

# **EVALUATING THE IMPACT OF WRF-3DVAR ASSIMILATION** FOR WEATHER FORECASTING IN THE ANTISANA GLACIER, ECUADOR



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# Abstract and Context

The Antisana is a stratovolcano covered by glaciers that provide drinking water for the population of Quito, Ecuador. It is located in the Ecuadorian Andes' east, near the amazon slope, reaching a maximum elevation of 5750 m.a.s.l.<sup>[1]</sup>. The Antisana area has a climatic influence form the Amazon basin, the Andes, and the Pacific Ocean, this causes a highlt variable behavior of atmospheric processes and hinders weather forecasts which have not been systematically studied in Ecuador<sup>[2,3]</sup>. The potentialities of data assimilation reported in studies internationally with the WRF model <sup>[4]</sup>, and the imminent need for improved forecasts at the Antisana glacier motivated this study.







## Objective

Evaluate the impact of WRF-3DVAR assimilation on the short-term (3-day) forecast of temperature, humidity, and solid and liquid precipitation in the Antisana glacier area.

#### Data and Methods

Data Assimilation is a widely used technique that reduces the errors in the initial conditions of the forecast model, and therefore improves the results obtained <sup>[4]</sup>.

Forecasts with assimilation have higher efficiency in January 2020 than in November 2019, the correlation of the data indicates improvements in most variables.

In January, temperature forecasts show a good representation of the magnitude and daily cycles of variation.

Assimilation reduced some of the underestimation in the cumulative solid and liquid precipitation forecasts without assimilation, but does not achieve a reliable prediction of precipitation event occurrence.

> PRAA - NOV EORE - NOVPRAA - JAN

EORE - JAN

0.9

0.95

1.5

0.99

WIND 800 hPa







November January 23 Data assimilation Data assimilation Forecast orecast

## Key Takeaways

The assimilation efficiency is influenced by the meteorological conditions of the time and month of the year being analyzed, and by the quality of the assimilated information.

Temperature was the variable that was best forecasted reaching Nash-Sutcliffe correlation values of 0.56 during the three days of

- forecasting compared to the value of 0.46 without assimilation. Precipitation and humidity did not show significant improvements through the correlation metrics; their forecast was not accurate and, especially in November, the abrupt variations in humidity values were accentuated and the cumulative magnitude of precipitation improved, but not the occurrence of events.
- The November wind anomalies show directions from south and southeast of the Amazon towards the Cordillera and the study area, in mesoscale spatial extent. This circulation pattern, being more localized along the eastern Andes mountain range in Ecuador, could be responsible for the low forecast efficiency with and without assimilation.
- The wind anomalies in January show a synoptic pattern from the northeast towards the mountain range and then diverge to the southeast. This feature is typical of a low-level jet, which is characteristic of Andean weather. As this circulation is of synoptic scale, the conditions for a better forecast are more suitable as they are less influenced by local variations.

### References

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