

Estimating and Reducing Precipitation Uncertainty in Atmospheric Systems using Data Assimilation: A Local-Scale Forecasting Study in the Andes

Danilo¹, OLucia², ManuelZ²

*For correspondence:
dasuarezh@eafit.edu.com (EAFIT)

¹MSc Applied Mathematics Universidad EAFIT; ²Universidad EAFIT

Present address:
[†]Medellín, Antioquia, Colombia

1 Introducción

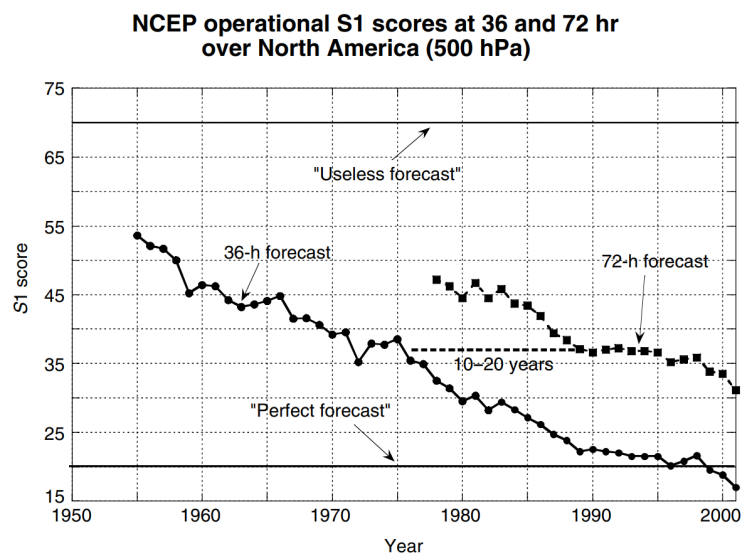


Figure 1. from *Kalnay (2003)*

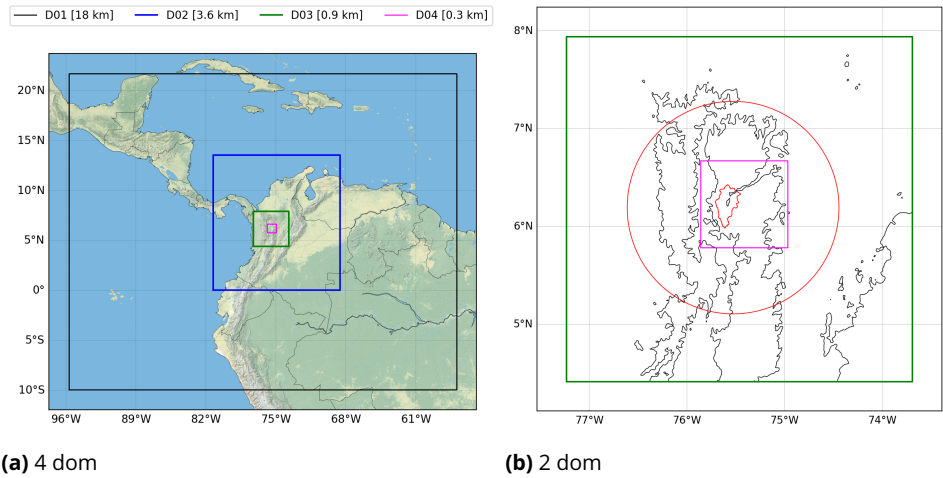


Figure 2. dominios WRF

2 Methodology

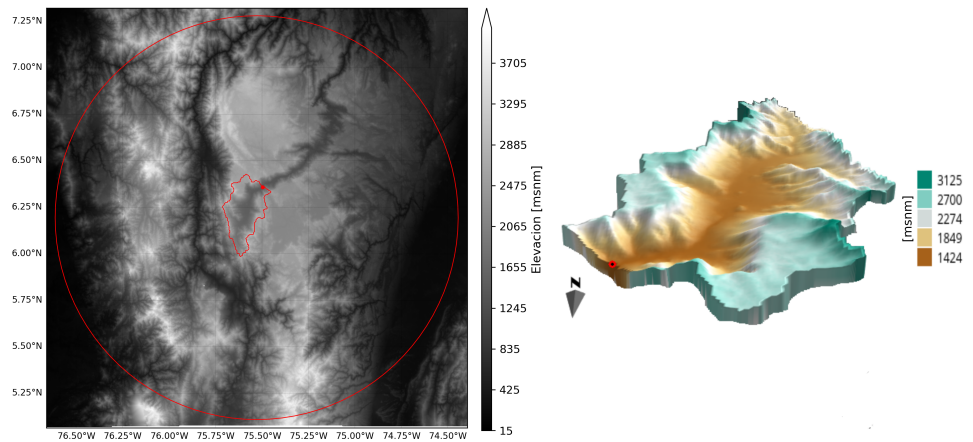


Figure 3. basin elevation + dem 3d

3 3DVAR

$$J(\mathbf{x}) = \frac{1}{2} \left\| \mathbf{x} - \mathbf{x}^b \right\|_{\mathbf{B}^{-1}}^2 + \frac{1}{2} \left\| \mathbf{y}^o - \mathcal{H}(\mathbf{x}) \right\|_{\mathbf{R}^{-1}}^2, \quad (1)$$



Figure 4. DA times 1



Figure 5. DA times 2

4 B

National Meteorological Center (NMC) method

$$\mathbf{B} \approx \frac{1}{T_n - 1} \sum_{t=1}^{T_n} (x_t^{24h} - x_t^{12h}) (x_t^{24h} - x_t^{12h})^T \quad (2)$$

Observations

- **IDE:** IDEAM Weather Stations
- **SWS:** SIATA Weather Stations
- **SCC:** SIATA Citizen Scientist Stations
- **SRD:** SIATA Radiometer
- **SPR:** SIATA Profiler
- **SWR:** SIATA C-band Weather Radar

Observations	Variable
IDE	PR, TM, RH, WV, WD
SWS	PR, TM, RH, WV, WD
SCC	PR*, TM, HR
SRD	TM
SPR	WV, WD
SWR	REF, VRA

Table 1. Caption

Domain	Observations
D01	
D02	IDE, SWS, SRD, SPR
D03	IDE, SWS, SRD, SPR, SWR
D04	IDE, SWS, SCC, SRD, SPR, SWR

Table 2. Caption

5 Results

<https://siata.gov.co/meteorologia/temporal/ot/>

$$\text{FSS} = 1 - \frac{\frac{1}{N} \sum_{i=1}^N (F_i - O_i)^2}{\frac{1}{N} \sum_{i=1}^N (F_i^2 + O_i^2)} \tag{3}$$

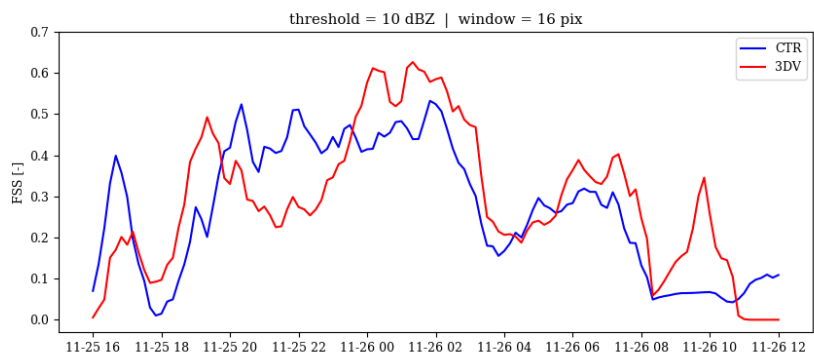


Figure 6. ppt ctr y da dom04

	CTR	3DV
Average FSS [-]	0.2703	0.2922

Table 3. Caption

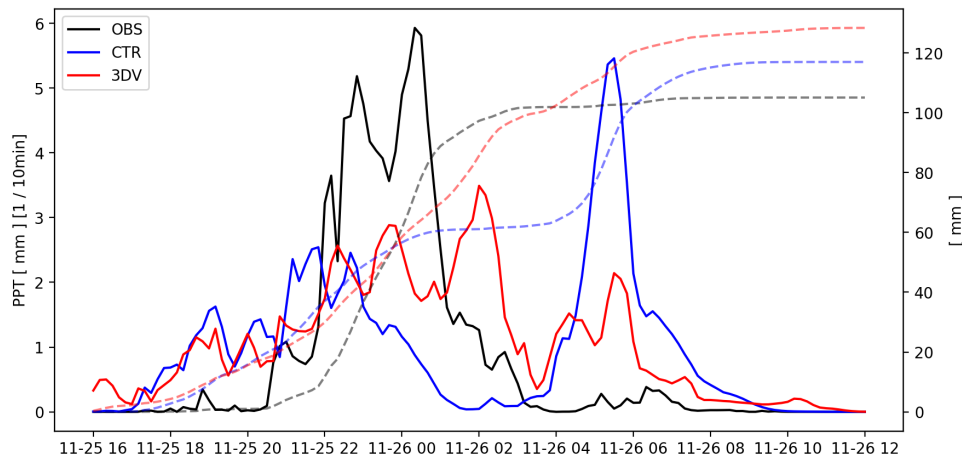


Figure 7. ppt ctr y da dom04

$$\text{RMSE} = \sqrt{\frac{1}{N} \sum_{i=1}^N \left(y_i^{\text{pred}} - y_i^{\text{obs}} \right)^2} \tag{4}$$

	CTR	3DV
RMSE [mm]	1.7756	1.2031

Table 4. Caption

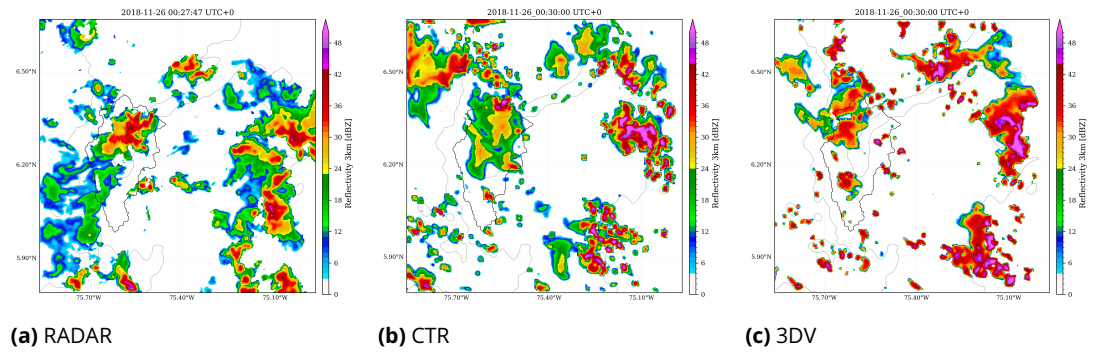


Figure 8. 2018-11-26 00:30:00

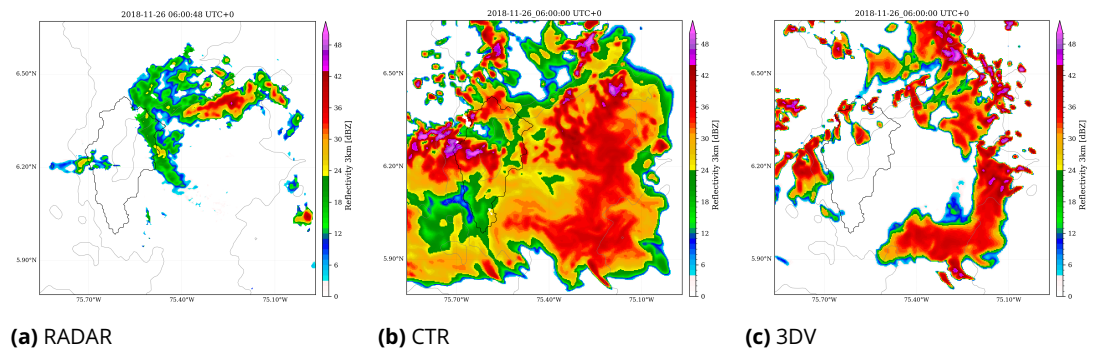


Figure 9. 2018-11-26 06:00:00

References

Kalnay E. Atmospheric modeling, data assimilation and predictability. Cambridge university press; 2003.