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Regime-dependent evaluation of accumulated precipitation in the COSMO model

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Regime-dependent evaluation is a relatively new approach to assess model performance. It consists of classifying the model biases according to a discrete number of regimes, and evaluating model output within each regime. In this paper the regimes are firstly defined by the large-scale atmospheric circulation, based on the objective Jenkinson-Collison classification technique which distinguishes synoptic patterns by strength, direction and vorticity of the geostrophic flow. Eight directional and two vorticity circulation regimes (circulation types) are specified. In this way, it is possible to quantify the model performance for cases with for example only westerly winds, or with only cyclonic circulation. A second regime classification is based on temperature, which allows for detection of temperature-dependent model performance. Modelled accumulated precipitation (mm/6h) is evaluated with both raingauges and radar observations for the years 2007 and 2008, using data of the GOP dataset (Crewell et al., 2008). Two variants of the COSMO model are evaluated: a fine-resolution version (2.8km, COSMO-DE) and a coarser resolution version (7km, COSMO-EU). In COSMO-EU, a windward/leeward effect becomes visible, as the circulation determines the dominant wind direction, hence the windward and lee side on topographic features. Positive biases (model overestimations) are found on windward sides, negative biases on lee sides. Making use of temperature-dependent evaluation, the magnitude of these systematic model biases turns out to be related with coldness, pointing to a solid precipitation model bias. Not exhibiting the circulation-dependent windward/lee effect, COSMO-DE is a clear improvement compared with COSMO-EU. However, a similar temperature-dependency is visible by a systematic positive bias located on the ridges/crests of all topographic features.
This research fits within the larger project Quantitative evaluation of regional precipitation forecasts using multi-dimensional remote sensing observations, QUEST (http://www.meteo.uni-koeln.de/crewell/doku.php/quest).

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