

INTRODUCTION

It is noteworthy that satellite information is of utmost importance in Numerical Weather Prediction. In addition to the massive amount of remote observations produced, satellites also reach areas such as oceans, deserts and high latitudes, difficult for measurements. The Center for Weather Forecast and Climate Studies (CPTEC from its Portuguese acronym) from the Brazilian National Institute for Space Research (INPE, Instituto Nacional de Pesquisas Espaciais) implemented in 2013, in operational mode, a three-dimensional variational data assimilation scheme based on the GSI (Gridpoint Statistical Interpolation). The coupling between GSI and GCM-CPTEC/INPE (Global Circulation Model from CPTEC/INPE) is the so called G3DVAR (Global 3DVAR). The new DA scheme replaces the former operational PSAS (Physical-space Statistical Analysis System), mainly due to its capacity of ingesting a much larger number of observations, particularly satellite radiances. Techniques for evaluating the impact of observations in data assimilation systems have been increasingly enhanced, however one of the oldest, most widely used and efficient, the Observing System Experiments, has been used to date. These experiments show how the incorporation of radiances affect CPTEC/INPE weather prediction as well as the impact and interaction between three different types of observations.

METHODOLOGY

The Observing System Experiment (OSE) is a technique where one or more observation systems are retained in the data assimilation process in order to assess the impact of the inclusion or exclusion of a particular observation on the quality of numerical weather prediction (NWP). Using this technique, three experiments were performed: without radiances data, without GPS data and without radiosonde data (according to the Table 1). Results from these experiments were compared with the control experiment, which uses all the available data. These experiments were carried out for January 2013, using the G3DVAR, which system uses GSI coupled to General Circulation Model (GCM) of the CPTEC/INPE in the T299L64 resolution. In Table 2 are shown the regions that were evaluated in this study.

Table 1. Data used for each experiment.

CTRL	NO_SAT	NO_RAD	NO_GPS
CONVENTIONAL	CONVENTIONAL	CONVENTIONAL*	CONVENTIONAL
GPS	GPS	GPS	
AIRS		AIRS	AIRS
AMSU A		AMSU A	AMSU A
HIRS 4		HIRS 4	HIRS 4
MHS		MHS	MHS
IASI		IASI	IASI

* Except radiosonde.

Table 2. Areas of study.

Northern Hemisphere	20°N – 80°N
Southern Hemisphere	80°S – 20°S
South America	0°-120°W and 60°S -12°N
Globe	0° - 360° and 90°S – 90°N
Tropical	0° - 360° and 20°S – 20°N

RESULTS AND DISCUSSION

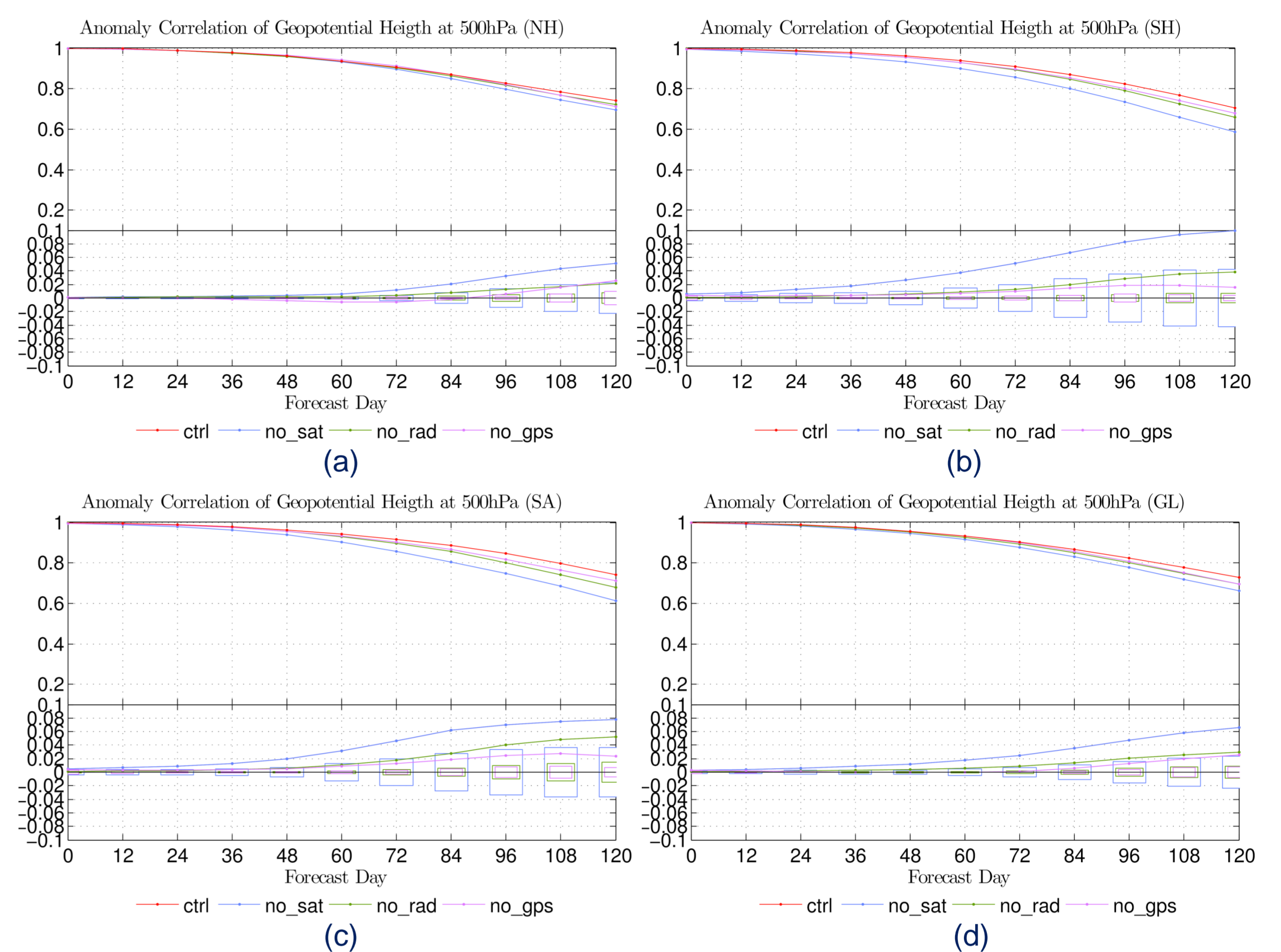


Figure 1. Anomaly correlation graphics for the 3 experiments and the four areas of study: (a) for Northern Hemisphere, (b) for Southern Hemisphere, (c) for South America and (d) for Globe. The x axis shows the forecast time and on the y axis the correlation values. The lower panel curves are differences with respect to the control. Lines outside the same color box are statistically significant at the 95% level.

From Figure 1 we observe that the experiments are consistent with the expected in the literature. The impact due to the denial of some observations in the Northern Hemisphere was smaller than the other analyzed areas. Although the NH impact was lower than the whole globe it was compensated with the large impact in the Southern Hemisphere. In the SH the impact on forecasts resulted in reducing in 18 hours the model predictability. Furthermore, South America and adjacent Oceans (South Pacific and Atlantic), performed better, considering that the CONTROL trial showed higher correlation, due to the lack of data, in particular GPS, radiosonde or satellites impacted much on forecasts, especially the lack of satellite data. Figure 2 shows that in the Tropical region radiances had larger impact than the other experiments, particularly at high levels (250hPa).

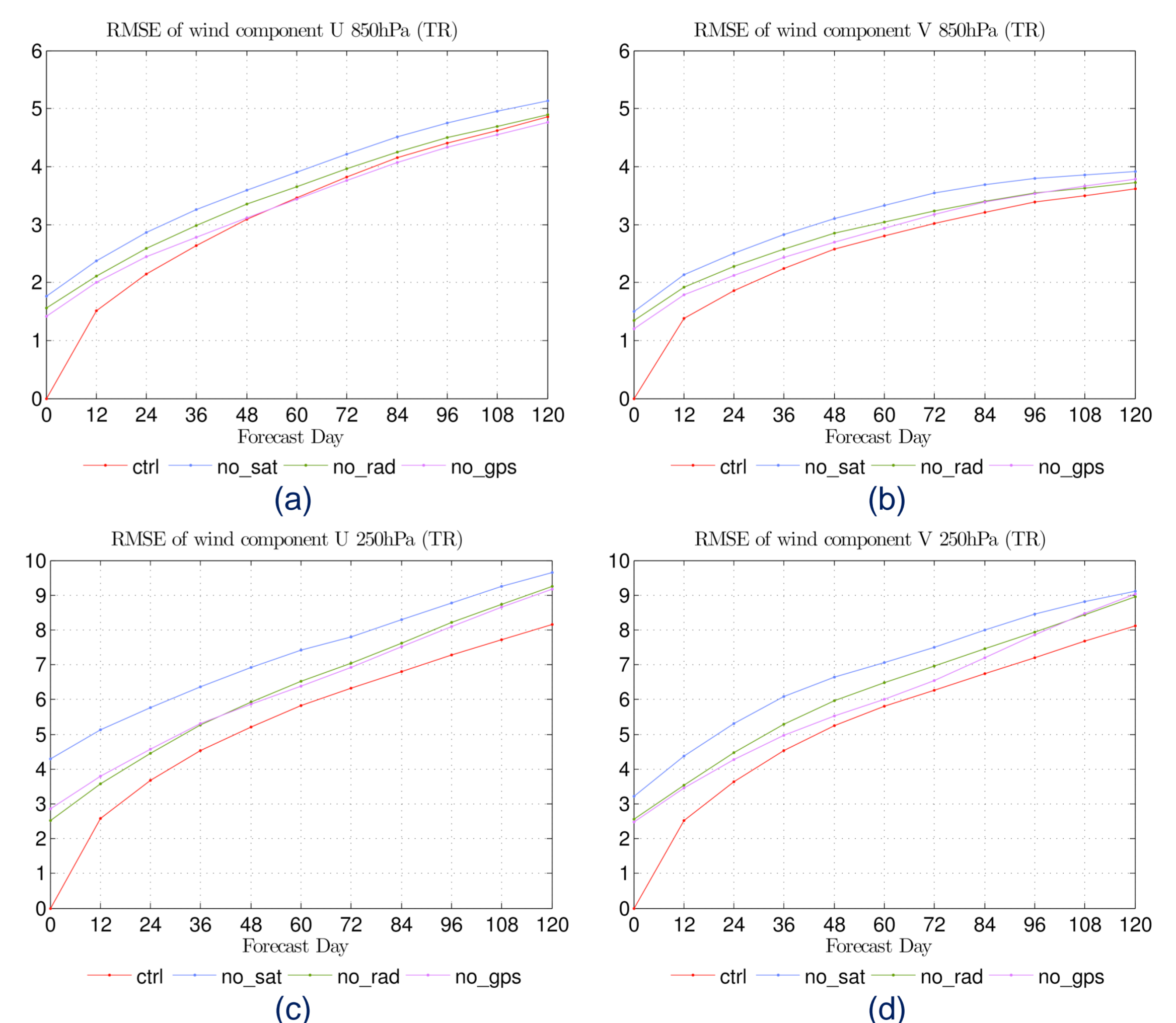


Figure 2. RMSE from Tropical Region, of wind component U in (a) and (c), and component V in (b) and (d). For 850hPa in (a) and (b) and for 250hPa in (c) and (d). The x axis shows the forecast time and on the y axis the RMSE values.

CONCLUSIONS

This study showed results from observations impact in the CPTEC/INPE Global 3DVar data assimilation system. The control experiment has shown a better skill in the region of greatest interest for CPTEC/INPE. Results confirm the importance of satellite data for most regions, in particular in the Southern Hemisphere.