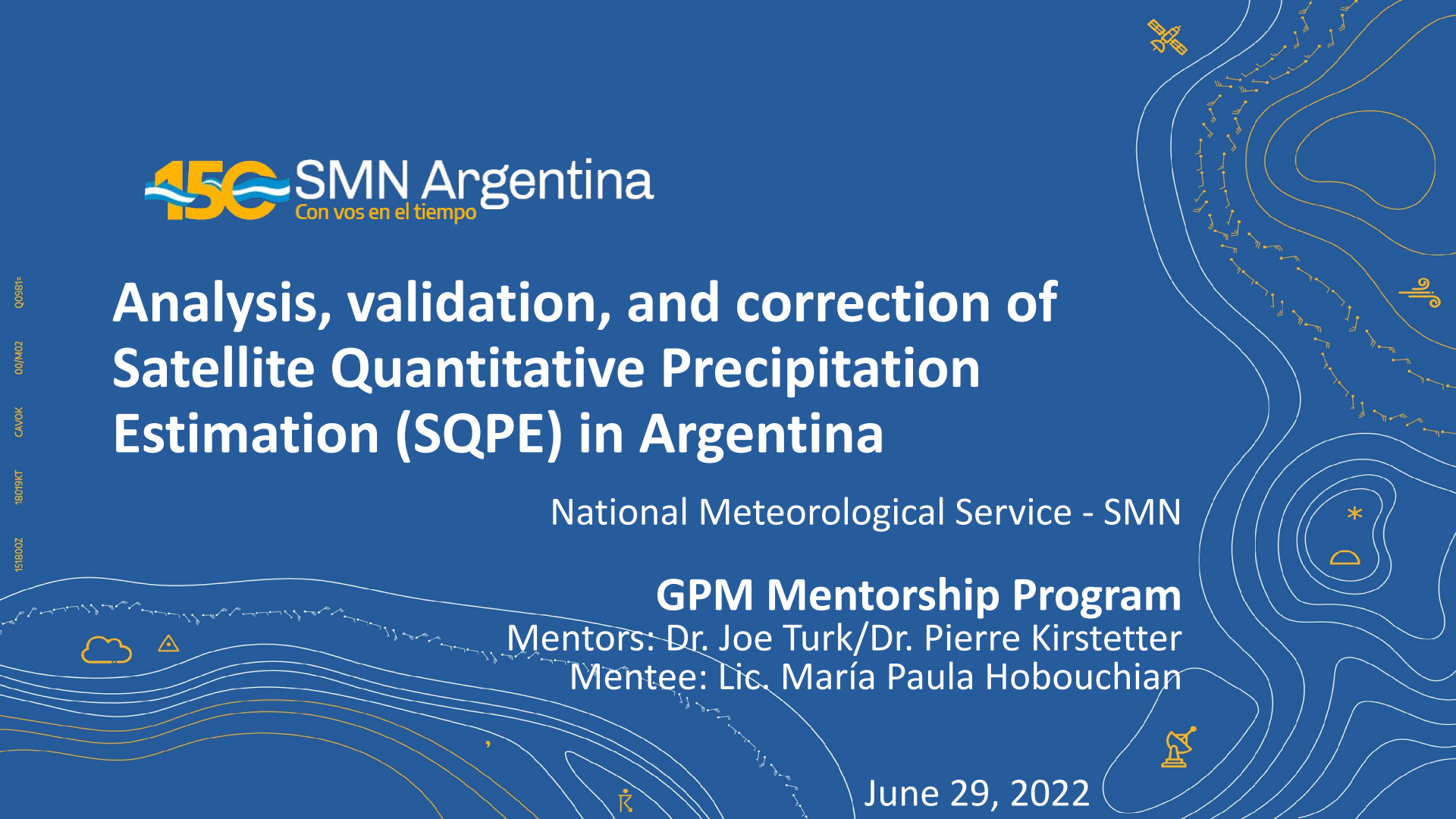# Analysis, validation, and correction of Satellite Quantitative Precipitation Estimation (SQPE) in Argentina

National Meteorological Service - SMN

**GPM Mentorship Program**
Mentors: Dr. Joe Turk/Dr. Pierre Kirstetter
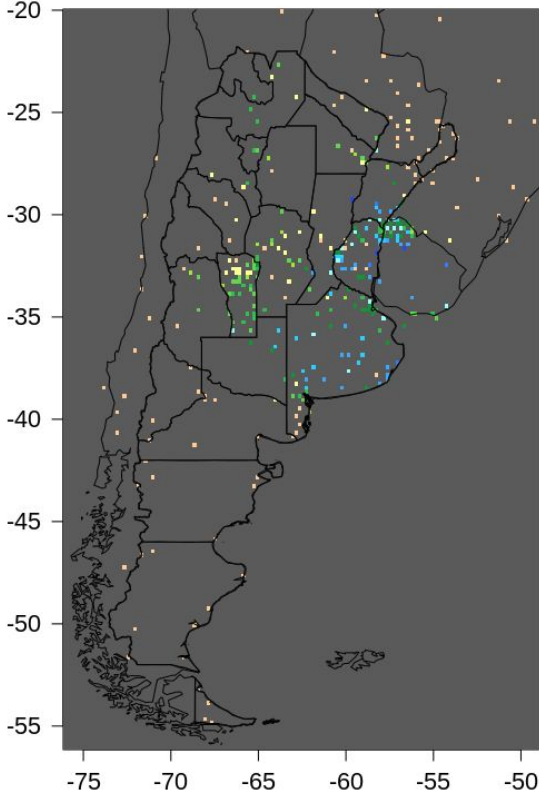Mentee: Lic. María Paula Hobouchian
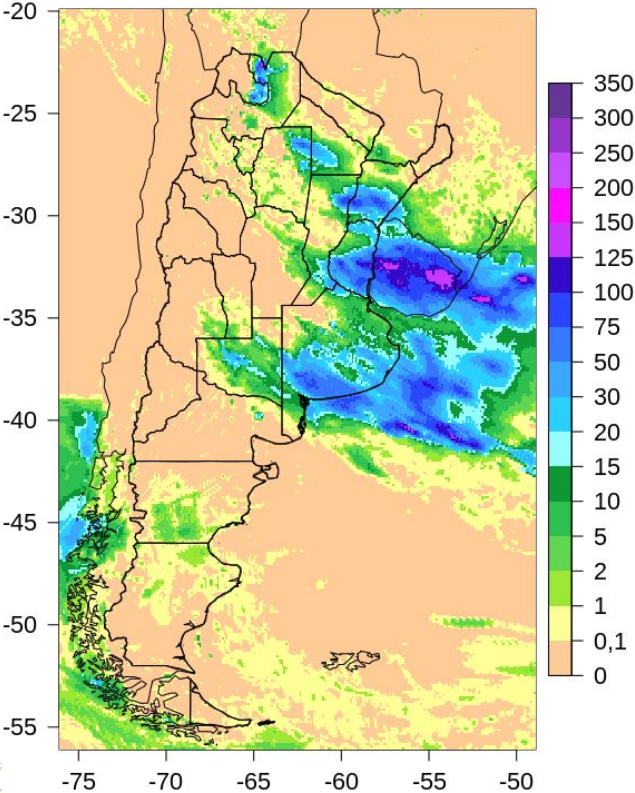
June 29, 2022

# Motivation to use the SQPE products in Argentina

- *Low-density rain gauge network.*

- *Challenges in representing precipitation.*

**Rain gauge observations**

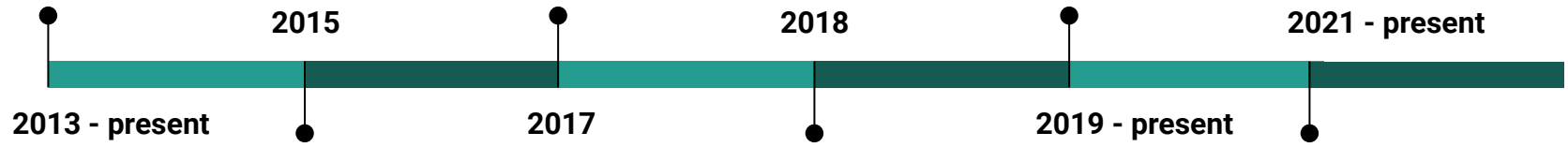**Satellite precipitation product**

**Precipitation (mm/day) April 10, 2021**



- *Uniform distribution of SQPE products.*

- *Global recognized SQPE products.*

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# Work experience with SQPE products in Argentina

**Implementation of Hydro-Estimator product**

1. **Validation and improvement efforts of the Hydro-Estimator product**

2. **Study and validation of SQPE products over the Subtropical Andes to analyze errors related to topography**

3. **Validation of SQPE products to agricultural insurance in Central Argentina**

**Project collaboration to improve the precipitation estimate by merging data sets available in Argentina**

**2015**          **2018**          **2021 - present**

**2013 - present**          **2017**          **2019 - present**

**Study and validation of SQPE products by regions and three-month period (Salio et al., 2015)**

**Daily validation of SQPE products from GPM mission by regions**

1. **Spatial correlation analysis of precipitation in Argentina**

2. **Correction of IMERG SQPE product with rain gauges in Argentina**

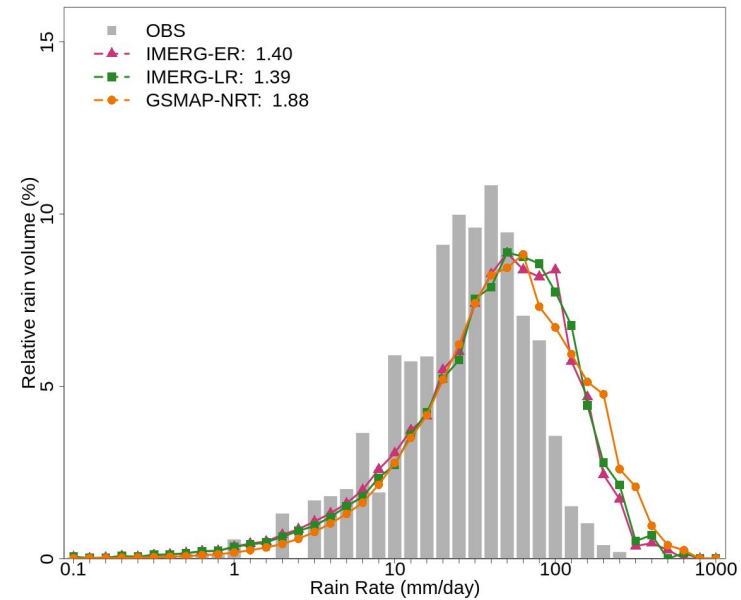3. **Project collaboration to evaluate the Gauge-Corrected SQPE in Argentina**

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# Current SQPE products available at SMN

| Estimation | Resolution | Latency | Type | Reference |
|---|---|---|---|---|
| HYDROESTIMATOR (SMN) | 4 km-10 min | 5 min | IR-HR-PW | Scofield and Kuligowski (2003) |
| IMERG ER (NASA) | 0.1°-30 min | 4 h | IR-PMW-DPR | Huffman et al. (2020) |
| IMERG LR (NASA) | 0.1°-30 min | 12 h | IR-PMW-DPR | Huffman et al. (2020) |
| IMERG FR (NASA) | 0.1°-30 min | 3 months | IR-PMW-DPR-OBS | Huffman et al. (2020) |
| GSMaP NRT (JAXA) | 0.1°-1 h | 4 h | IR-PMW-DPR | Kubota et al. (2020) |
| GSMaP Gauge (JAXA) | 0.1°-1 h | 4 h | IR-PMW-DPR-OBS | Kubota et al. (2020) |
| ABI RRQPE (NOAA) | 2 km-10 min | 5 min | IR-PMW | Kuligowski (2010) |
| CHIRPS (CHG) | 0.05°-24 h | 6 days | IR-OBS | Funk et al. (2015) |

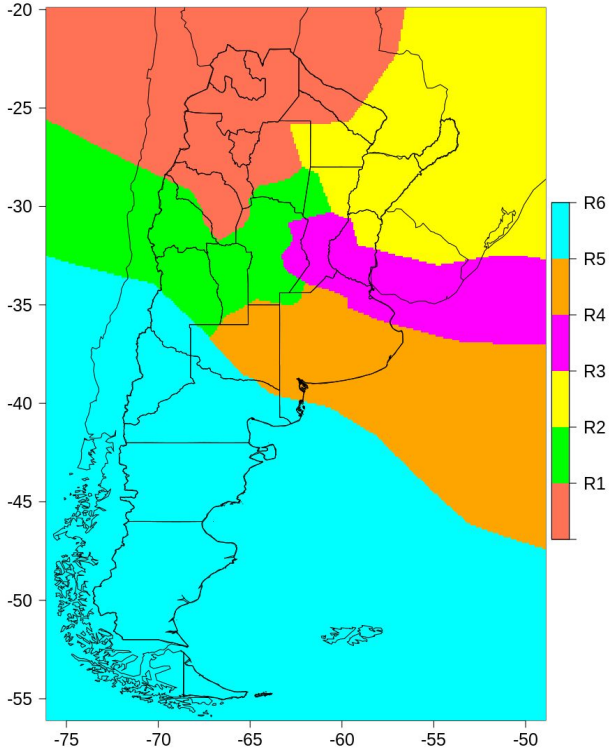*Selection of the SQPE for the Gauge-Corrected product:*
- *Low data latency less than 6 hours.*
- *Regional evaluation of GPM products (Hobouchian et al., 2018): IMERG ER, IMERG LR, and GSMaP NRT.*
- *Initial use of IMERG Early Run (Huffman et al., 2020).*



Volumetric PDF for Central Argentina

OBS
IMERG-ER: 1.40
IMERG-LR: 1.39
GSMAP-NRT: 1.88

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# Study region and daily rain gauge network in Argentina
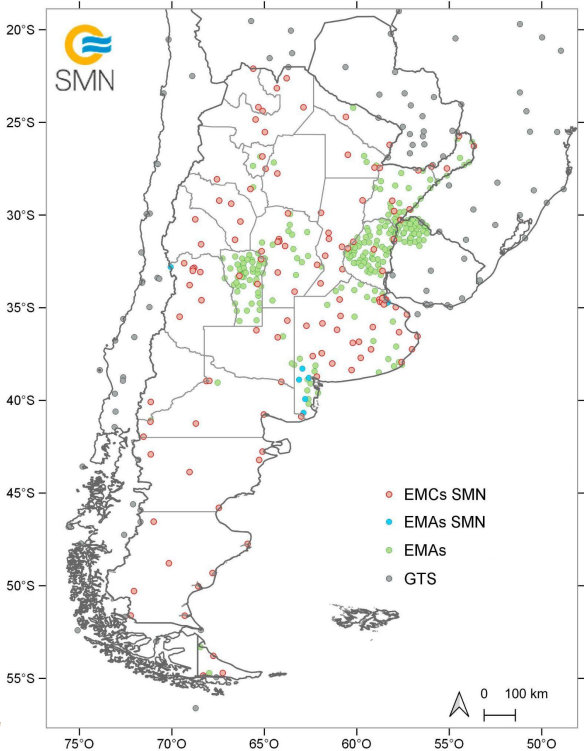
## Climatic regions



## Rain gauge network



### Methods application by:

- **Climatic regions** from Central Climate Division at SMN.
  - *Three-month periods: DJF, MAM, JJA, SON.*

### Daily rain gauge data:

- *Conventional meteorological stations of SMN and adjacent countries (**reference network**).*
  - *In addition to Automatic meteorological stations of SMN and external stations (**complete network**).*
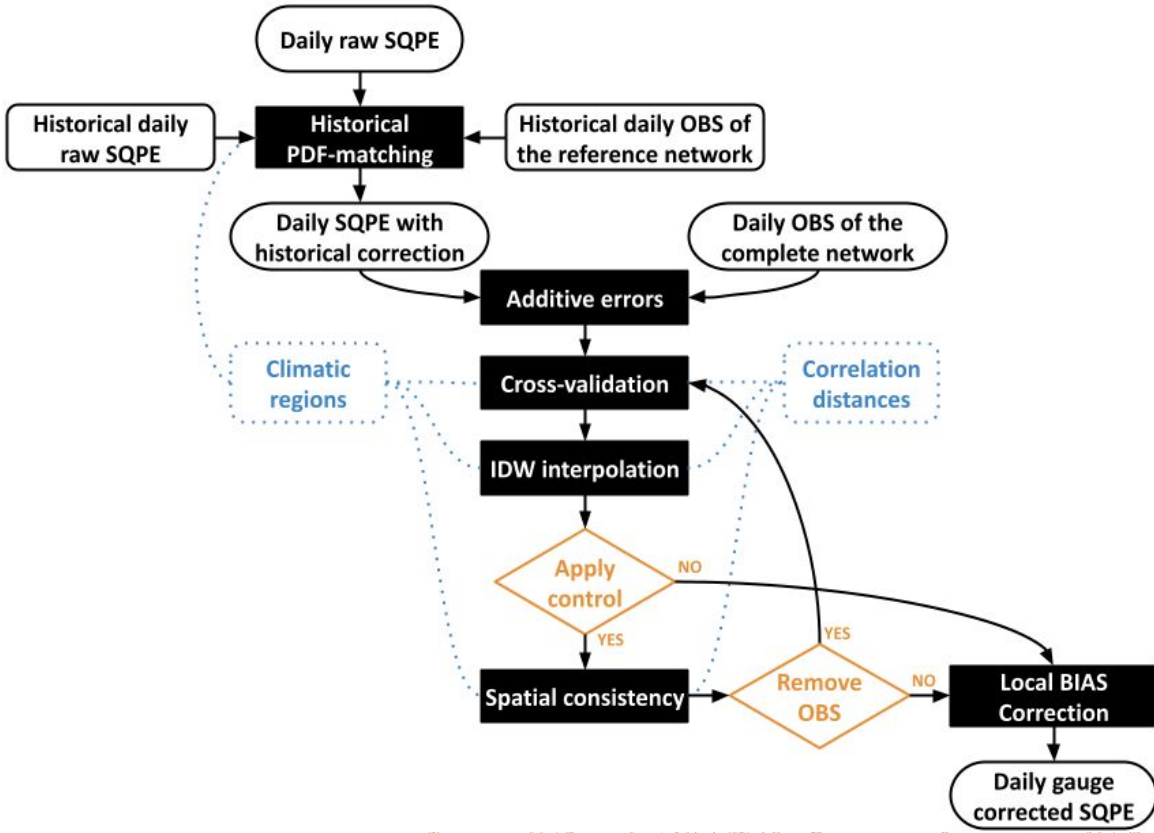
# Gauge-Corrected SQPE

1. **Historical PDF-matching Correction** (<u>Gudmundsson et al., 2012</u>): match between distributions by region and three-month period, using daily IMERG Early Run and reference high-quality network since 2001.

2. **Daily Local BIAS Correction** (<u>Zhang et al., 2011</u>): IDW technique by region, using correlation distances for BIAS interpolation, daily IMERG Early Run first corrected with PDF-matching, the complete rain gauge network, and a spatial consistency method.

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# Gauge-Corrected SQPE
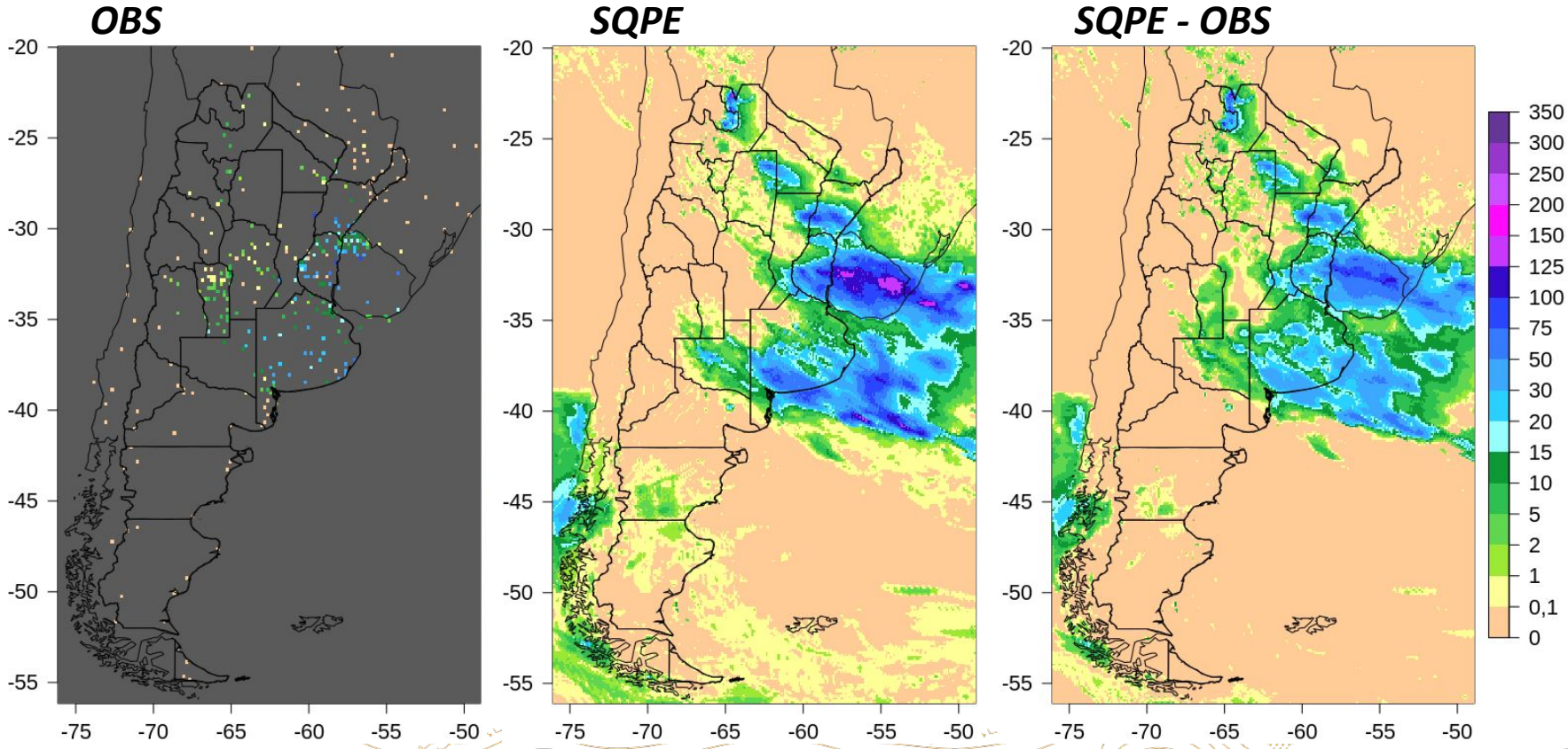


**Flowchart of the current product:**

1. *Methodology steps.*
2. *Input/output precipitation data.*
3. *Fix data from previous processes.*
4. *Decision steps.*

**SQPE** - *Satellite Quantitative Precipitation Estimation*
**OBS** - *rain gauge OBServations*

*Gauge-Corrected SQPE product is daily available with an about latency of 4h (IMERG ER data in addition to correction process of 5 min)*

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# Gauge-Corrected SQPE

**Precipitation (mm/day) for April 10, 2021**
*SQPE - Satellite Quantitative Precipitation Estimation*
*OBS - rain gauge OBServations*

OBS

SQPE

SQPE - OBS

# Topics of interest for the project guide

1. Real-time PDF-matching correction or other suggested methods to improve the current Gauge-Corrected satellite product.

2. Study and|or assessment of precipitation extremes.

3. Using satellite products for early detection of heavy rainfall and flash flood events.

# BIAS correction alternative to consider in Argentina

**Work plan with the Kriging with External Drift (KED) technique:**

1.  Provide a better daily precipitation estimate in Argentina with a sparse rain gauge network.

2.  Practice the KED technique and comparison with the IDW interpolation method by computing summary statistics.

3.  Discuss the KED technique, code, and results with the mentors.

4.  Adapt the code to local IMERG Early Run and rain gauge observations.

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Argentina

Dorrego 4019 (C1425GBE) Buenos Aires . Argentina
Tel: (+54 11) 5167-6767. smn@smn.gob.ar

www.smn.gob.ar