Postprocessing of Convection-Permitting Precipitation Forecasts using UNets

Marcos Esquivel-González, Albano González, Juan Carlos Pérez,
Juan Pedro Díaz, Pierre Simon Tondreau

Universidad de La Laguna

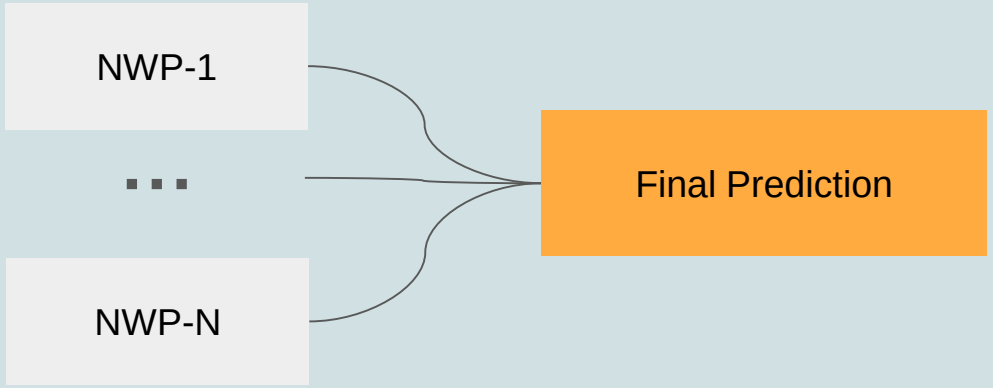
Grupo de Observación de la Tierra y la Atmósfera (GOTA), Avenida Astrofísico Francisco Sánchez, s/n,
La Laguna, 38200, Canary Islands, Spain

1. Research context

Reliable forecasting

Numerical Weather Prediction (NWP)

Ensemble forecasting

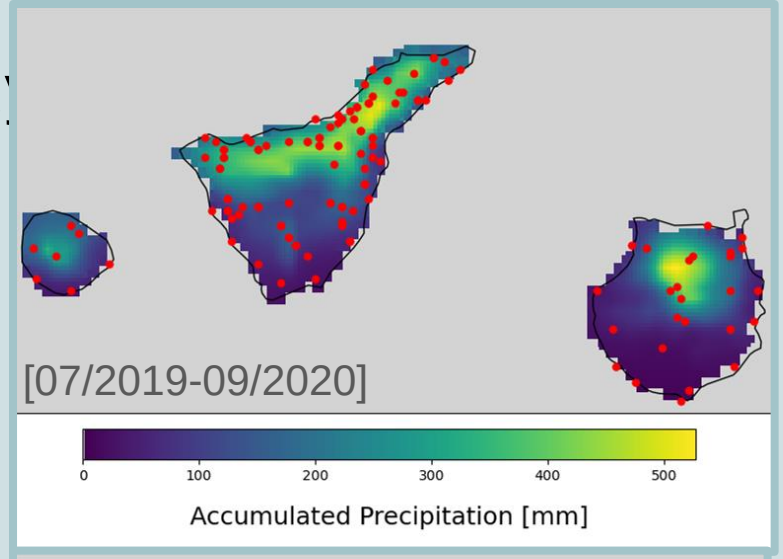


2. Objective and Case stud

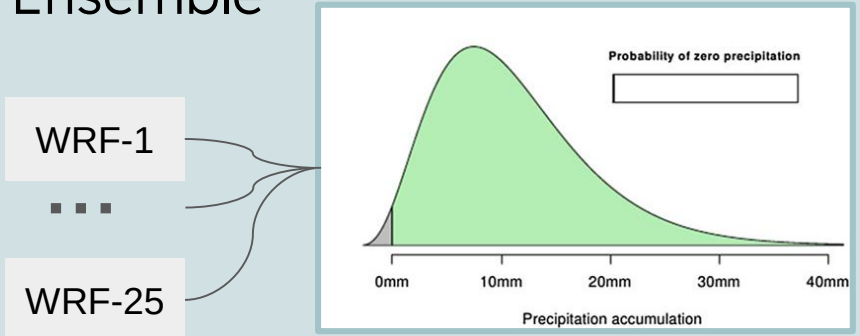
- Canary Islands
- 25 WRF simulations:

(24h forecast, 15 month of hourly simulation)

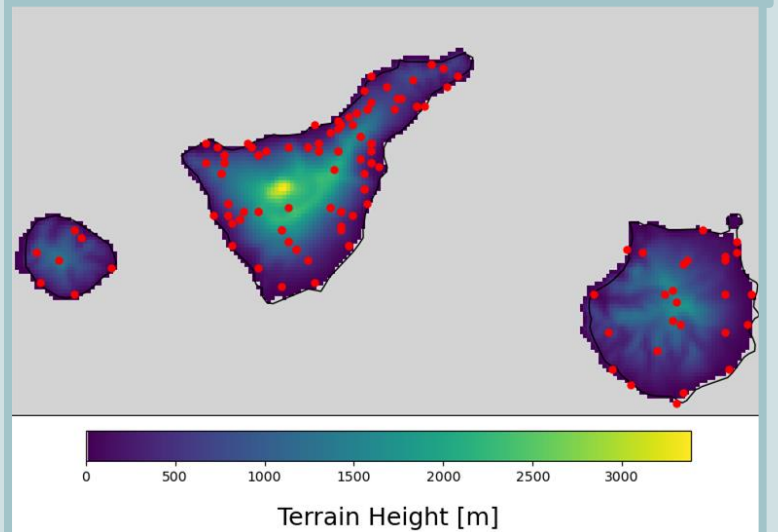
- 130 weather stations



Ensemble

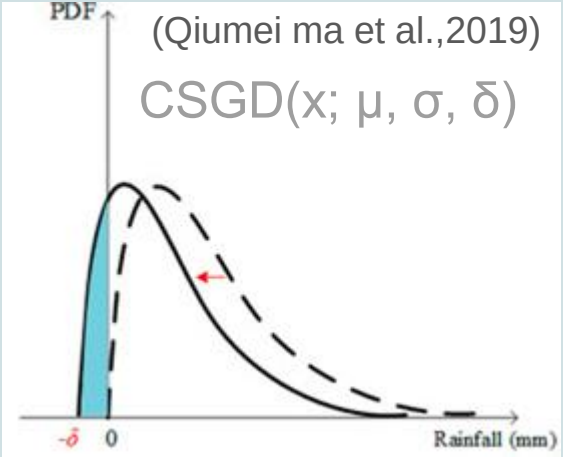


(Scheuerer et al.,2015)

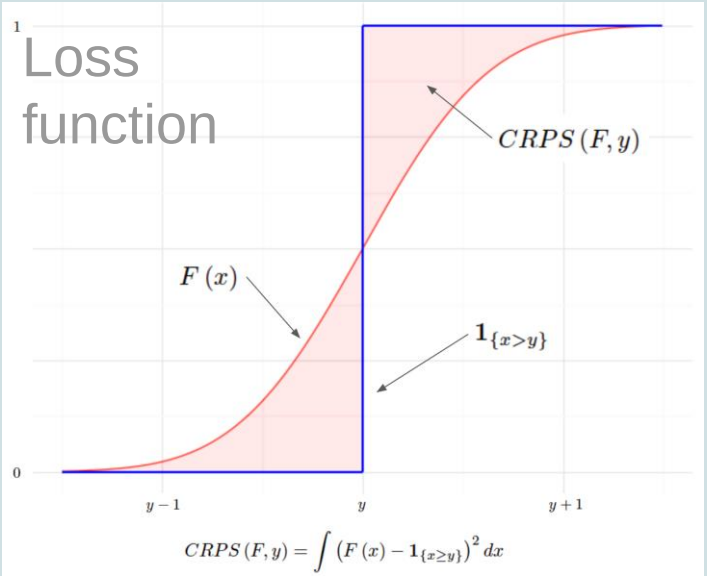


3. Postprocessing methods

Model type	Model name	Dimensionality Reduction	Distribution Type
UNet	UNet-All	None	CSGD
	UNet-PCA	PCA	CSGD
	UNet-FS	FS	CSGD
	UNet-DS	DS	CSGD
Analogue ensemble	AnEn	None	Empirical CDF
	AnEn-FS	FS	Empirical CDF
CSGD based EMOS	PredCSGD	None	CSGD
	PredCSGD-FS	FS	CSGD
ANN	ANN-CSGD	None	CSGD
	ANN-CSGD-FS	FS	CSGD
Ensemble	Ensemble	None	Empirical CDF
	Ensemble-FS	FS	Empirical CDF

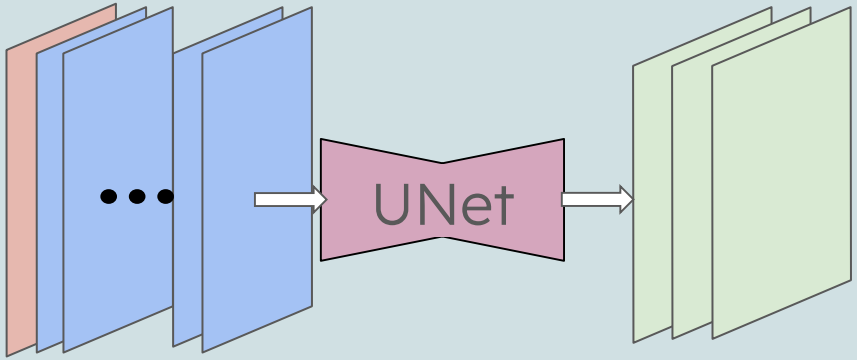


(Itamar Faran.,2023)



3. Postprocessing methods

Elevation + WRF simulations

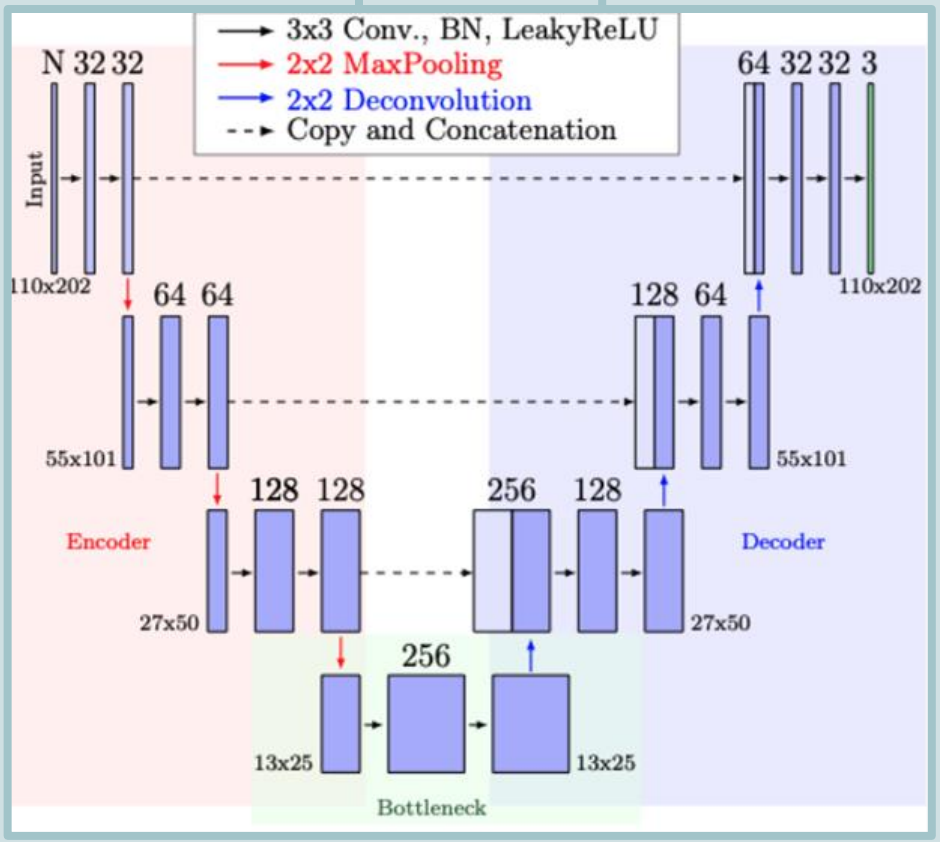


μ σ δ

Model name	Dimensionality Reduction
UNet-All	None
UNet-PCA	PCA
UNet-FS	FS
UNet-DS	DS

It reduces to only 10 WRF simulations

UNet



4. Findings

- UNets outperformed or matched benchmarks
- UNet-FS**: maintain skill with fewer inputs**
- Terrain height = key input
- Strong generalization (5-fold CV)

CRPSS = 1 - CRPS/CRPS_ensemble

CRPSS (Higher than 0 is better than ensemble)	Weather station locations	‘New’ locations
Unet-FS	**0.10±0.05**	**0.08±0.05**
PredCSGD	0.07±0.05	-
AnEn	0.05±0.05	-

Thanks for your attention

CORDEX
Flagship Pilot Studies

MAC 2021-2027
Cooperación Territorial

PLANCLIMAC2

Interreg
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Cofinanciado por
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GOTA
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AEMet
Agencia Estatal de Meteorología

Contact information:
Marcos Esquivel
marcos.esquivel.13@ull.edu.es

https://github.com/marcosesgonz/ProbabilisticPostprocessingPrecipitationUNets

Acknowledgements:
-World Climate Research Programme. Coordinated Regional Climate Downscaling Experiment (CORDEX)
-Consejería de Transición Ecológica y Energía. Canary Government. Spain.
-European Union Funds: INTERREG VI-D (Madeira-Azores-Canarias) MAC 2021-2027: PLANCLIMAC 2 Project (1/MAC/2/2.4/0006).

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Itamar Faran.CRPS – A Scoring Function for Bayesian Machine Learning Models.https://towardsdatascience.com/crps-a-scoring-function-for-bayesian-machine-learning-models-dd55a7a337a8/