

Forecast of probabilities of December-January-February 2012 precipitation in Rio Grande do Sul and Northern Uruguay using the NOAA CFS v2 and a statistical downscaling technique.

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In this work we use hindcasts and forecasts of the meridional wind at 850 hPa obtained with the NOAA Coupled Forecast System version 2 (CFS v2, described at http://cfs.ncep.noaa.gov/CFS_v2.info). The NOAA CFS hindcasts and forecasts considered here are initialized with oceanic and atmospheric conditions assimilated during November and early December of each year. A downscaling technique allow us to use these hindcasts and forecasts to estimate probabilities for rainfall in the region between 60°W and the Atlantic coast, and between 32.5°S and 27.5°S. We call this region “Rio Grande do Sul and Northern Uruguay” (RGS-NU, Fig. 1). The technique by-passes the direct use of model-calculated seasonal rainfall which we know have deficiencies derived mostly from the low resolution of the model used.

First we show results for the hindcasts of DJF atmospheric circulation. We focus on the meridional wind at 850 hPa since this variable is well correlated with surface climate anomalies at the region of interest both in observations (Nogués and Mo 1997, Liebmann et al. 2004, Zamboni et al. 2010) and in the CFS v2 hindcasts. Figure 2 shows the field of correlations of the hindcasts of DJF meridional wind at 850 hPa with the simultaneous precipitations at RGS-NU, for the period from 1983 to 2010. We name each DJF season according to the year correspondent to January and February. We exclude from the computations the 1998 case, since it had large anomalies of precipitation and hindcasted meridional wind that can produce an increase of the correlation that is not completely representative of the whole population. Precipitation at RGS-NU is computed from the prec-1 analysis (Chen et al. 2002). Figure 2 also shows the region in South America in which the hindcasted meridional wind at 850 hPa has maximum correlation with the precipitation in RGS-NU. The meridional wind averaged within this region (and multiplied by -1) is defined as the v850 index. Its correlation with prec-1 precipitation in RGS-NU is 0.55, statistically significant at a level larger than 99%.

Figure 3 shows the values of the hindcasted v850 index and the correspondent prec-1 precipitation at RGS-NU for all the years from 1983 to 2010, (excluding 1998). The forecasted value of the v850 index for DJF 2012 is 1.80 m/2. We consider the 8 most negative cases of v850 index in the 1983-2010 record as the most reasonable subpopulation analogous to DJF 2012 in terms of expected v850 index. The choice of 8 as the number of cases of the analogue subpopulation is based on a compromise. A lower value would yield results without statistical significance (computed as in Cazes Boezio et al. 2011), while a larger value would include cases not similar to the 2012 forecast. The precipitation median of this subpopulation is 338mm, and it has 6 cases out of 8 with lesser precipitation than the median of the total population of hindcasts, which is 380 mm. Considering this, we propose an expected median of 338 mm for the precipitation over RGS-NU for DJF 2012, and a chance of 6/8; (0.75) of precipitation below the median of the total population.

In summary, in RGS-NU, we expect a moderate negative shift of the expected DJF 2012 precipitation

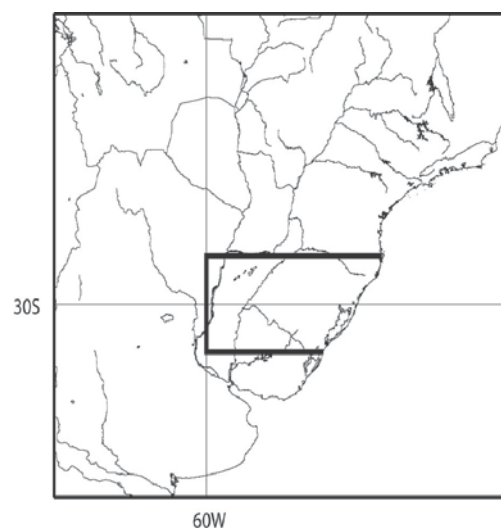


Figure 1: RGS-NU region.

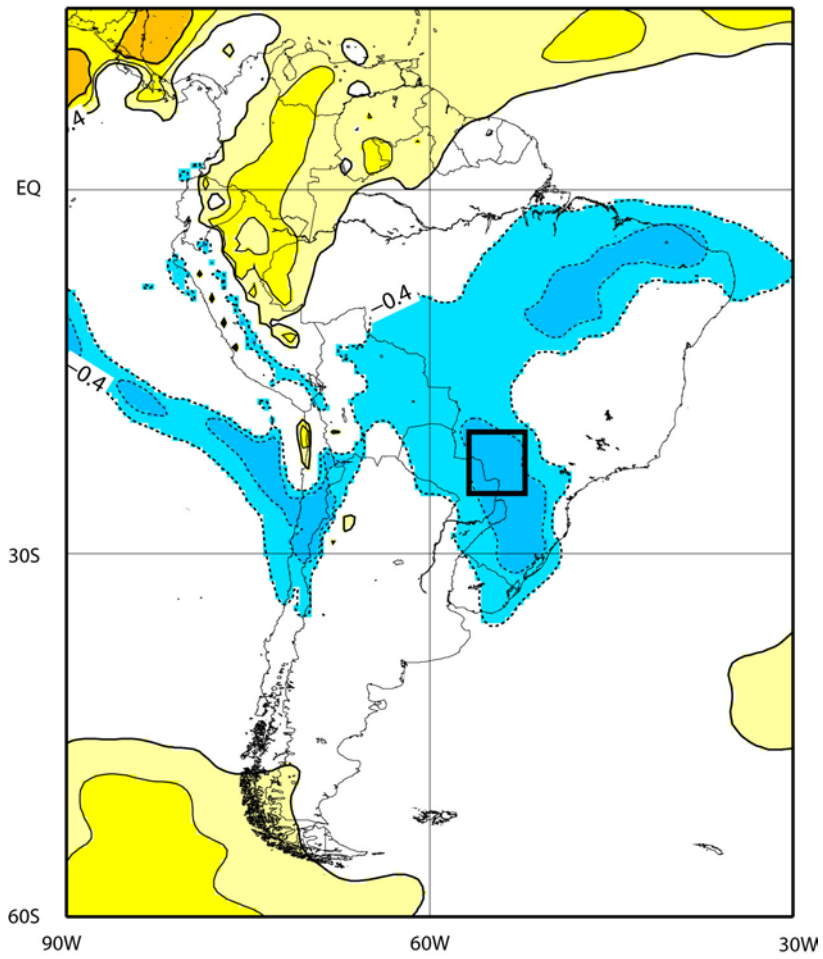


Figure 2: Correlation coefficients of the DJF meridional wind at 850 hPa from the CFS v2 hindcasts versus the simultaneous prec-1 precipitation at RGS-NU. The correlations are computed at each grid point of the CFS v2 model, and we consider the 1983-2010 period, excluding the 1998 case. Contour interval is 0.1, only contours above 0.4 or below -0.4 are shown. The box shows the region where the v850 index is defined.

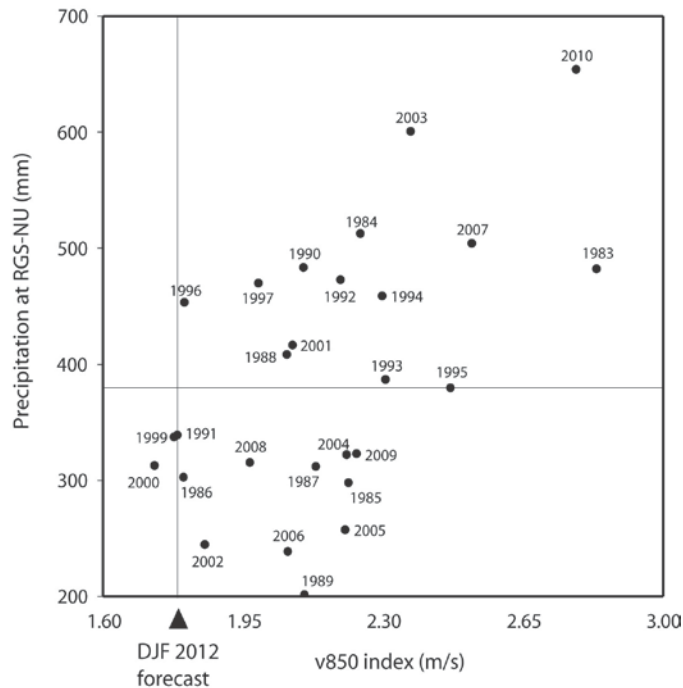


Figure 3: v850 index vs. prec-I precipitation in RGS-NU, for the DJF seasons in the period from 1983 to 2010 (excluding the 1998 case). The horizontal line shows the median of the precipitation for the whole population. The vertical line shows the v850 index value of 1.80 m/s (forecasted for DJF 2012) The 7 hindcasts with lower v850 index values are the closer to the 2012 forecasts.

References

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