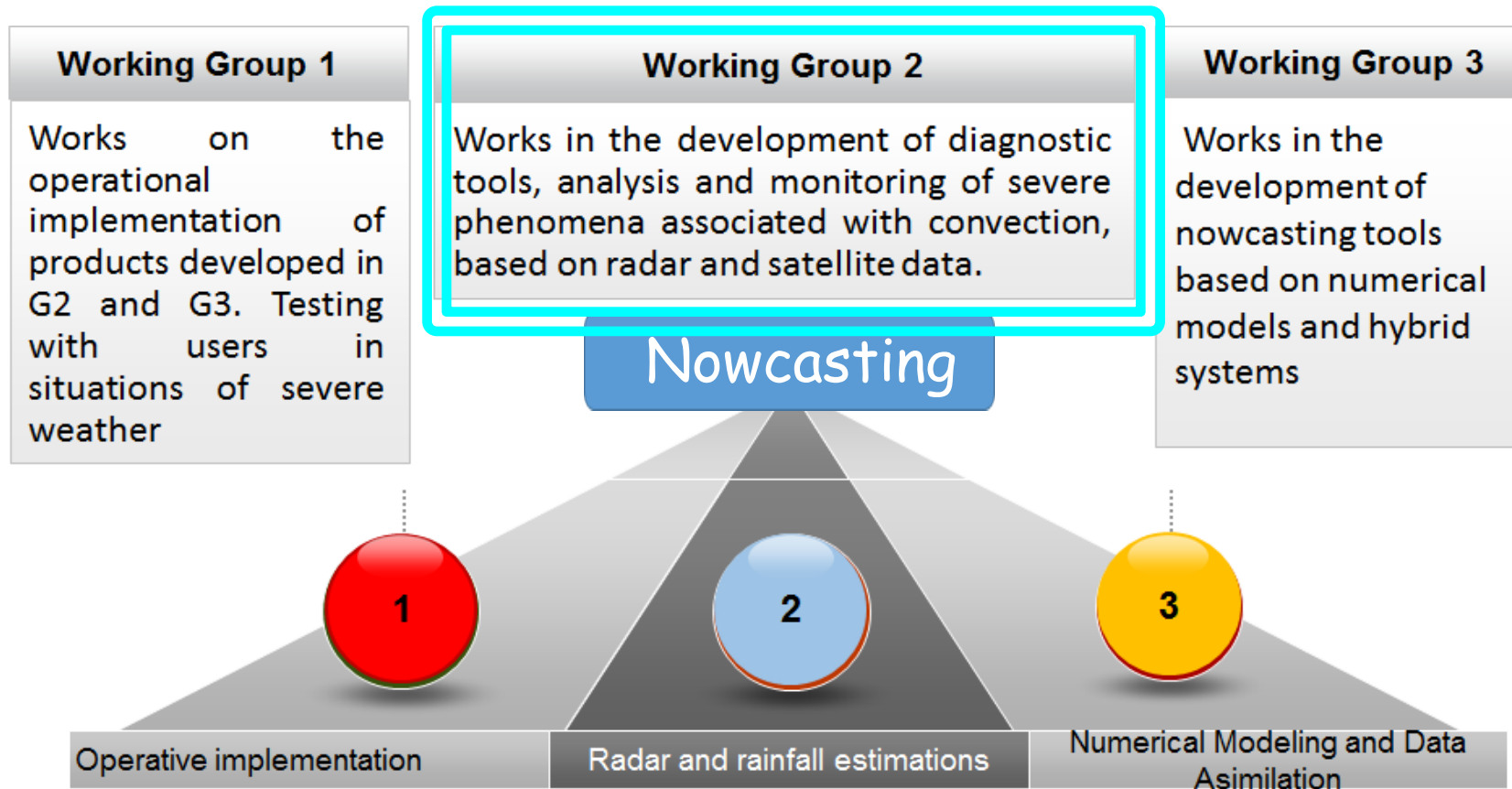
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The objectives are focused on the development of high quality information from remote sensing and numerical forecast at convective scale in order to improve lead time warning

Alertar

"ALERTAR" means warning in spanish

ALERT.AR is an agrement between NMS, CONICET and INTA from May 2015 - May 2018

Remote Sensing Data Quality

RELAMPAGO: Experimental phase to test all components of the system on IOPs and dense obs network

Nowcasting Tools

Operational numerical modeling system including radar data assimilation

Generation of a hazard weather testbed

Forecasting HIWEs in Argentina
**Implementation and strategies in operations at NMS**

Working Group 1

Works on the operational implementation of products developed in G2 and G3. Testing with users in situations of severe weather

Working Group 2

Works in the development of diagnostic tools, analysis and monitoring of severe phenomena associated with convection, based on radar and satellite data.

Working Group 3

Works in the development of nowcasting tools based on numerical models and hybrid systems

Nowcasting

1 — Operative implementation

2 — Radar and rainfall estimations

3 — Numerical Modeling and Data Asimilation

PI: Dr. Paola Salio (CIMA-UBA/CONICET) salio@cima.fcen.uba.ar

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Operative implementation

Radar and rainfall estimations

Numerical Modeling and Data Asimilation

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Radar Network in Argentina: present & future

SINARAME Project :

SIstema NAcional de RAdares MEteorológicos

+ 6 extra radars sites TBD

— Actual Doppler DP+SP

— Actual Doppler DP (Not operative yet)

➢ C-band
➢ Maximum range: 480km
➢ Operational range: 240km (*circles*)
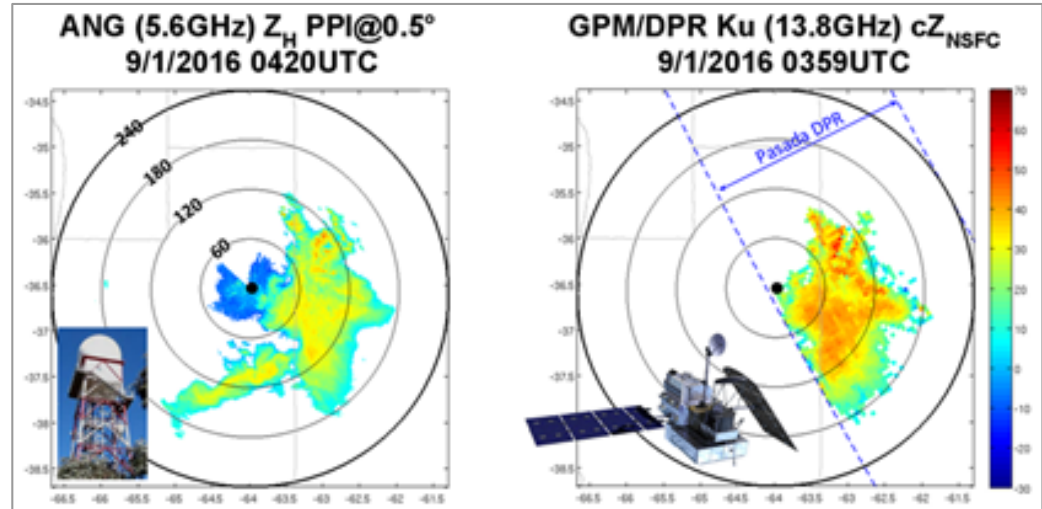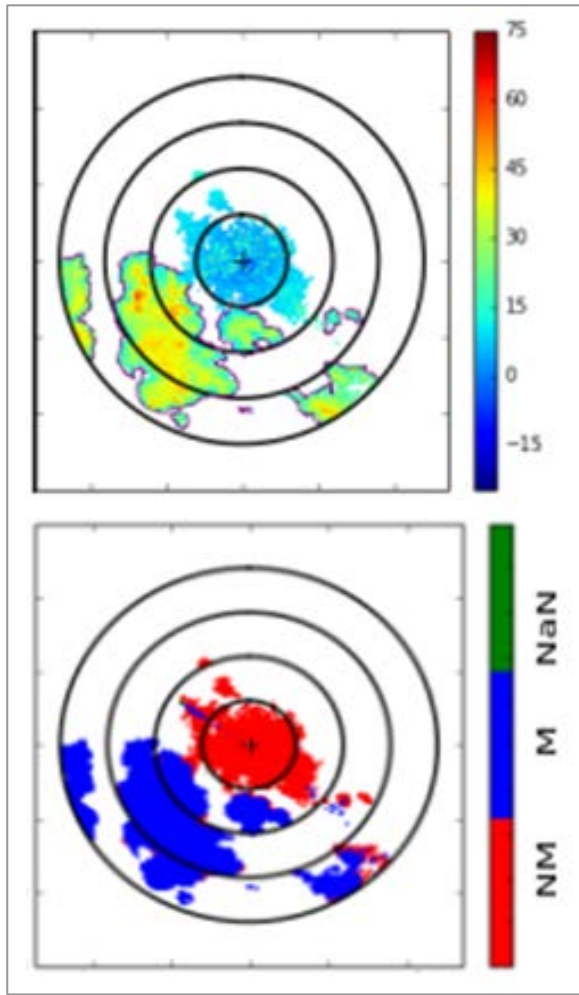➢ VCP: 12/15 elevations (0.5 to 20deg)
➢ Every 10min
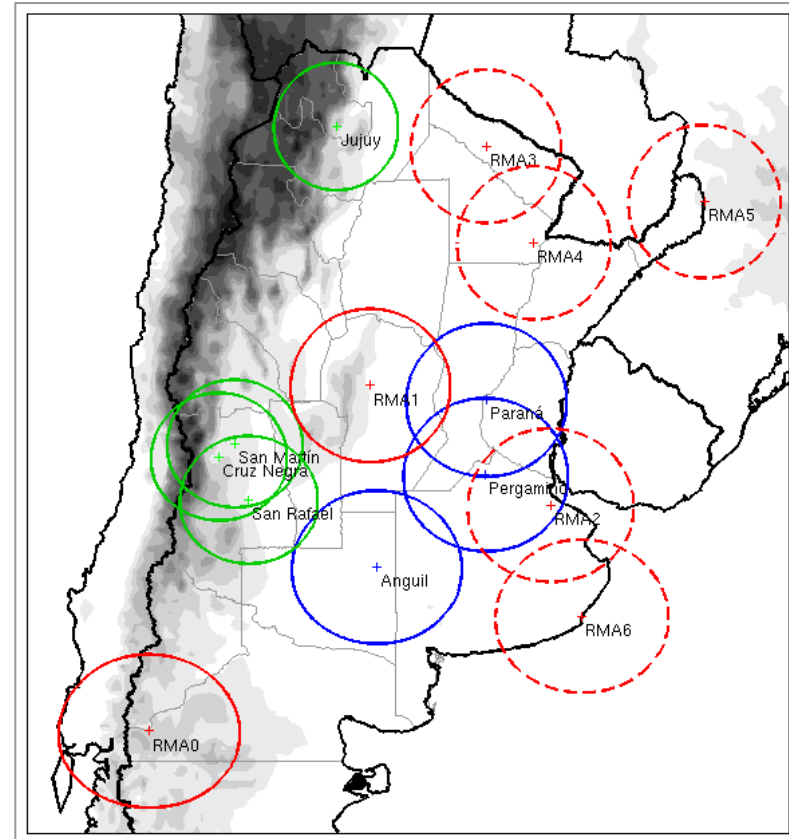
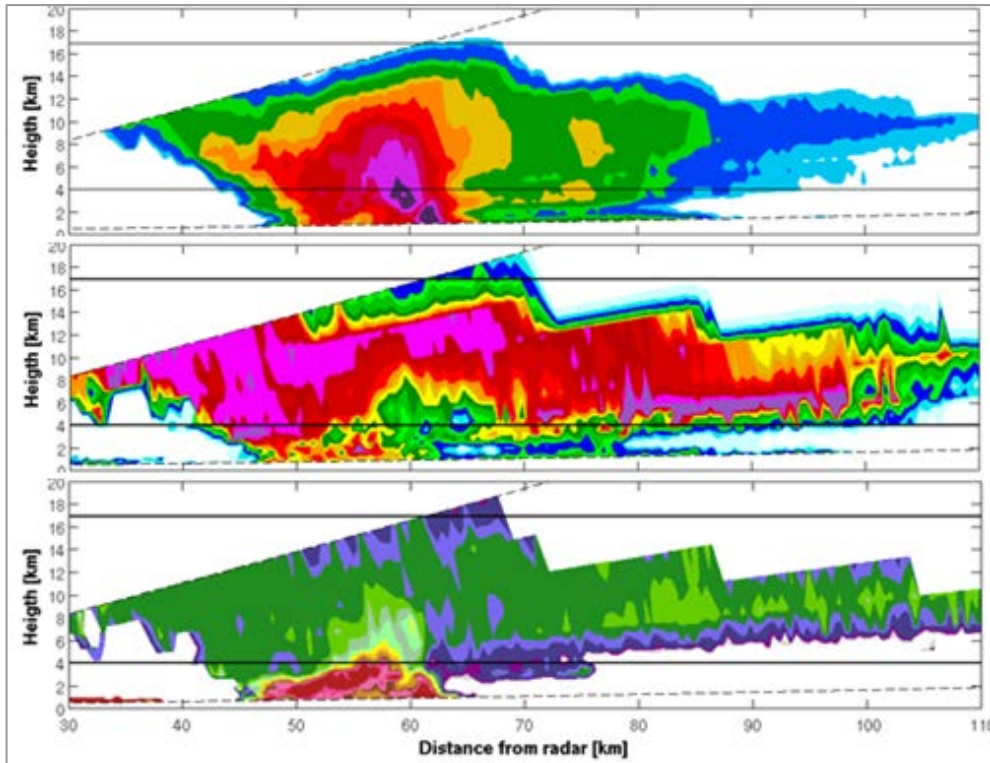Network => Single and dual-polarization Doppler C-band weather radars

Development of algorithms to distinguish meteorological and non-meteorological echoes based on dual polarization variables

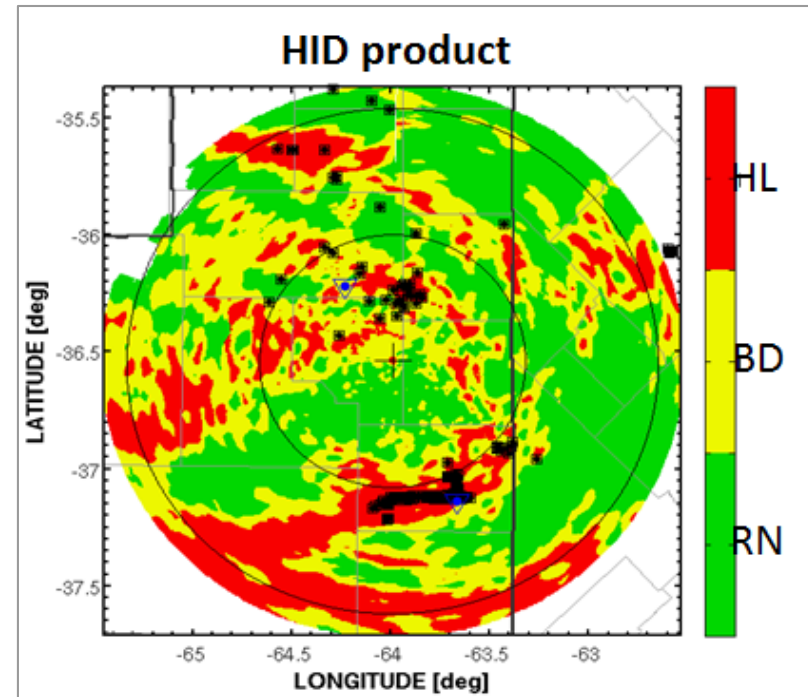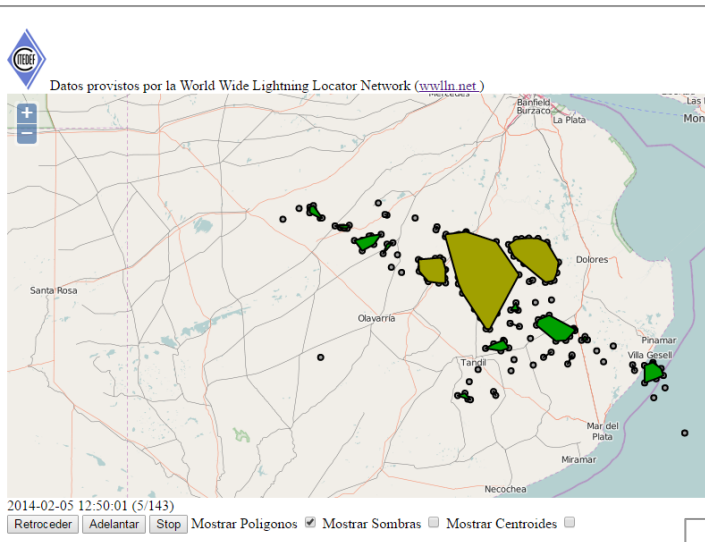**Comparisons against satellite and disdrometer data**
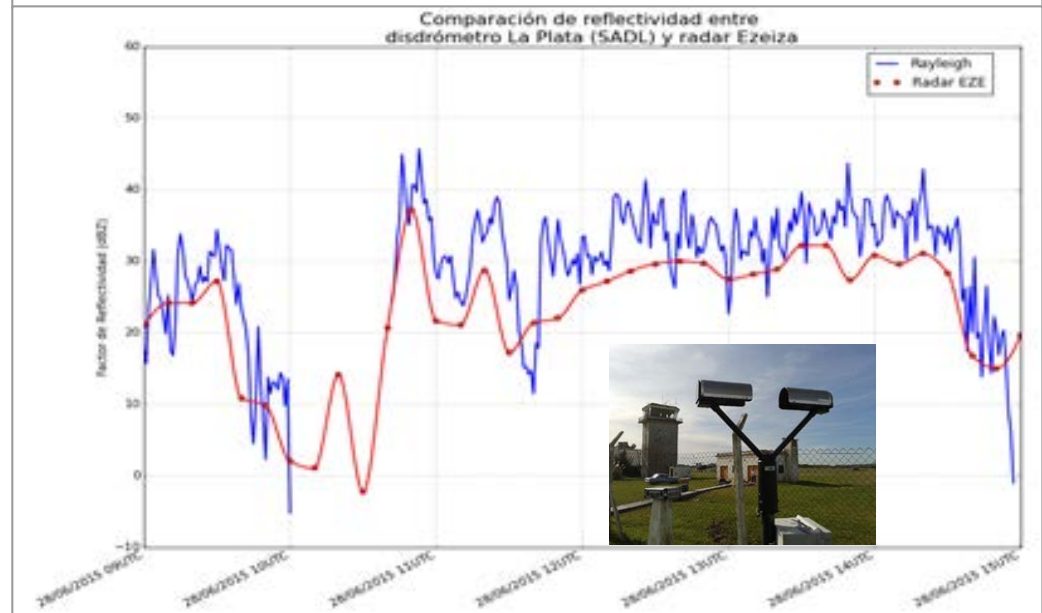
Use of fuzzy-logic techniques to DP variables for an objective identification of hail

HID product
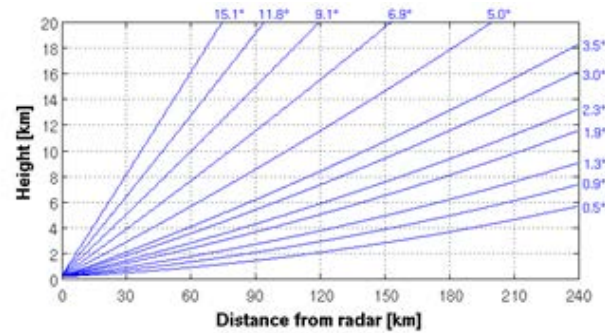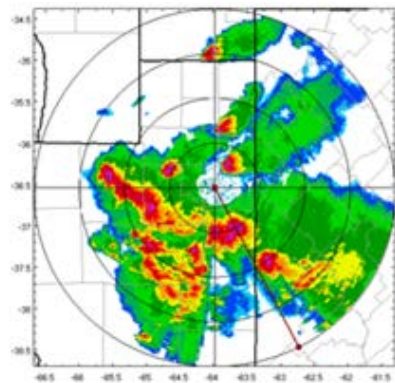
❖ Hail damage reports during the whole studied day are indicated with black squares. Tornado report is indicated by blue triangle.

❖ HID categories are integrated from Jan 15 17UTC to Jan 16 06UTC.

❖ Southern hail surface reports are coincident with HL categories.
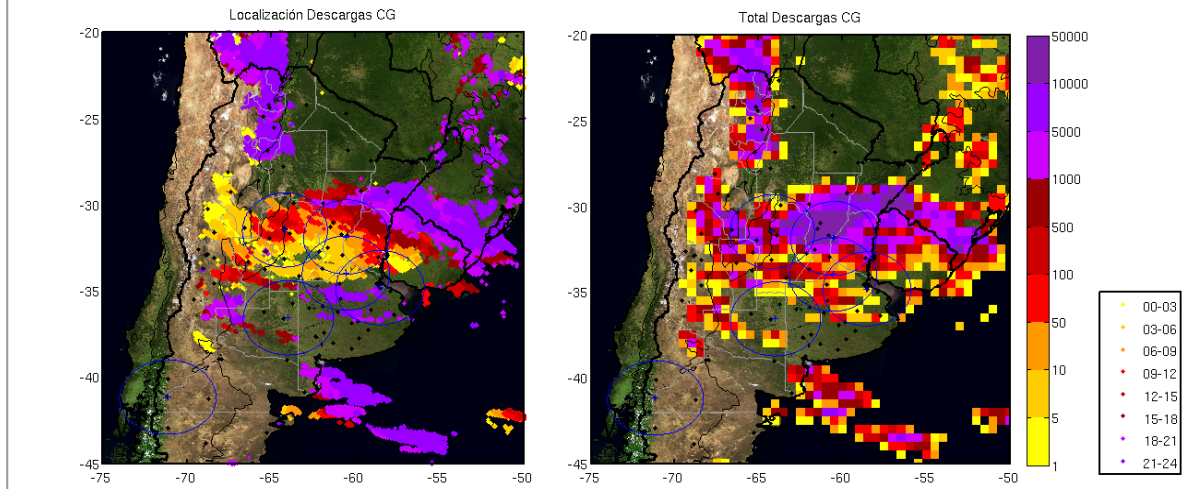
Lightning Activity

Information from 2 global networks: Vaisala GLD360 and WWLLN

Real time monitoring and tracking: "GEORAYOS" tool based on WWLLN network data

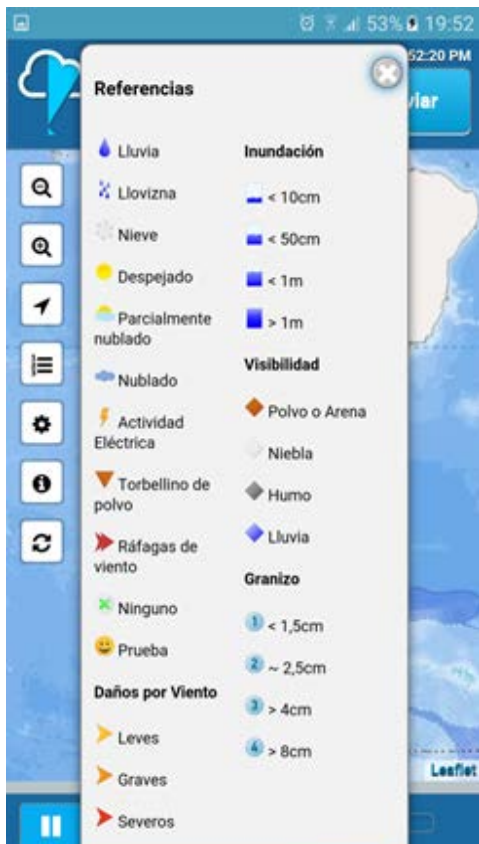Actividad Electrica en Argentina - GLD360 Network
20160208

[I+D] Servicio Meteorológico Nacional

Total strokes daily accumulated map for southeastern South America detected by the Vaisala GLD360 network

Temporal serie of total strokes in Central Argentina during December 2015
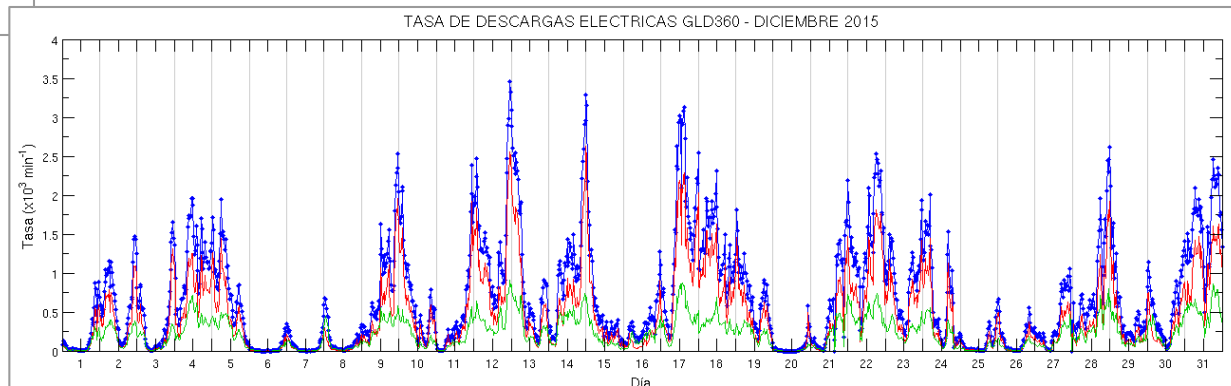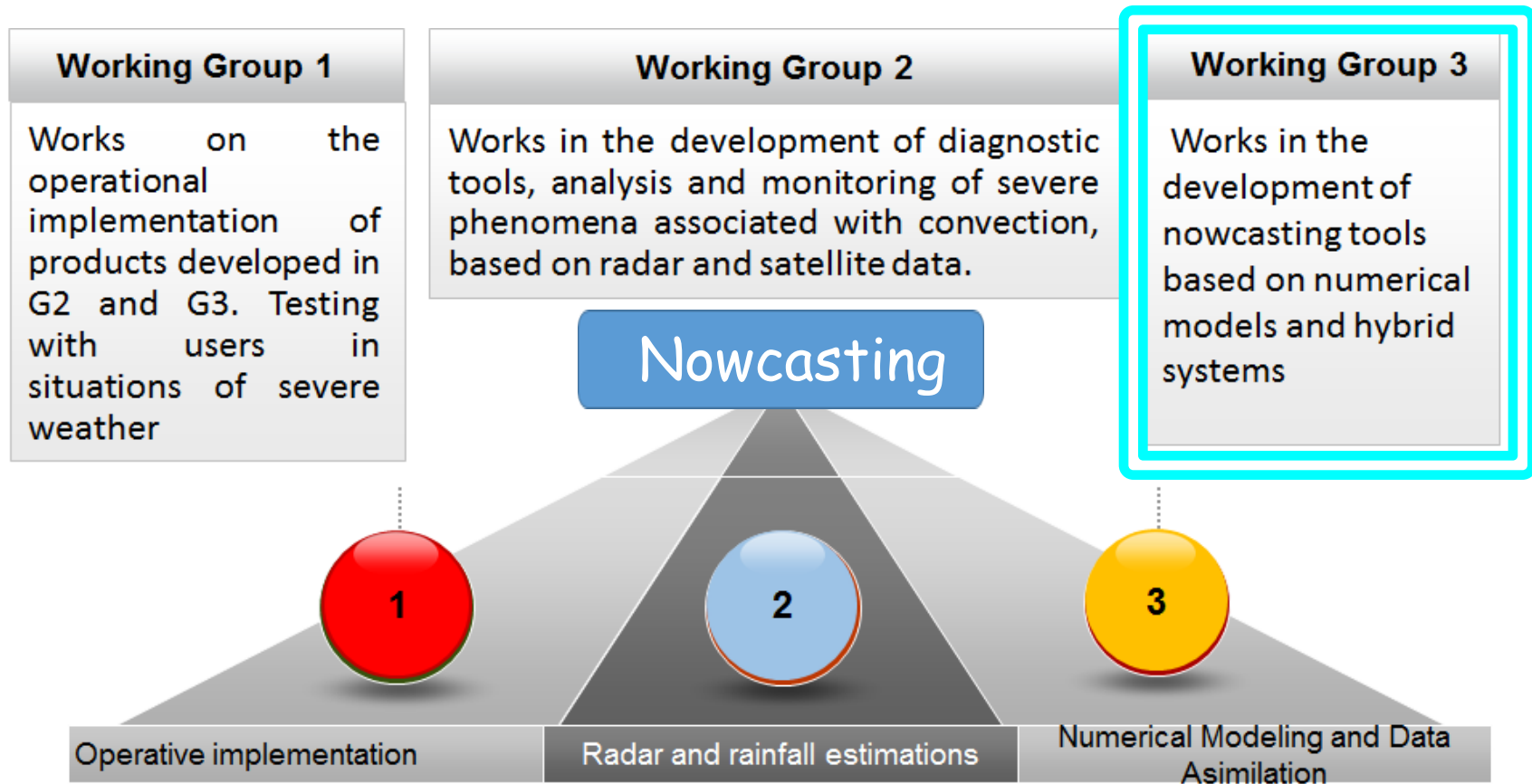
Monitoring severe phenomena

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Alertamos app allows any citizen to report weather phenomena, building a database of severe weather in real time for radar data verification

More Information: **www.alertamos.smn.gov.ar**

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Forecast and Tracking the Evolution of Cloud Clusters (ForTraCC) using GOES IR 10.7 μm imagery
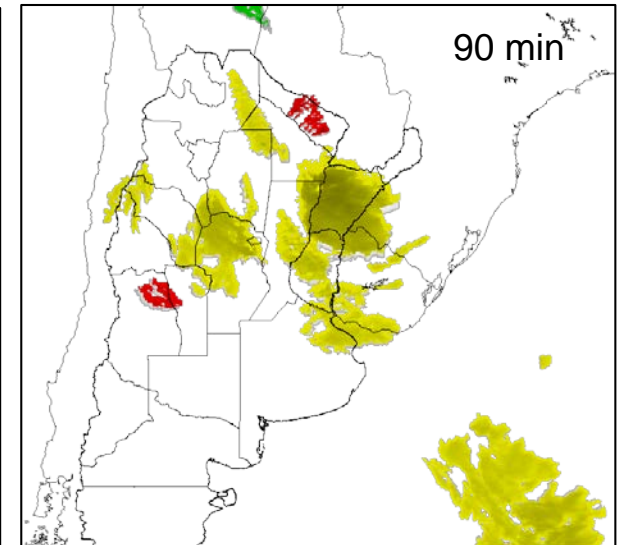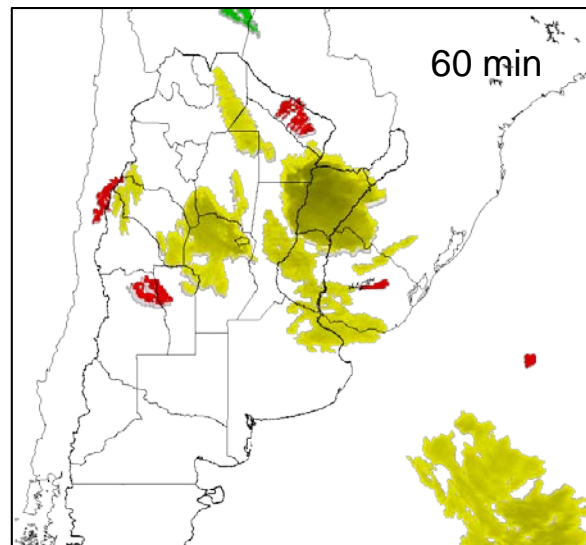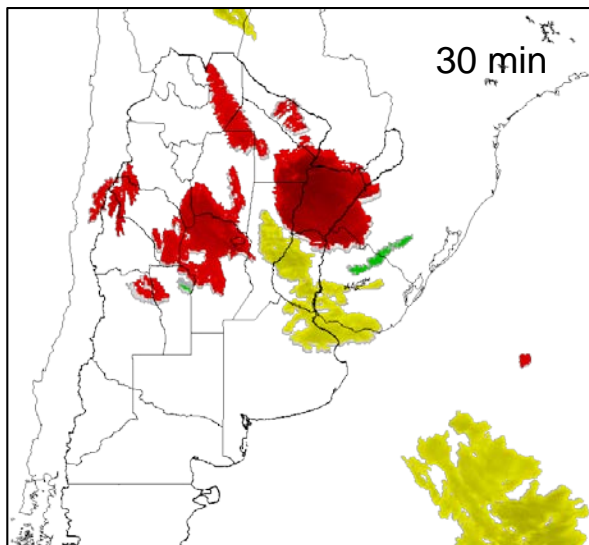
Developed by DSA/CPTEC - Brazil-

➡ Dissipating

➡ mature

➡ intensifying
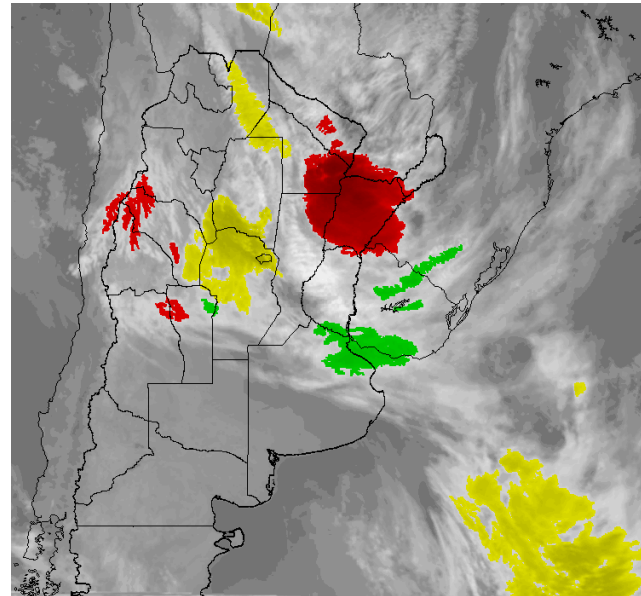
Identifies:
location, size, Tb min, convective fraction index, expansion rate, speed, direction, time of life, CS stage and classification
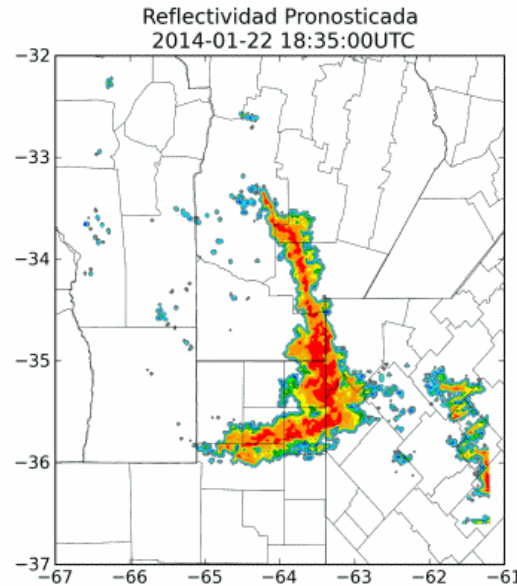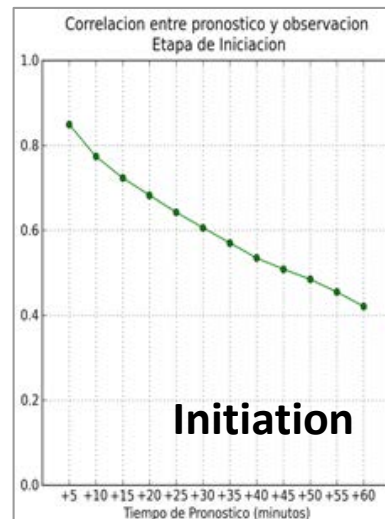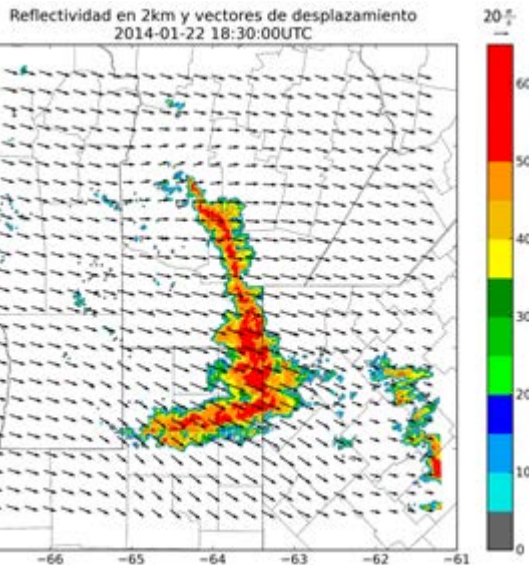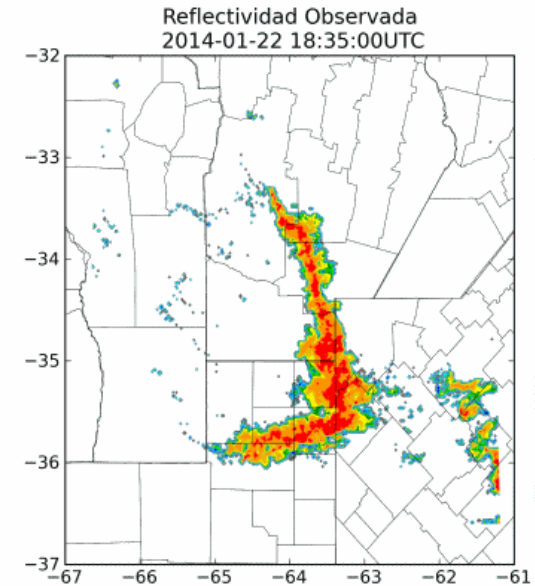

30 min

60 min

90 min

Extrapolation of reflectivity fields using a semi-lagrangian advection scheme and TREC

Synthetic Reflectivity fields obtained from an experiment generated with the WRF Model.

Resolution: 2 km, 5 minutes

Forecast

Synthetic Reflectivity

Initiation

Maturity
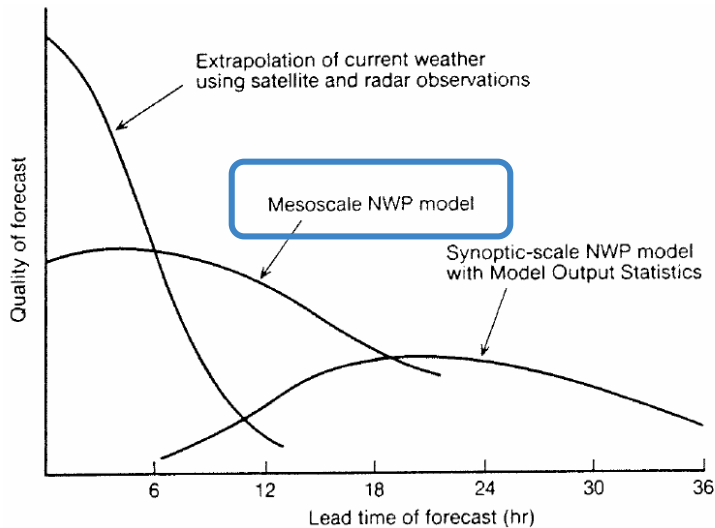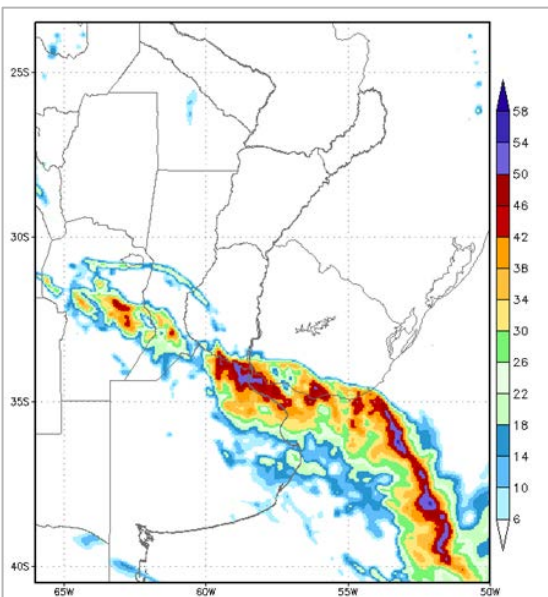
Fig. 1. A schematic diagram after Browning (1980) conceptualizing the relationship between forecasting methodology, skill and forecast range.

WRF-ARW maximum column reflectivity

Resolution: 4 km, 1 hour

High resolution numerical forecasts capture possible extreme events associated with convection, explicitly represent convective initiation associated with mesoscale circulations and convective organization modes

But the **lower predictability of small-scale phenomena** imposes an additional challenge to numerical forecasts
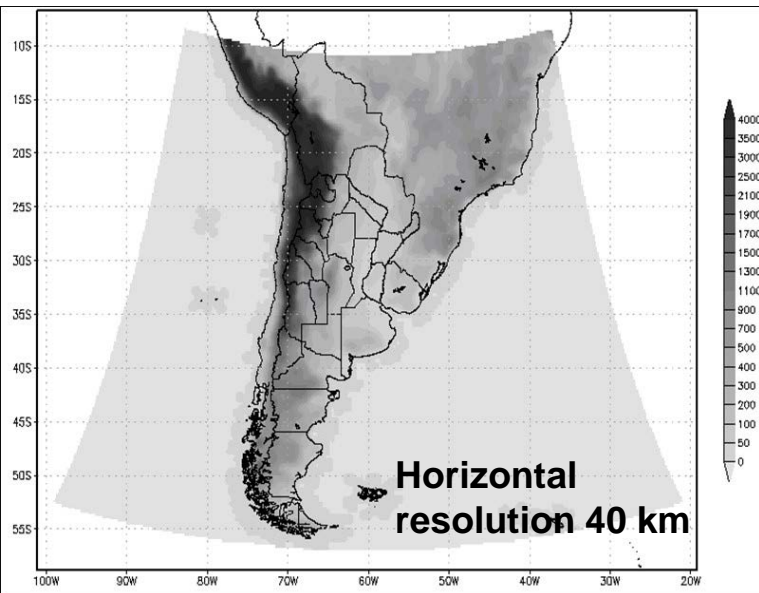
Data Assimilation

Ensemble forecasting

Regional data assimilation

Horizontal resolution 40 km

First steps on DA with real observations using WRF-LETKF (Weather Research and Forecasting Model - Local Ensemble Transform Kalman Filter) in the region

Dillon et al (2016)

Different experiments were performed
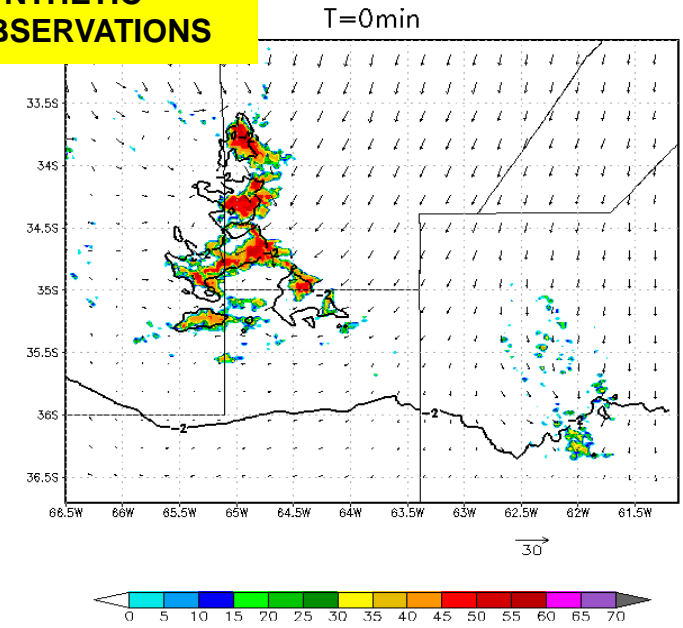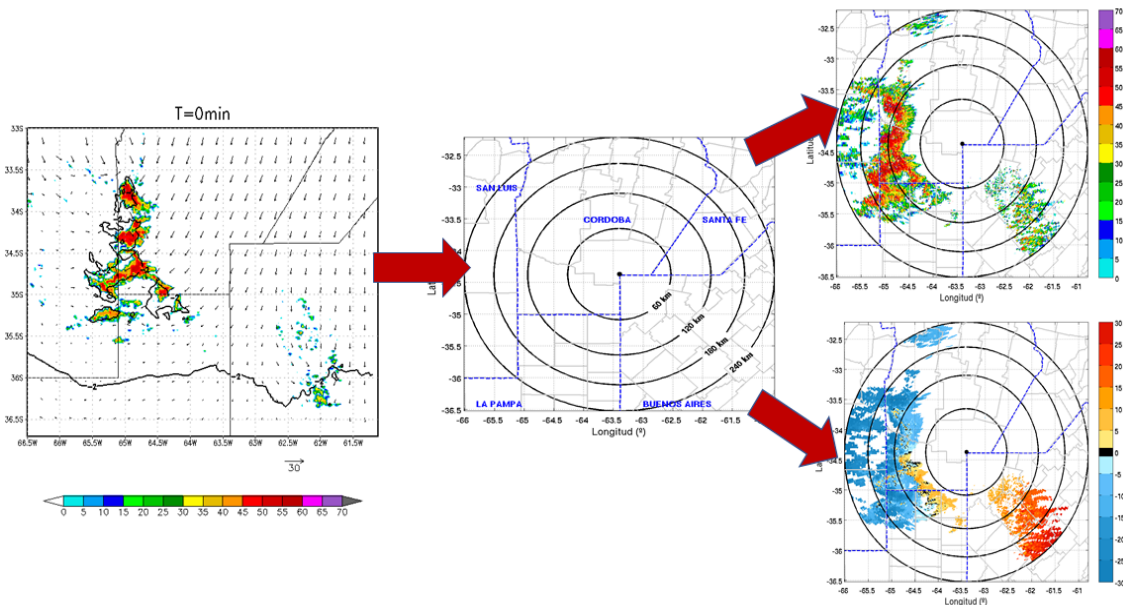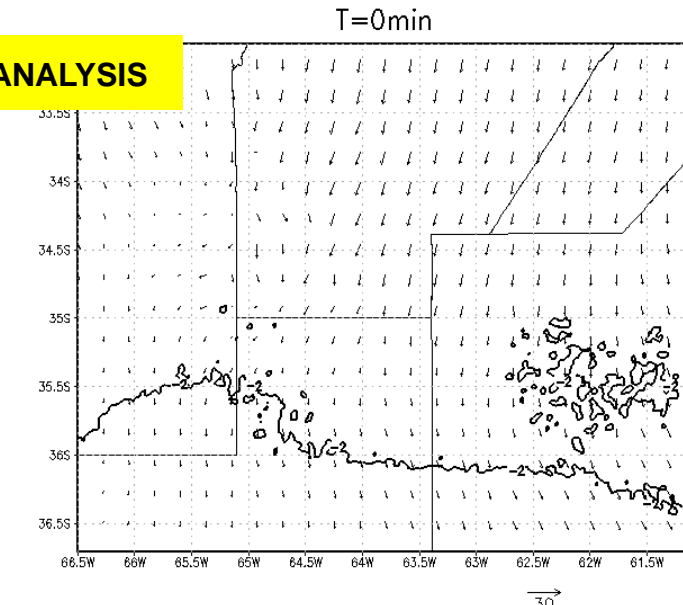
Radar data assimilation

An idealized experiment with synthetic observations produced by numerical models

Increased capacity computing combined with frequent observations of precipitating systems can recover the 3D structure of precipitating clouds and improve prognosis in the coming hours.

SYNTHETIC OBSERVATIONS

T=0min

ANALYSIS

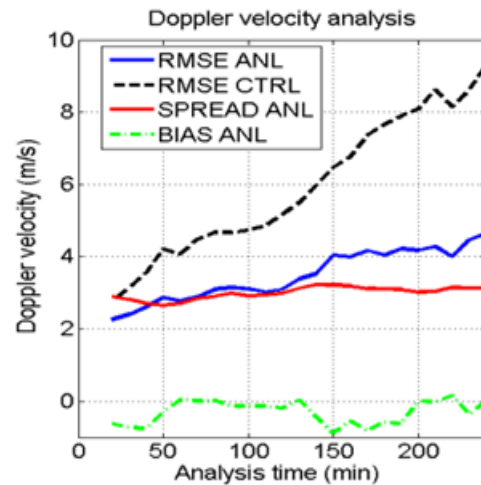T=0min

Radar data assimilation

First experiment with real radar data in Argentina
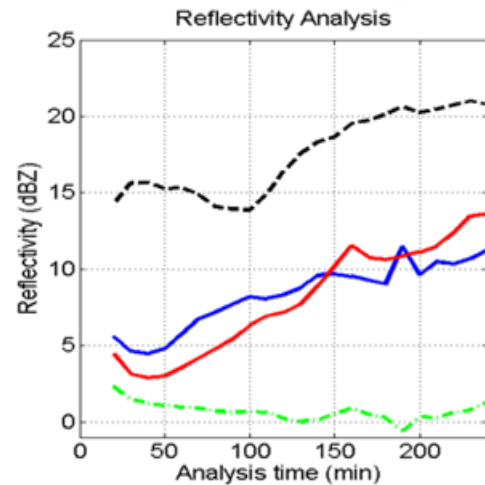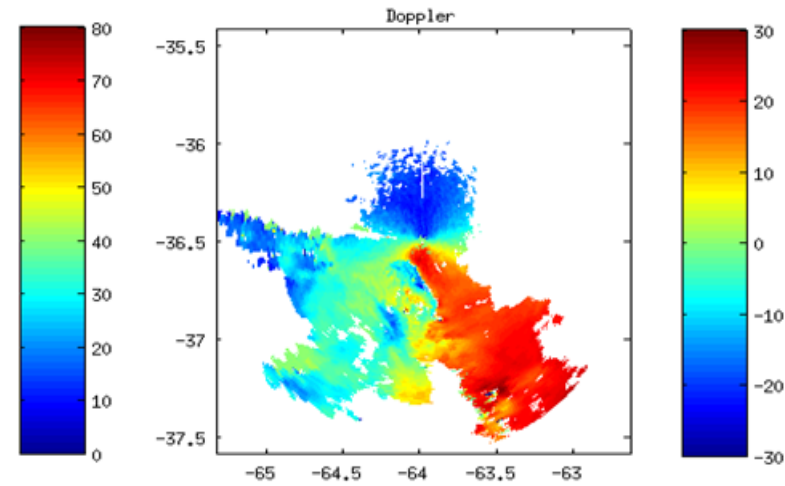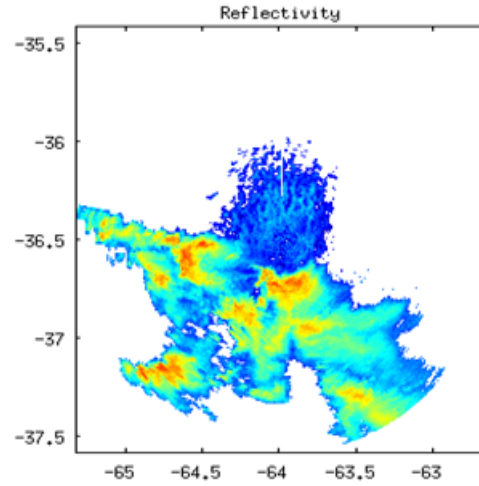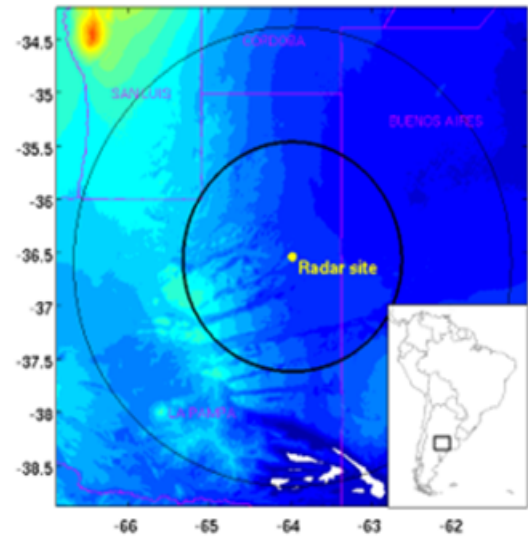
Reflectivity and doppler radar data were assimilated every 10 minutes using LETKF-WRF System

The analysis reproduce the location and intensity of convection

High resolution ensembles

First steps in designing a regional 4-km resolution ensemble system for Argentina

Analysis focused on analyse the impact of using perturbed ICs and consider a multiphysics ensemble with different MP and PBL schemes

ALERT.AR Project

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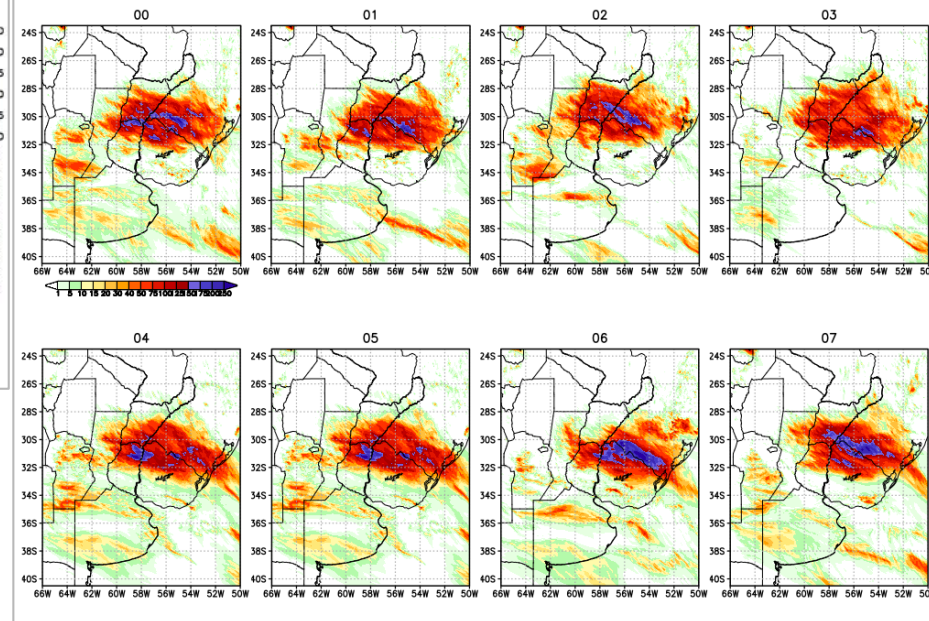
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From R&D to operations

How to achieve the transference from development to operations?
How to make an effective communication of the warnings?

Operational implementation of products developed
Testing products with users in severe weather case studies

Within the NMS	Outside the NMS

Work together with users and decision makers
in order to define a new early warning system.

The goals are to:
- Work closely with users and forecasters
- Work on our warnings communication strategy
- Questioning our products
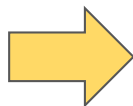
TPEMAI
Taller Interinstitucional para el pronóstico de eventos meteorológicos de alto impacto /
Interinstitutional annual workshop for forecasting high-impact weather events

December 2014 and 2015

Nowcast - Forecast products Testbed with forecasters:

-Evaluation of new tools before to be implemented at forecast office.

-Test the interpretations of radar algorithm using dual polarization observation.

-Test the interpretation of probabilistic forecasts

How do users understand warnings?

Promote a closer relation with qualified users such as firefighters and civil defense in order to get to know them and understand what they need from NMS
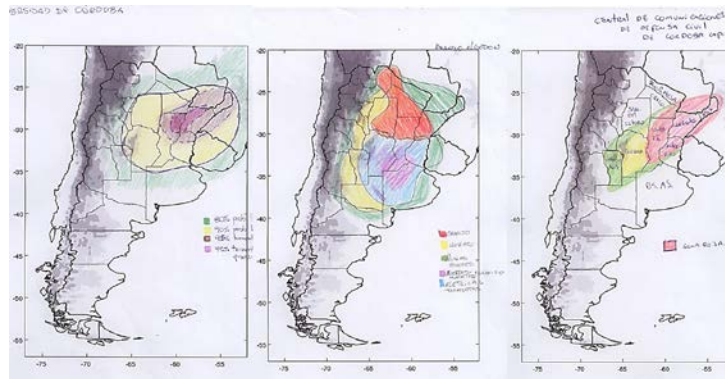
There is a long way to go but some steps were made on

- ❖ radar quality control

- ❖ algorithms to identify hydrometeors

- ❖ tracking and extrapolation of convective systems using remote sensing observations

- ❖ regional and radar data assimilation

- ❖ high resolution ensemble numerical weather prediction

- ❖ testbeds with forecasters and decision makers

- ❖ working on our communication strategy

This is a **collaborative work** that must go on, to finally implement operationally all the developments and obtain a real benefit of the reached results
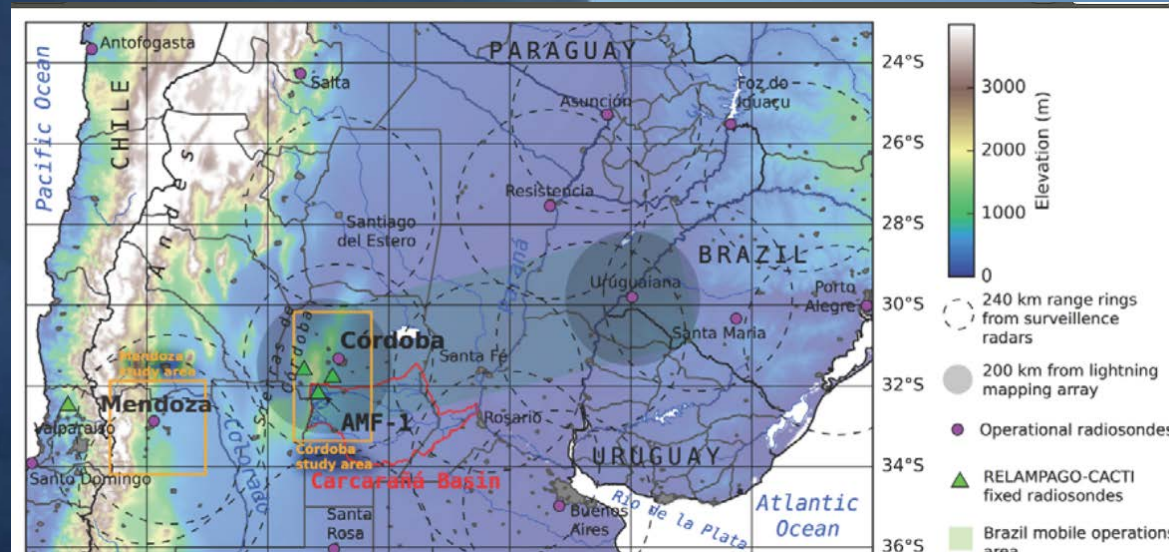
An international field campaign that will be performed in Central Argentina during the warm season 2018-2019

RELAMPAGO - CACTI
Remote sensing of electrification, lightning and meso-scale / micro-scale processes with adaptive ground observations - Clouds, Aerosols, and Complex Terrain Interactions

Data provided by this experiment will be particularly useful for nowcasting tools evaluation and tuning

A Forecast - Research Demonstration Project has been proposed to WMO-WWRP to improve local latin american knowledge about nowcasting techniques and tools during this unique observational opportunity

A collaborative work between....

Cynthia Matsudo, Paola Salio, Aldana Arruti, Lucas Bali, Claudia Campetella, Julia Chasco, Maria Eugenia Dillon, Yanina García Skabar, Valeria Hernandez, Paula Hobouchian, Pedro Lohigorry, Paula Maldonado, Matías Mellaned, Pablo Mercuri, Romina Mezher, Santiago Moya, Gabriela Nicora, Federico Robledo, Martin Rugna, Juan Ruiz, Sofía Ruiz Suarez, Maximiliano Sacco, Marcos Saucedo, Celeste Saulo, Luciano Vidal
International Collaborations: Eugenia Kalnay, Takemasa Miyoshi, Steve Nesbitt, Daniel Vila, Iztar Zawadzki.
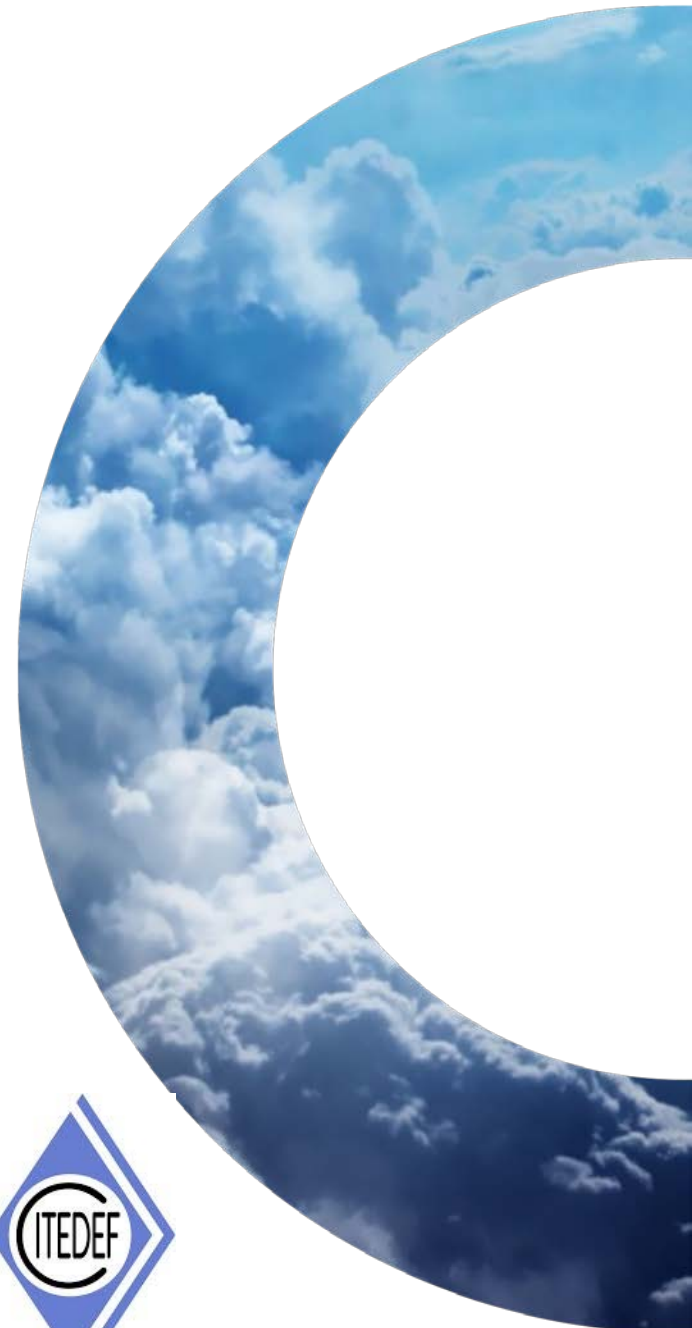
Thank you for your attention!

Servicio
Meteorológico
Nacional