

# Skill of user-tailored seasonal forecasts for the agricultural sector in Peru

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## Crop-specific optimal temperature ranges

### Definition

Percent of days within crop-specific optimal temperature range for respective growing stage.  
(Tab. T1; all results for maize)

Tab. T1  
Thresholds for different phenological phases of maize [3]

	Maize	
	Min	Max
Germination	15	25
Emergence	15	21
Growing	15	20

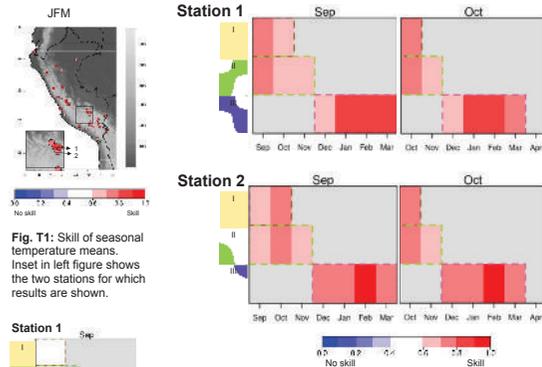


Fig. T1: Skill of seasonal temperature means. Inset in left figure shows the two stations for which results are shown.

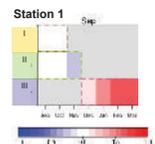


Fig. T2: Correlation between observed temperature-based index and Niño 3.4 SST anomalies at station 1. The rows indicate different growing stages (see Tab T1). Results at station 2 are similar for Jan-Mar.

⇒ Index shows skill at both stations. Highest skill during January — March.

⇒ Highest skill is observed during months of strongest correlations with Niño 3.4 SST.

## MOTIVATION

Prediction of user relevant indices may be more beneficial for specific applications than predicting mean values at the seasonal scale. In this study, the skill of two selected indices, tailored for applications in the agricultural sector, is assessed:

- Optimum temperatures dependent on crop phenological phase
- Onset of rainy season

The study is part of the project CLIMANDES aiming at developing climate services for the agricultural sector in the Peruvian Andes.

## DATA

**Variables:** daily mean temperature and precipitation

**Seasonal forecasts:** ECMWF system 4 seasonal prediction system (1° grid and interpolated to stations)

**Verification data:** Station data and PISCO gridded dataset (only for precipitation: 5km resolution, interpolated to 1° grid). Both datasets from SENAMHI.

**Niño 3.4:** sea surface temperature (SST) anomalies [2]

**Time period:** 1981-2012

## VERIFICATION METRICS

Skill is assessed using the **Generalized discrimination score** for tercile forecasts [1]. Values higher than 0.5 indicate skill.

**Potential predictability:** A perfect model approach is employed. The generalized discrimination score is calculated as the mean over the individual scores using all ensemble members one by one as observations.

## CHALLENGES

- Quality and availability of observational and reanalysis data for verification
- Representation of precipitation in climate models (see Fig.C1)
- Insufficient knowledge about specific user needs

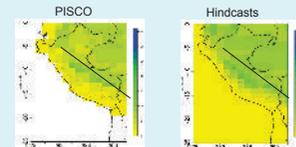


Fig. C1: Climatology (1981-2012) of November precipitation of PISCO-dataset and hindcasts (Ensemble mean, initialized in October). Black line: guide to the eye. Model precipitation is shifted westwards. ERA-Interim Reanalysis data shows a similar shift (not shown).

## CONCLUSIONS

- Seasonal predictions of user-tailored temperature indices for the Andes region are skillful and are promising for climate service products for the agricultural sector in Peru.

- Seasonal precipitation indices are less promising, showing mostly only little skill and potential predictability in the Peruvian Andes.

## Onset of rainy season

### Definition

Onset as days after 1 of August  
 $P(d)>0$  and  $P(d : d+6)>10\text{mm}$  and  $N(P(d : d+30)>0)>10$  [4]

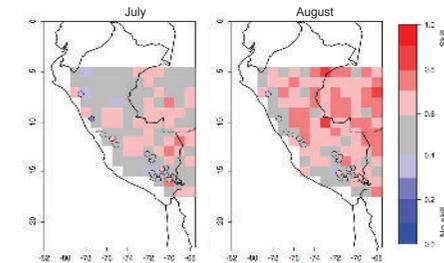


Fig. P1 Skill for hindcasts initialized in July (left) and August (right).

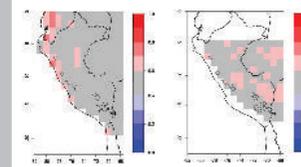


Fig. P2: Potential predictability of precipitation means (SON, initialized in July).

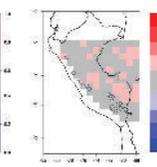


Fig. P3 Potential predictability of onset of rainy season for hindcasts initialized in July.

⇒ No or only little skill and potential predictability, especially in Peruvian Andes. Skill is higher in the west of Andes, a region where the index is not well-defined.

### References:

- [1] Mason, S. J. & Weigel, A. P. A generic forecast verification framework for administrative purposes. *Monthly Weather Review*, 2009, 137, 331-349
- [2] Rayner, N. A., D. E. Parker, E. B. Horton, C. K. Folland, L. V. Alexander, D. P. Rowell, E. C. Kent, A. Kaplan, Global analyses of sea surface temperature, sea ice, and night marine air temperature since the late nineteenth century. *J. Geophys. Res.*, 2003, 108 (D14), 4407, doi:10.1029/2002.JD002670.
- [3] SENAMHI, Caracterización agroclimática del distrito de Cutervo, departamento de Cajamarca, internal report
- [4] Gurgiser, W. et al., Comparing peasants' perceptions of precipitation change with precipitation records in the tropical Callejón de Huaylas, Peru, *Earth System Dynamics Discussions*, 2015, 6