Project: **1133**

Project title: **Low-level circulation, Moisture Convergence and Precipitation Biases in Regional Climate Simulations for Central America with COSMO-CLM**

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In the second year of the project an external factor has not allowed to perform all the originally planned simulations. More specifically, the CLM-community has not provided until now a routine for the conversion of the CMIP6 available simulations to the format required by int2lm (interpolation routine of COSMO-CLM). Efforts for the release of an official conversion routine are currently ongoing, involving several collaborators from different research centres over Europe. The first version should be available by September 2021 (P. Ludwig (KIT), personal communication). This means that none of the planned downscaling experiments of future projection and historical CMIP6 simulations has been performed so far in the project. In these months the work has focused on the performance of only two of the three originally planned 12-km resolution simulation. This resulted in the use of only approximately 23000 node hours so far in the year 2021. Since for the mentioned reasons we were not in the conditions of using all the resources initially planned for the year 2021, a similar value of 22000 node hours was expired in the first 2 quarters of the year.

Of the two performed 12-km simulations, one had an error in the configuration file, so that the results were not useful for a comparison with previously performed 25-km resolution simulations.

The other accomplished simulation at 12-km resolution is the one with the optimal model configuration determined for the region in the first year of the project.

In this case, a first comparison of the results against the ones of the corresponding 25-km resolution simulation has been conducted with the goal of assessing the added value of an increase in model resolution for the region.

Preliminary results seem very interesting. In particular, very pronounced differences in monthly climatological values for the period 1996-2015 (5 years considered as spinup and excluded from the analysis) are evident between the two simulations, for different variables. For 2-meter temperature the absolute value of these differences exceeds 5°C in some cases (Fig.1, upper row). Monthly precipitation show also important differences, with absolute values exceeding 200 mm/month over large parts of the domain (Fig1, middle row). In this case, it is evident that the amount of precipitation associated with the ITCZ is reduced following the increase in model resolution in both seasons. Additionally, also low-level circulation seems to be highly affected by the changes in resolution, in every season (Fig.1, bottom row). Interestingly, for all of the considered variables, the differences are particularly pronounced not only locally, over areas characterized by complex topography like the Andes and the Central America region, but also over a large part of the domain, pointing to an important role of secondary large-scale feedbacks, whose role changes when considering different scales. Further analyses are needed in this sense, with the potential to lead to a better understanding of the physical processes relevant for the climate of the region, that could consequently lead to more reliable climate projections.

We decided to include the new results in a paper in preparation for international journal of climatology, together with the results of the first year of the project. This was a personal

decision of the project members to increase the quality of the final manuscript.

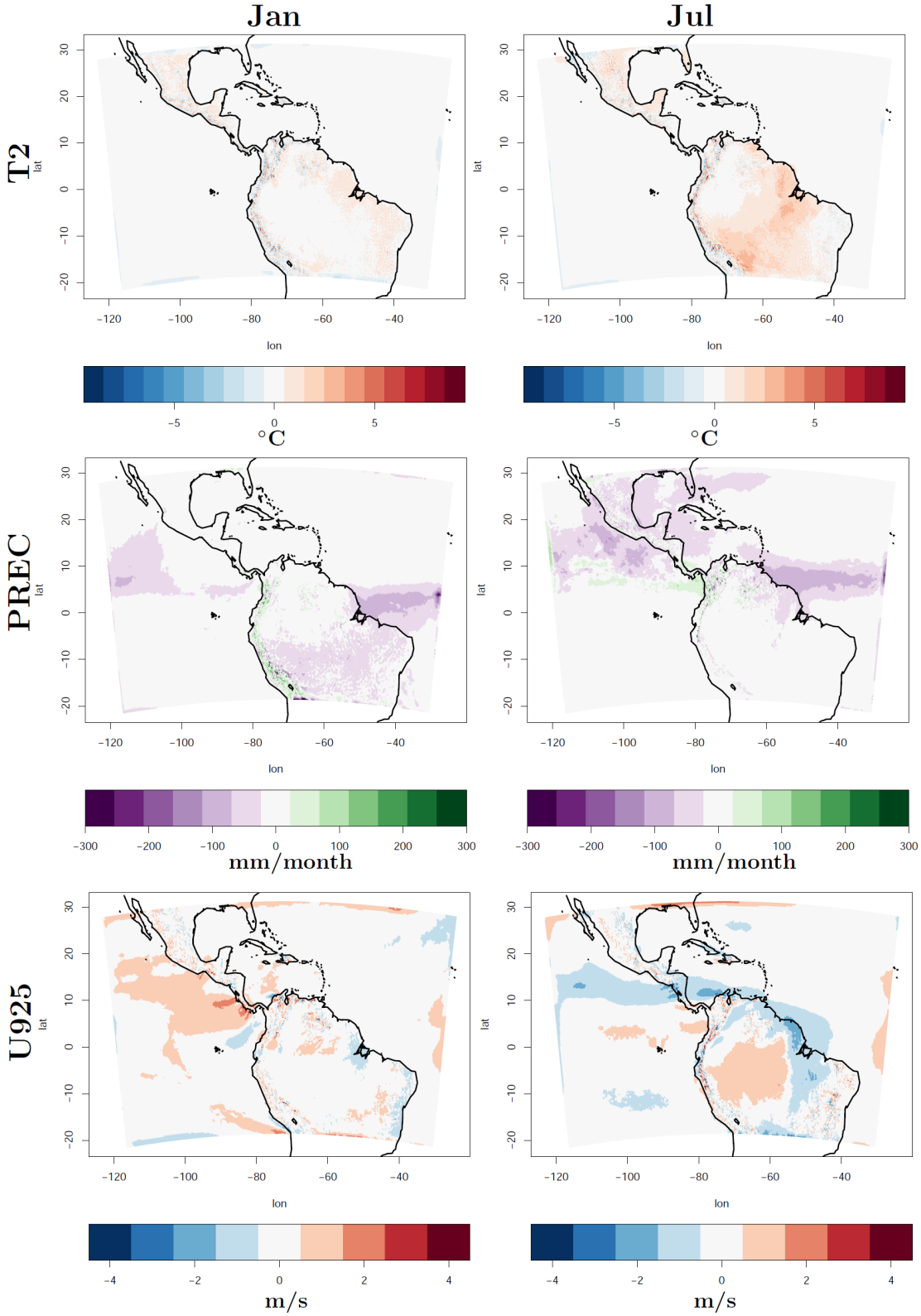

Fig 1: Differences in monthly climatological values for the period 1996-2015, calculated for January (left column) and July (right column) between two COSMO-CLM simulations at 12 and 25 km resolution. The higher resolution results are upscaled to the coarser resolution grid prior to the comparison. From top to bottom results obtained from the comparison of 2-meter temperature (T2M), total precipitation (PREC) and horizontal component of the wind at 925 hPa (U925) are shown.