Asia-Pacific Economic Cooperation

APEC PERU 2024

Progress in Weekly Sub-Seasonal Forecasts for Peru

Service of Meteorology and Hydrology (SENAMHI), PE.

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August 12 2024

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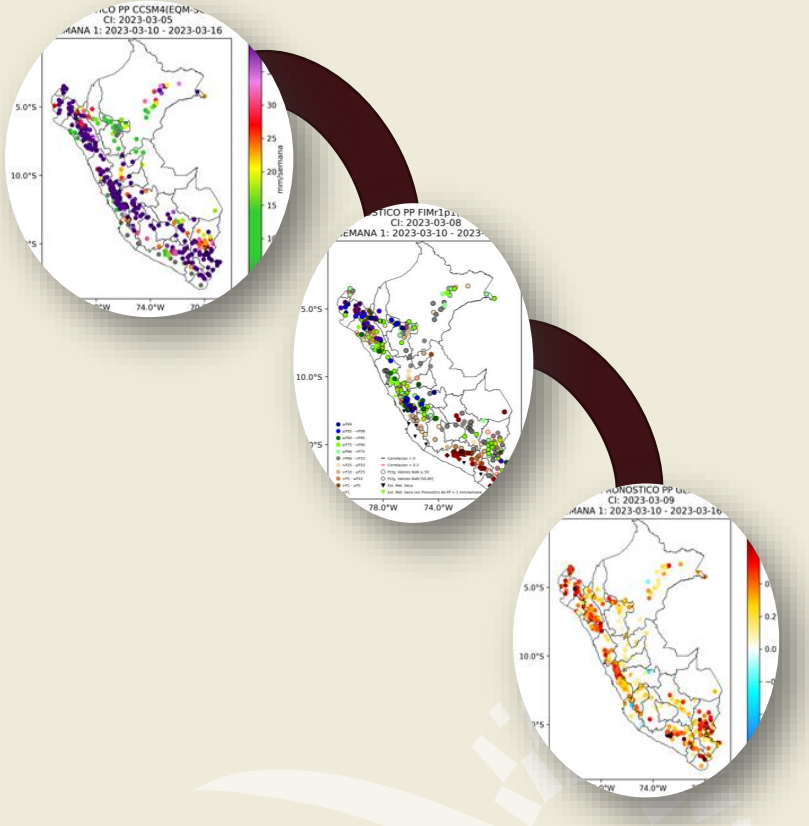
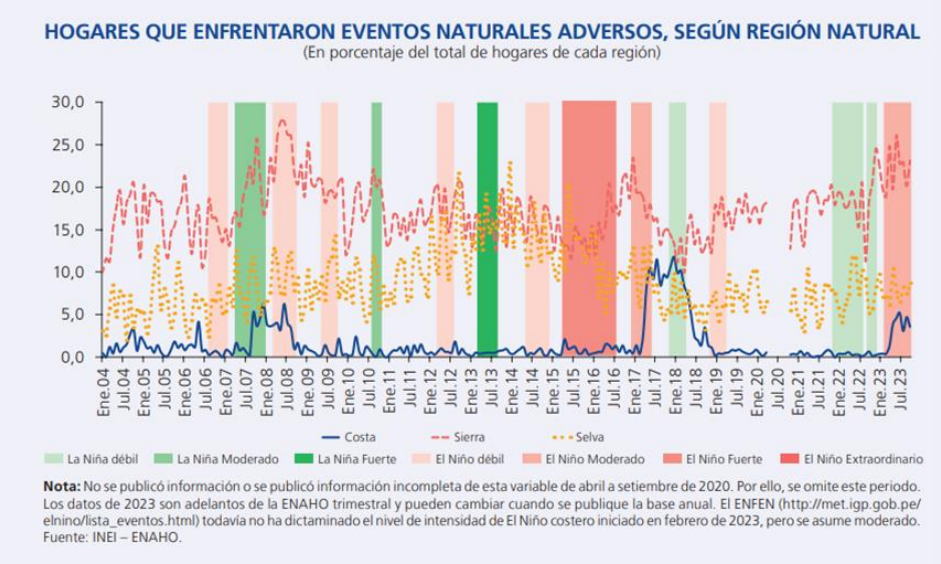
CONTENT

- INTRODUCTION
  - DATA AND METHODOLOGY
    - RESULTS
      - CONCLUSIONS



INTRODUCTION

Climate events and economic



Inflation Report. March 2024-Central Reserve Bank of Peru

Ranking	País	Evento	Costo per cápita US$
1	Hawai (EE.UU.)	Incendio forestal	4.161
2	Guam	Tormenta	1.455
3	Vanuatu	Tormenta	947
4	Nueva Zelanda	Tormenta	468
5	Nueva Zelanda	Inundación	371
6	Italia	Inundación	164
7	Libia	Inundación	105
8	Perú	Inundación	66
9	España	Sequía	50
10	Myanmar	Tormenta	41
11	Chile	Inundación	39
12	Haití	Inundación	36
13	México	Tormenta	35
14	Chile	Incendio forestal	30
15	Estados Unidos	Tormenta	25
16	China	Inundación	23
17	Perú	Tormenta	20
18	Malawi	Tormenta	17
19	Estados Unidos	Tormenta	16
20	Perú	Inundación	9

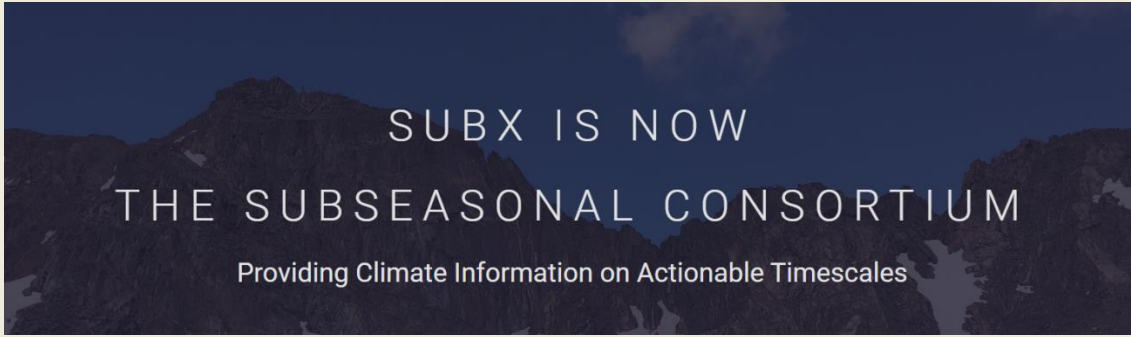
2021 Climate Risk Index compiled by GermanWatch

"…An initial indication that adverse natural events increase household vulnerability is that between 2004 and 2022, an average of 96.9 percent of households affected by these events reported a loss of income or assets each year. The reduction in income is the most significant problem for households facing adverse natural events.." , "…in the 2021 Climate Risk Index compiled by GermanWatch, Peru is ranked 45th out of 180 countries, indicating high vulnerability and exposure to extreme weather events."

DATA AND METHODOLOGY

The SubX/C project

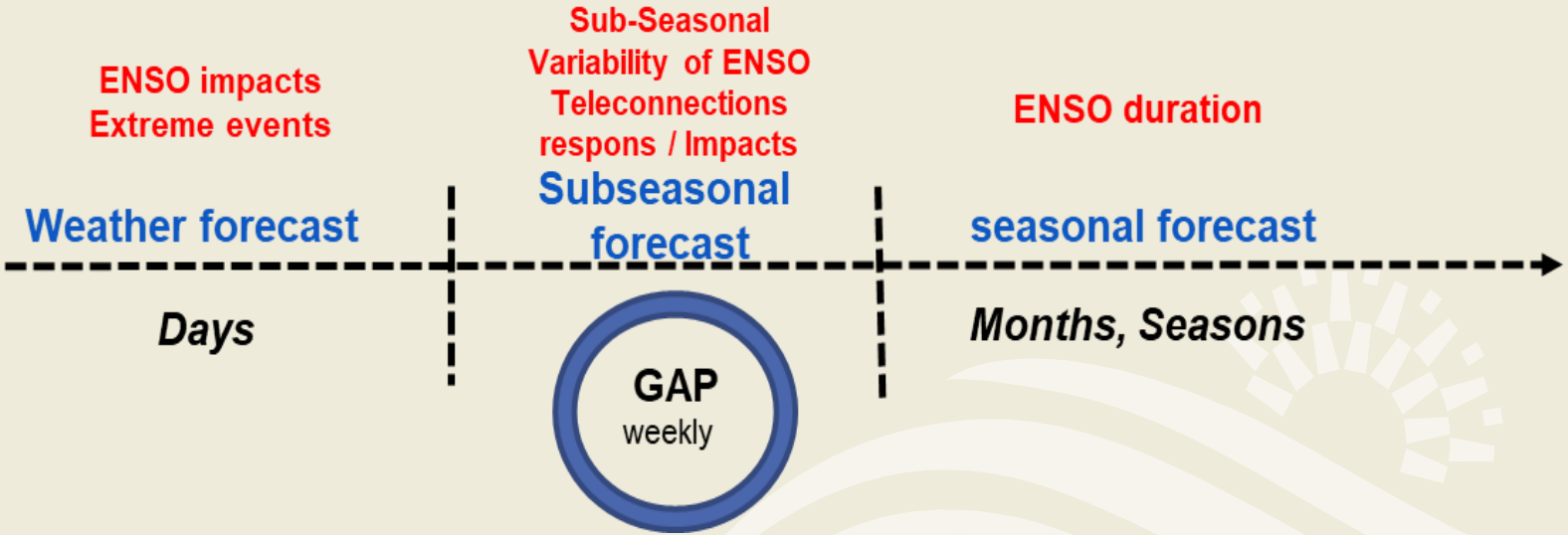
The Subseasonal Experiment Project (SubX) by NOAA aims to improve subseasonal forecasts using a multimodel approach.



International Research Institute for Climate and Society
EARTH INSTITUTE | COLUMBIA UNIVERSITY

IRI

The initiative to generate subseasonal forecasts was developed within the framework of the “ENANDES” Project, which seeks to improve the adaptation capacities of Andean populations by providing climate services that respond to their real needs.



Details to be consider about the SubC models

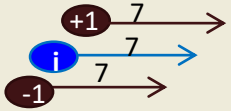
Model	Institute	Members	Length of forecast (days)	Hindcast Period	Initialization Day
ECCC-GEPS7	Environment and Climate Change Canada	4 [21]	32	2001- 2020	Thursday
EMC-GEFSv12	National Centers for Environmental Prediction, Environmental Modeling Center	11 [31]	35	1989- 2019	Daily
ESRL-FIMr1p1	National Oceanic and Atmospheric Administration, Earth System Research Laboratory	4	32	1999- 2017	Wednesday
GMAO-GEOSv2p1	National Aeronautics and Space Administration, Global Modeling and Assimilation Office	4	45	1999- 2016	Every 5 Days
NCEP-CFSv2	National Centers for Environmental Prediction	4[16]	45	1999- 2017	Daily (every 6 hours)
RSMAS-CCSM4	National Center for Atmospheric Research, run at the University of Miami Rosenstiel School of Marine and Atmospheric Science	3 [9]	45	1999- 2016	Sunday*

Details about the subseasonal forecast process:

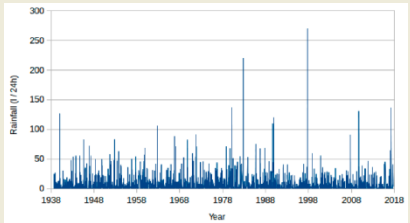
Weekly forecasts

WEEK 1 → WEEK 2 → WEEK 3 → WEEK4

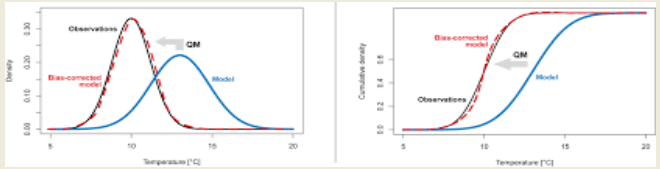
To increase variability, weekly total/average values are computed each year, considering lags of +1 day and -1 day (IC).



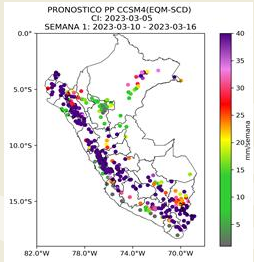
..thus, for the observations/hindcast data in the EQM process, we will have a maximum of 54 values approx." .



EQM BIAS correction

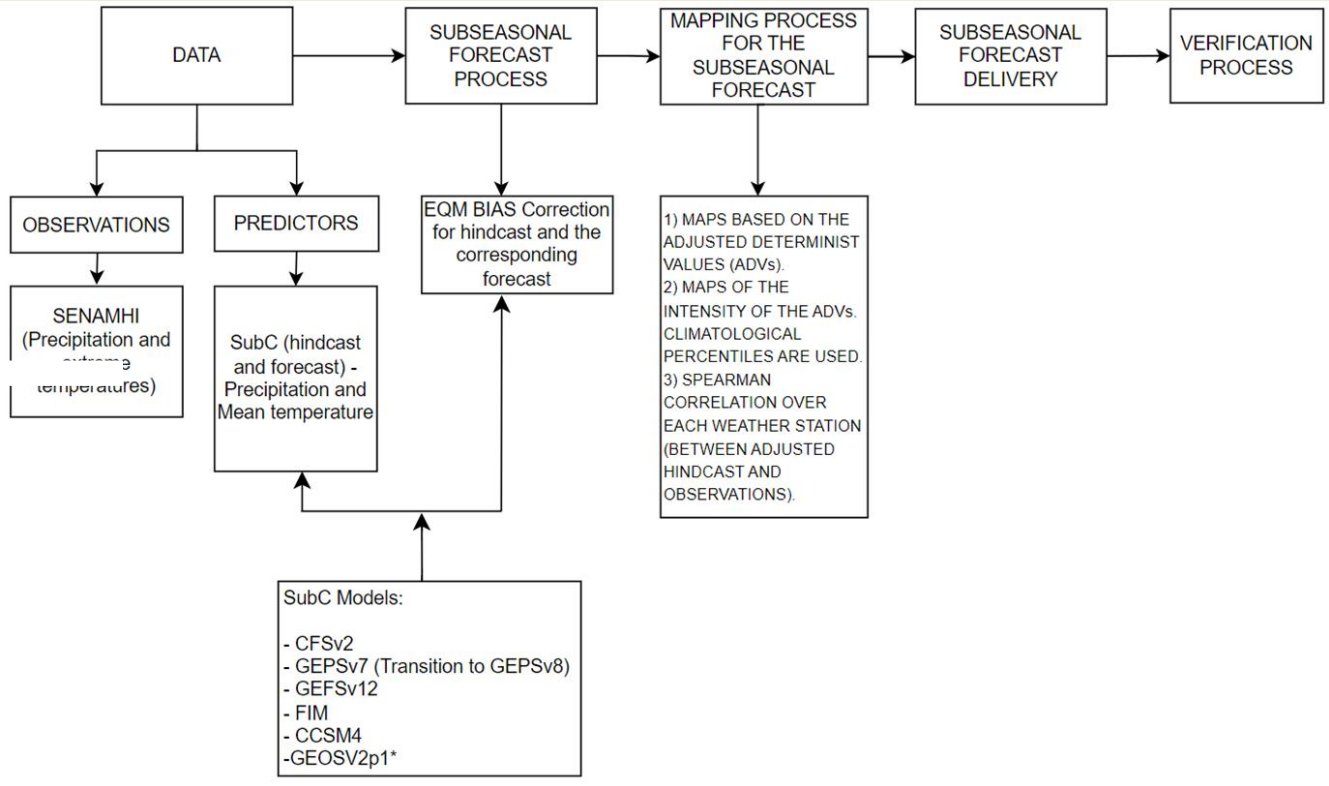


The EQM is applied over the forecast data at each weather station.



Wilks DS (1995) Statistical methods in atmospheric science. Academic, New York, p 467

PROCESS FLOW



- White, R. H. and Toumi, R. (2013) The limitations of bias correcting regional climate model inputs, Geophysical Research
- Piani, C., Haerter, J. O., and Coppola, E.: Statistical bias correction for daily precipitation in regional climate models over Europe, Theor. Appl. Climatol., 99, 187–192, 2010.
- Maraun, D. (2013) Bias Correction, Quantile Mapping, and Downscaling: Revisiting the Inflation Issue, Journal of Climate.

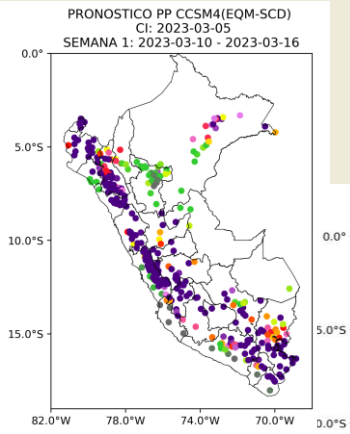
RESULTS

EXAMPLE OF A SUBSEASONAL FORECAST FOR WEEK 1

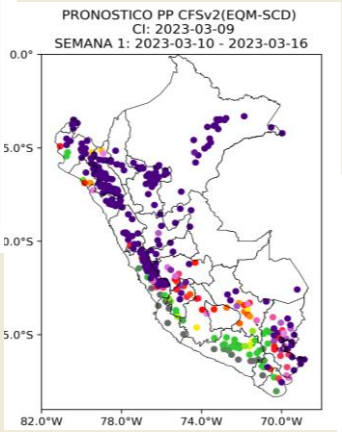
(10-16 Marzo 2023)

Deterministic Forecasts

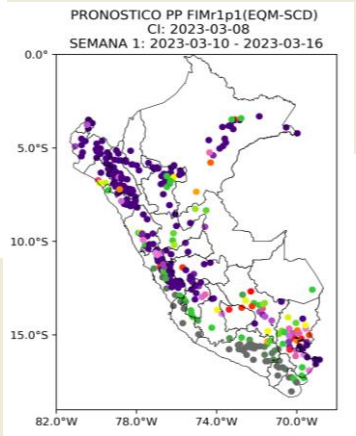
CCSM4



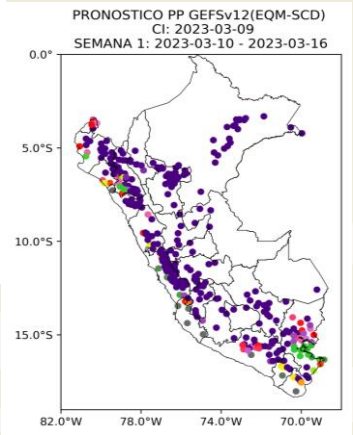
CFSv2



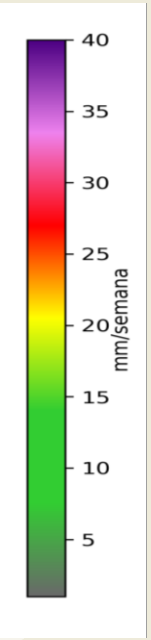
FIMr1p1



GEFS



(mm/week)



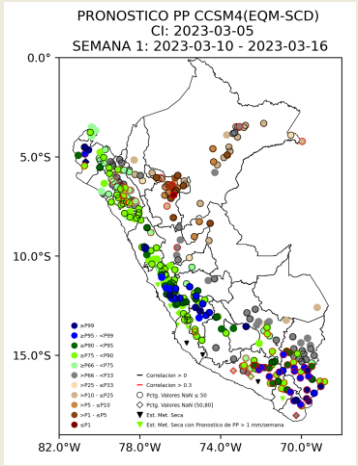
Forecasts of deterministic values for weekly accumulated rainfall.

EXAMPLE OF A SUBSEASONAL FORECAST FOR WEEK 1

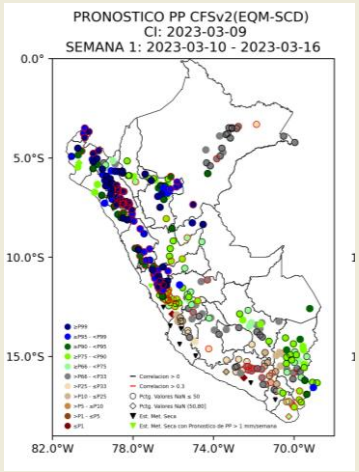
(10-16 Marzo 2023)

Intensity of The forecast

CCSM4



CFSv2



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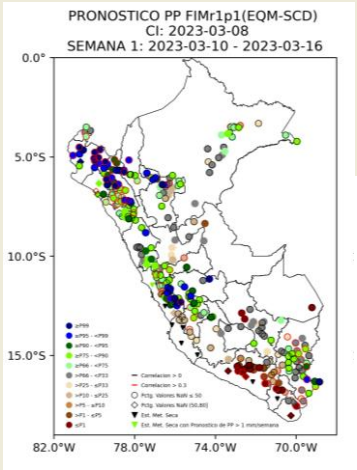
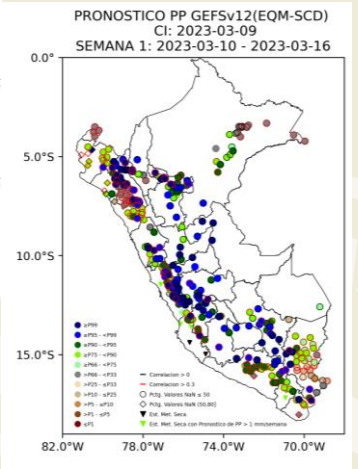


GEFS



(Percentile)

- ≥P99
- ≥P95 - <P99
- ≥P90 - <P95
- ≥P75 - <P90
- ≥P66 - <P75
- >P66 - <P33
- >P25 - ≤P33
- >P10 - ≤P25
- >P5 - ≤P10
- >P1 - ≤P5
- ≤P1

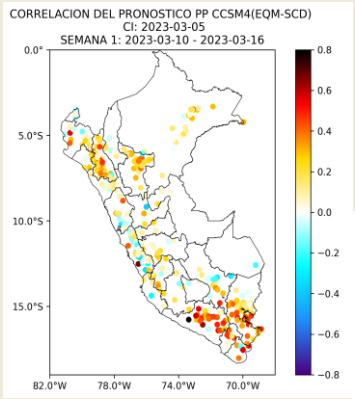
Forecasts categorized according to percentile levels.

EXAMPLE OF A SUBSEASONAL FORECAST FOR WEEK 1

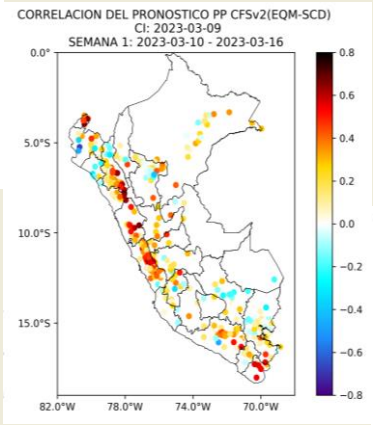
(10-16 Marzo)

Spearman Correlation

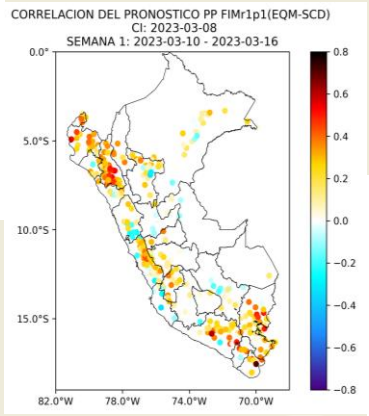
CCSM4



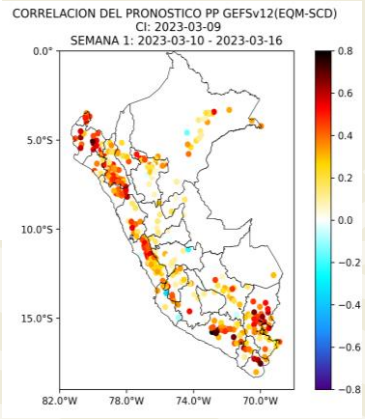
CFSv2

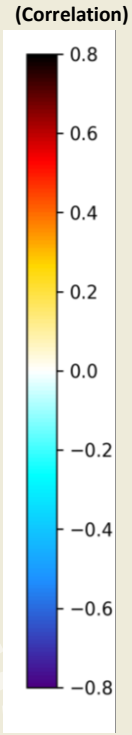


FIMr1p1



GEFS





..an approximation to a skill metric

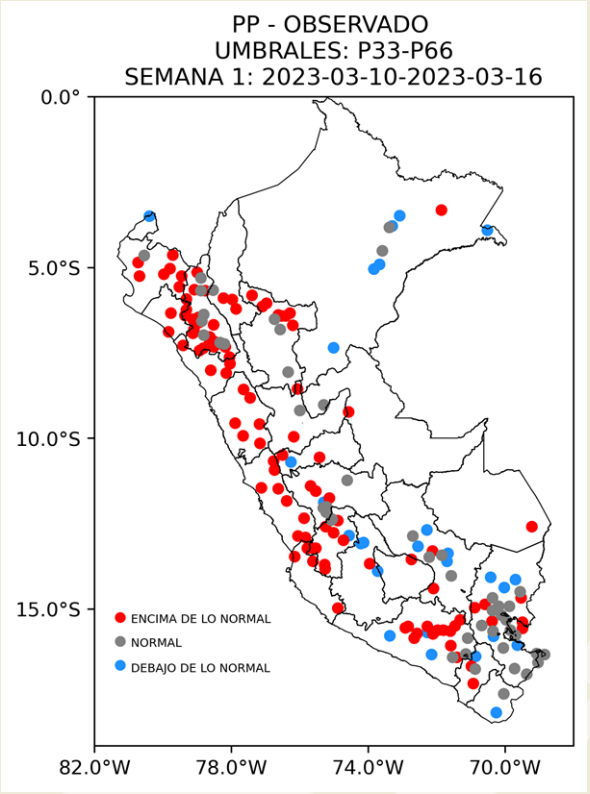
Subseasonal Forecast Example: Case study of the Yaku cyclone

Videos from the newspaper "LA REPUBLICA"
Date: March 2023
"Yaku" event.

Subseasonal Forecast Example: Case study of the Yaku cyclone

An unusual 'unorganized cyclone with tropical characteristics' formed off the northern and central coasts of Peru.

… associated with the warming of sea surface temperatures and the second band of the Intertropical Convergence Zone (ITCZ).

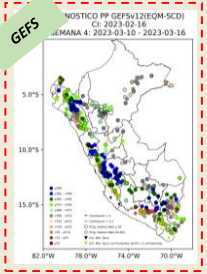


Extreme event report N°001-2023
https://repositorio.senamhi.gob.pe/handle/20.500.12542/2789

Subseasonal forecast for the Yaku event

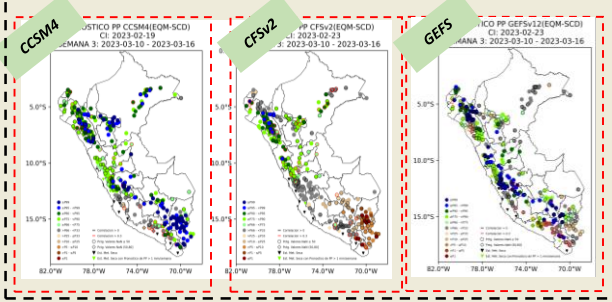
23 days before

IC : 16-02-2023
Forecast:10-16 march 2023



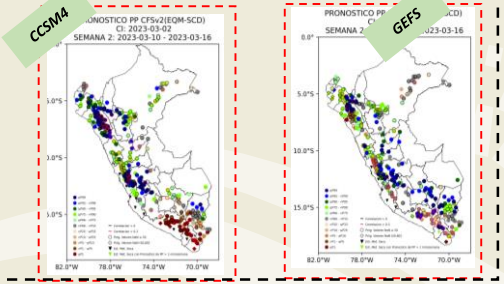
16 days before

IC : 23-02-2023
Forecast:10-16 march 2023



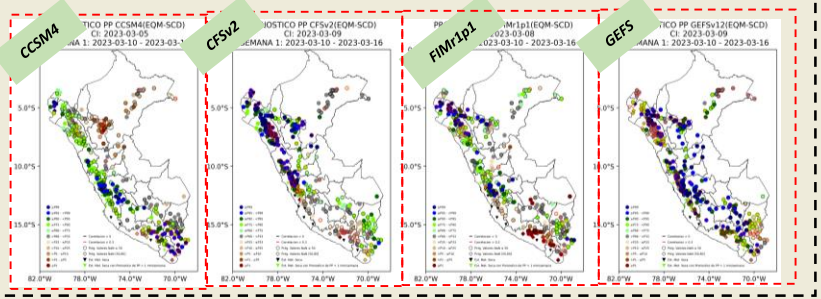
9 days before

IC : 02-03-2023
Forecast:10-16 march 2023



1 day before

IC : 09-03-2023
Forecast:10-16 march 2023



PERCENTILE LEVELS

- ≥P99
- ≥P95 - <P99
- ≥P90 - <P95
- ≥P75 - <P90
- ≥P66 - <P75
- >P66 - <P33
- >P25 - ≤P33
- >P10 - ≤P25
- >P5 - ≤P10
- >P1 - ≤P5
- ≤P1

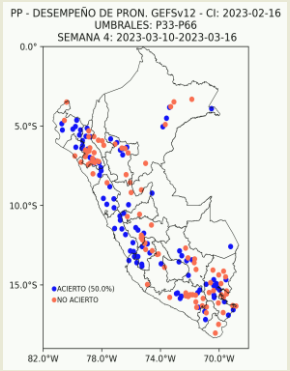
EXCESSES OF RAIN

RAIN DEFICIENCY

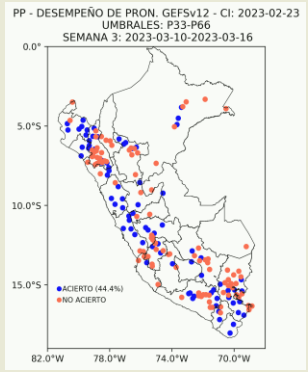
AN EXAMPLE OF THE VERIFICATION PROCESS FOR THE GEFSv12 MODEL

HIT AND NO HIT MAPS

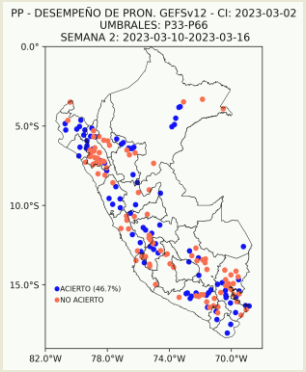
23 days before



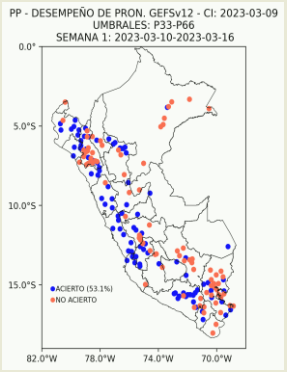
16 days before



9 days before



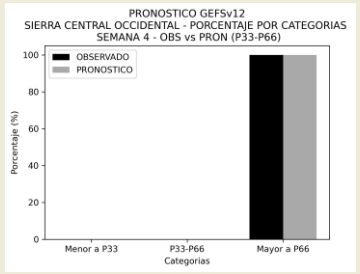
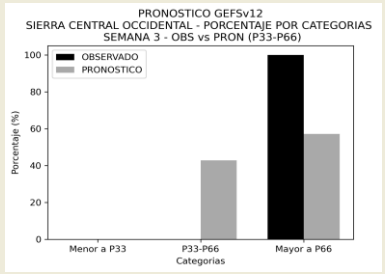
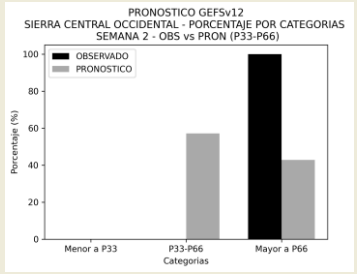
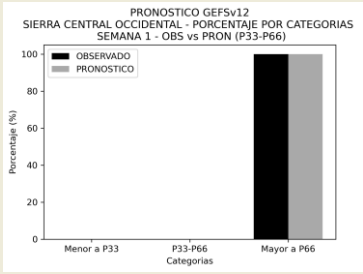
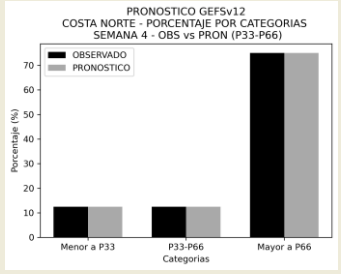
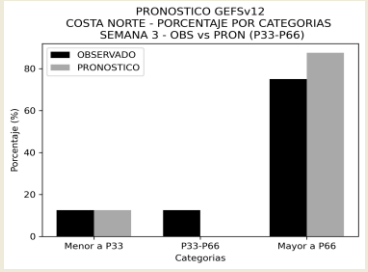
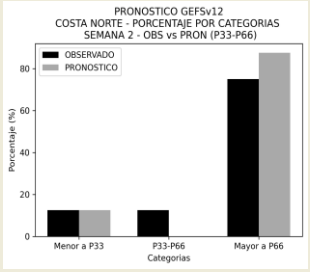
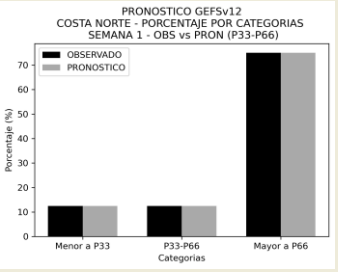
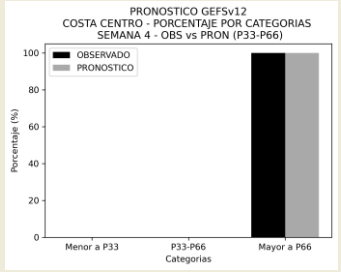
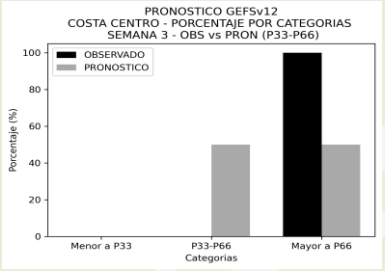
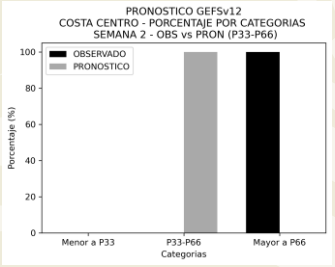
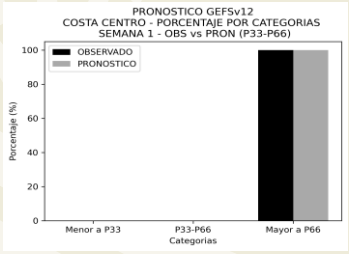
1 day before



HIT **NO HIT**

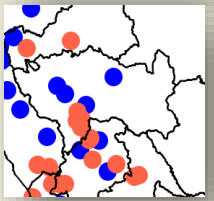
An evaluation of the results predicted by all meteorological stations in the country showed success percentages close to 49% based on the three categories. However, in the coastal regions and northern highlands, where the event had a greater impact, success rates ranged between 70% and 80%

AN EXAMPLE OF THE VERIFICATION PROCESS FOR THE GEFSv12 MODEL

	23 days before	*16 days before*	*9 days before*	*1 day before*
WESTERN CENTRAL HIGHLANDS				
NORTHERN COAST				
CENTRAL COAST				

CONCLUSIONS

- Subseasonal forecasts are useful, and their monitoring will be relevant for decision-makers.



- For certain regions, the forecast signal can be consistent over time. However, it might be noisy in other sectors of the country. This depends on many factors such as methodology, missing values, etc.

- There is still much work to be done in exploring additional local and non-local calibration methodologies, as well as in examining gridded information as an approximation to data from observed meteorological stations.

- We are in the process of finalizing a study on the primary results of predicted summer rainfall. Our plan is to submit this study for scientific publication by the end of the year.

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2024

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