Supporting Information for

Dominant influence of Pacific climate modes on global observed and reanalysis cloud cover fields

Petru Vaideanu[1,2], Mihai Dima[1,2], Monica Ionita[1,3] and Mirela Voiculescu[4]

[1]Alfred Wegener Institute Helmholtz Centre for Polar and Marine Research, Bremerhaven, 27570, Germany
[2]Faculty of Physics, University of Bucharest, Măgurele, 077125, Romania
[3] Emil Racovita Institute of Speleology, Romanian Academy, Cluj-Napoca, 400006, Romania
[4] Department of Chemistry, Physics and Environment, University "Dunărea de Jos", Galaţi, 800008, Romania

In table S1 and S2, we show the percentage of variance explained for all the spatial structures provided by the EOFs and the CCAs used in our study

Table S1 | The variances explained by each EOF pattern from ISPCC, PATMOS-x and ERA5R TCC data

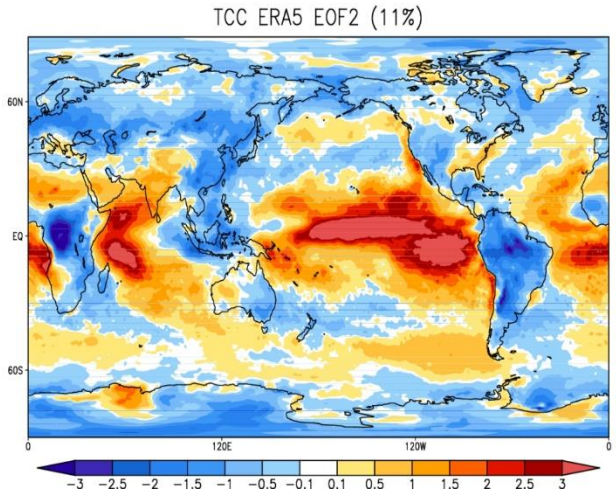
	ISPCC **Explained variance**	**PATMOS-x** **Explained variance**	**ERA5R** **Explained variance**
EOF 1	24 %	23 %	19 %
EOF 2	11 %	9 %	11 %
EOF 3	5 %	4%	10 %
EOF 4	4 %	4%	4 %
EOF 5	4 %	3%	3 %
EOF 6	3 %	2%	3 %
EOF 7	3 %	2%	2 %
EOF 8	2 %	2%	2 %

Table S2 | The variances explained by each pattern obtained through the CCA time using ISPCC PATMOS-x, and ERA5R TCC data

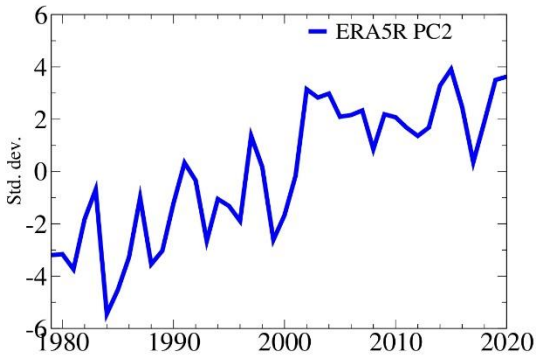
CCA	**Explained variance** **TCC ISPCC**	**Explained variance** **TCC PATMOS-x**	**Explained variance** **TCC ERA5R**
CCA Pair1	5 %	5 %	4 %
CCA Pair2	4 %	4 %	5 %
CCA Pair3	19 %	17 %	13 %
CCA Pair4	7 %	8%	6 %
CCA Pair5	4 %	3 %	7 %
CCA Pair7	4 %	2 %	3 %
CCA Pair7	3 %	4 %	3 %
CCA Pair8	3 %	4 %	2 %

In Fig. S1, the second EOF obtained using the ERA5 TCC data together with its temporal evolution. The increasing trend from the PC2 can be related to natural or anthropogenic influence and it is not the subject of our study

a



b



The global cloud structures associated with the EP ENSO (Fig. S3) and the CP ENSO (Fig. S4) are similar over most of the regions, but differences between the results obtained using the ISPCC and the PATMOS-x data are observed over parts of Australia, North America and South America. In order to assess the robustness of these differences among both datasets, we performed an EOF analysis on both cloud cover data restricted to 120°E - 80°W, 10°S - 10°N region and we regressed the ISPCC and PATMOS-x cloud data on the two associated PC's, with results shown in Fig. S2

The regression maps associated to the EP ENSO (a and b) are virtually identical with the ones from the CCA pair linked to this climate mode). It has been shown that El-Niño events generate an increase in precipitation over the south-eastern part of North America (Chiodi and Harrison, 2013), the south of California (Jong et al., 2016) and the south-eastern part of South America (Garreaud et al., 2009). Over most of Australia (King et al., 2015) and the north-eastern part of South America (Garreaud et al., 2009; Sulca et al., 2018), El-Niño events generate a decrease in precipitation. These regional features regional features are better captured by the global TCC structure obtained using the PATMOS-x data. Also, the regression maps obtained using the PATMOS-x data (Supp. Fig 2, b) include an increase in cloudiness in the north-western part of South America, which has been only recently identified (Sulca et at., 2018) and is not captured in the regression map obtained using ISPCC data. Also, the areas where the statistical significance is over 95 % are more extended in the spatial structure obtained using the PATMOS-x data

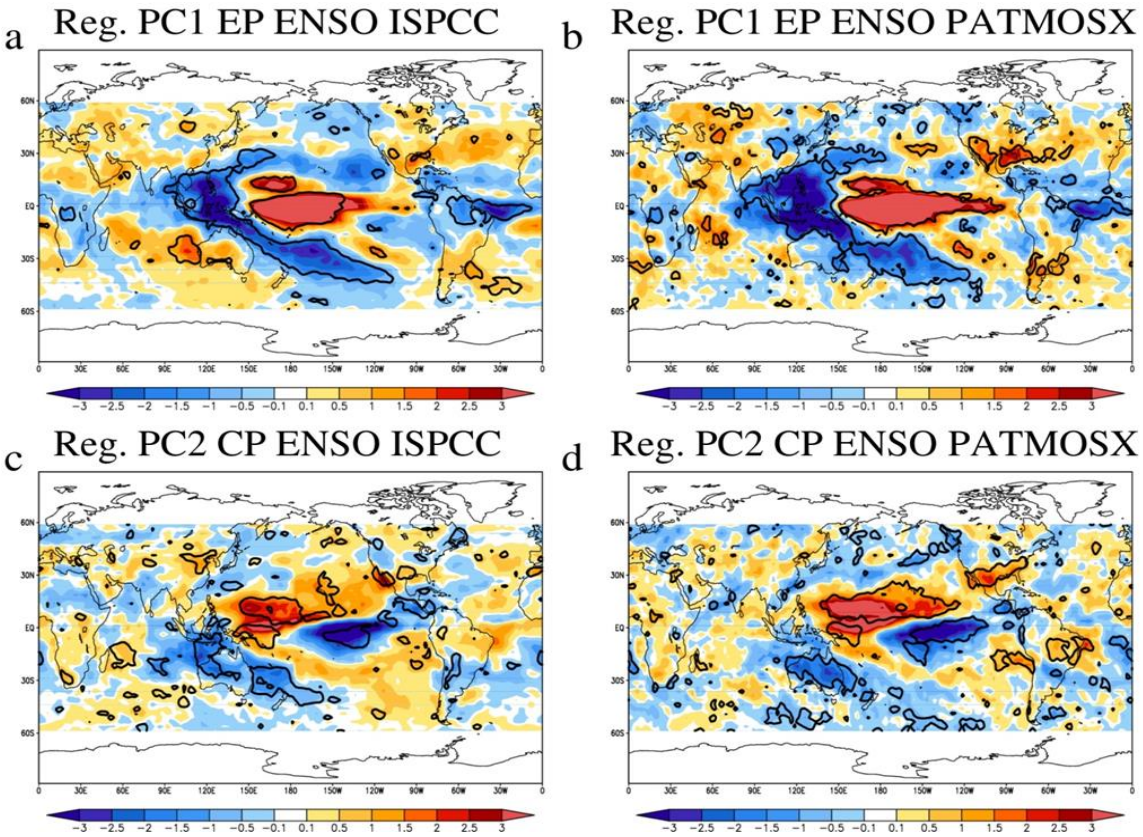


Fig S2 | Regression maps of ISPCC (a, c) ((std. dev/ %) and PATMOS-x (b, d) (std. dev/%) fields on the time series of the Tropical Pacific EOF structure associated to the EP ENSO (a, b) and the CP ENSO (c, d). The associated statistical significance in the highlighted areas is above 95 %.

References

Chiodi, A.M.: Diagnosing and Predicting ENSO SSTA Development from Moored-Buoy and Scatterometer Winds, J Climate, 32, 8755–8770, https://doi.org/10.1175/JCLI-D-19-0183, 2019.

Jong, B-T., Ting, M., and Seager, R.: El Niño's impact on California precipitation: seasonality, regionality, and El Niño intensity, Environ Res Lett 1, 0540211, 2016.

Garreaud, R.D., Vuille, M., Compagnucci, R., Marengo, J.: Present-day South American climate, Palaeogeogr., Palaeoclimatol., Palaeoecol., 281, 180-195, doi: 10.1016/j.palaeo.2007.10.032, 2009.

King, A.D., Markus, G., Donat, M.G., Alexander, L.V., and Karoly, D.J.: The ENSO Australian rainfall teleconnection in reanalysis and CMIP5, 44:2623–2635, doi:10.1007/s00382-014-215, 2015.

Sulca, J., Takahashi, K., Espinoza, J.C., Vuille, M. and Lavado-Casimiro, W.: Impacts of different ENSO flavors and tropical Pacific convection variability (ITCZ, SPCZ) on austral summer rainfall in South America, with a focus on Peru, Int J Climatol, doi:10.1002/joc.5185, 2018.