EUROBRISA: A EURO-BRazilian Initiative for improving South American seasonal forecasts

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in collaboration with

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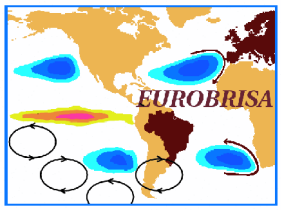


http://www.cptec.inpe.br/~caio/EUROBRISA

1. Key idea

To improve seasonal forecasts in South America, a region where there is seasonal forecast skill and useful value

Aims

• Strengthen collaboration and promote exchange of expertise and information between European and South American seasonal forecasters

• Produce improved well-calibrated real-time probabilistic seasonal forecasts for South America

• Develop real-time forecast products for non-profitable governmental use (e.g. hydropower production, agriculture and health)

Forecasting approach

Produce combined and calibrated (i.e. integrated) forecasts using a hybrid system composed by an empirical (statistical) and dynamical (physical) coupled models.

The current version of the system uses 1987-2001 hindcasts from ECMWF System 3, UK Met Office and the empirical model (see 2). CPTEC hindcasts for the same period are planned to be included next.

2. The empirical model

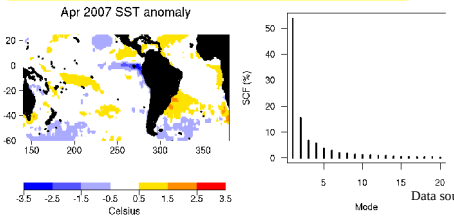
$$Y|Z \sim N(M(Z - Z_o), T)$$

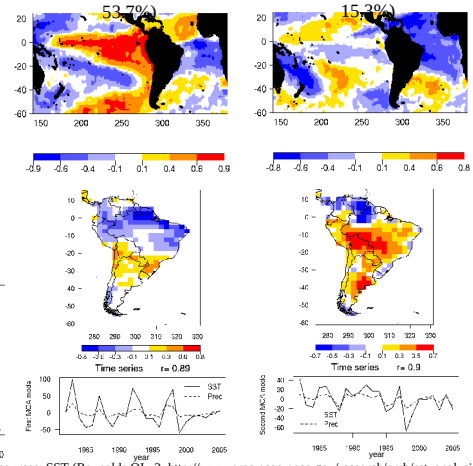
Y: JJA precipitation

Z: April sea surface temperature (SST)

$$M = S_{YZ}S_{ZZ}^{-1} \qquad Y: n \times q$$
$$-M\,Z_o = \overline{Y} - \overline{Z}M \qquad Z: n \times v$$
$$T = S_{YY} - S_{YZ}S_{ZZ}^{-1}S_{YZ}^{T} \qquad T: q \times q$$

Model uses first six leading Maximum covariance analysis (MCA) modes of the matrix $Y^T Z$.





Data sources: SST (Reynolds OI v2, http://www.emc.ncep.noaa.gov/research/cmb/sst_analysis/)
Precipitation (GPCP v2, http://precip.gsfc.nasa.gov/gpcp_v2_data.html)

3. Forecast Assimilation: Calibration and combination procedure for producing integrated forecasts

Y: JJA precipitation
X: 1-month lead precip. forecasts for JJA

$$p(Y \mid X) = \frac{p(X \mid Y)\,p(Y)}{p(X)}$$

Prior: $Y \sim N(Y_b, C)$

Likelihood: $X \mid Y \sim N(G[Y - Y_o], S)$

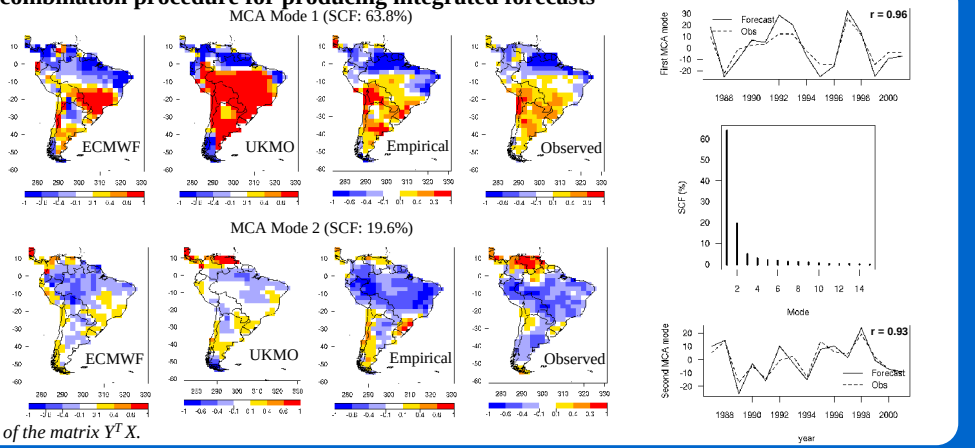
$$G = S_{XY}S_{YY}^{-1}$$
$$-GY_o = \overline{X} - G\overline{Y}$$
$$S = S_{XX} - GS_{YY}G^{T}$$

$X: n \times p$
$Y: n \times q$
$Y_b: 1 \times q$
$C: q \times q$
$S: p \times p$
$Y_a: n \times q$
$D: q \times q$

Posterior: $Y \mid X \sim N(Y_a, D)$

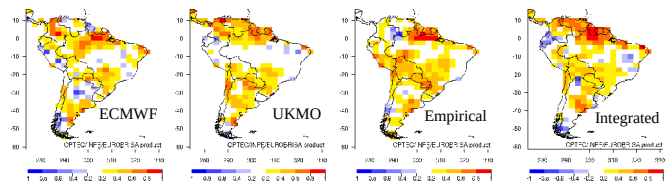
$$Y_a = Y_b + L[X - G(Y_b - Y_o)]$$
$$D = (G^{T}S^{-1}G + C^{-1})^{-1} = (I - LG)C$$
$$L = CG^{T}(GCG^{T} + S)^{-1}$$

Forecast assimilation uses first three leading MCA modes of the matrix $Y^T X$.

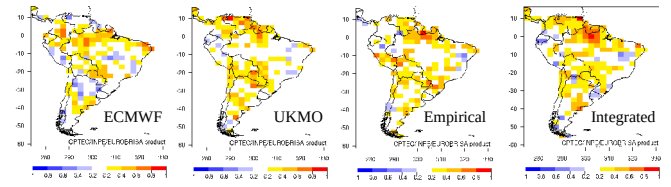


4. Skill assessment: 1-month lead precipitation forecasts for JJA

Correlation



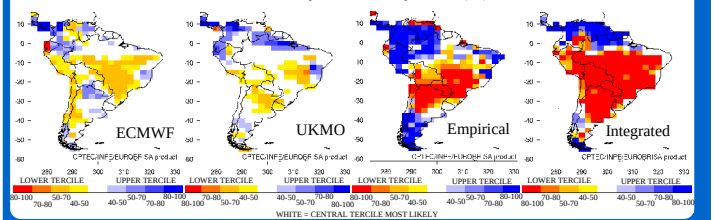
Gerrity score for tercile categories



Integrated forecasts have improved skill when compared to coupled and empirical forecasts

5. Example: JJA 2007 precipitation forecast (issued in May)

Probability of most likely tercile (%)



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Acknowledgments: CASC thanks WCRP and RMetSoc for travel support and FAPESP processes (05/05210-7 and 06/02497-6) for research funding. We also thank ECMWF, UK Met Office and Météo-France for providing their coupled model forecasts.