Geophysical Research Abstracts
Vol. 21, EGU2019-12800, 2019
EGU General Assembly 2019

Oceanic impacts on the atmospheric and terrestrial moisture budgets in RCMs

Klaus Goergen (1,2) and Stefan Kollet (1,2)

(1) Research Centre Jülich, Institute of Bio- and Geosciences (IBG-3, Agrosphere), 52425 Jülich, Germany (k.goergen@fz-juelich.de, s.kollet@fz-juelich.de), (2) Centre for High-Performance Scientific Computing, Geoverbund ABC/J, 52425 Jülich, Germany

Regional climate models (RCMs) are indispensable tools in climate research, e.g., as a basis for process studies and impact assessments of global change. In this study, we inspect regional atmospheric moisture budgets and the atmospheric moisture exchange between the ocean and continental areas from ten representative evaluation experiment RCM ensemble members over Europe at 0.44 degree resolution from 1989 to 2008 taken from the EURO-CORDEX project, driven by ERA-Interim reanalysis, which also constitutes the reference, REF, in the analysis. Over large enough time scales, when atmospheric storage changes are negligible, the atmospheric moisture flux divergence div(q) equals the difference of evapotranspiration (E) from the oceans and land surfaces into the atmosphere, and precipitation (P), div(q)=E-P. Because the RCMs, as limited area models, constitute numerically boundary value problems, all RCMs in the dynamical downscaling setup of the CORDEX evaluation runs use the same lateral boundary conditions and over the oceans the same prescribed reanalysis sea surface temperatures (SSTs). When comparing the E and P of the RCMs for the complete domain, i.e. considering the overall atmospheric moisture budget, the RCMs cluster around the REF values. As expected E exceeds P over the oceans and P exceeds E over land, with a much larger inter-RCM spread over the oceans and a tendency of the RCMs over land and ocean towards a more intense hydrological cycle with higher E and P than REF. Considering differences of E-P over the oceans versus E-P over land, the RCMs are expected to match REF if they reproduce the re-analysis, i.e. the same E over the ocean would be recycled as P over land. Observed deviations from the 1:1 relationship reflect, e.g., effects induced by different boundary forcing treatments in the models. In addition we observe a systematic shift of some RCMs towards higher E-P values over the ocean, leading to higher P over land. We interpret this behaviour as an E-bias of the RCMs over the ocean, associated with the prescribed ERA-Interim SST and flux calculation over the oceans, which may lead to excess P, or rather positively biased P, over land in maintaining div(q) over the model domain prescribed by the boundary conditions. We argue that irrespective of the RCMs' convection and microphysics schemes, the E-flux over the ocean substantially impacts the RCMs P-bias over land. This should be taken into account the setup of modelling studies and the ensuing analyses.