EVALUACIÓN DEL MODELO DE SUPERFICIE TERRESTRE NOAH-MP PARA LA SELECCIÓN DE ESQUEMAS DE PARAMETRIZACIÓN EN LA PENÍNSULA IBÉRICA

EVALUATION OF NOAH-MP LAND SURFACE MODEL FOR SELECTING PARAMETERIZATION SCHEMES OVER THE IBERIAN PENINSULA

Nicolás Tacoronte[(1)], Matilde García-Valdecasas Ojeda[(1,2)], David Donaire-Montaño[(1)], Juan José Rosa-Cánovas[(1)], Emilio Romero-Jiménez[(1)], Yolanda Castro-Díez[(1,2)], María Jesús Esteban-Parra[(1,2)] and Sonia R. Gámiz-Fortis[(1,2)]

[(1)] Departamento de Física Aplicada, Universidad de Granada, Granada, Spain. nicotacor@ugr.es

[(2)] Instituto Interuniversitario de Investigación Tierra en Andalucía (IISTA-CEAMA), Granada, Spain

SUMMARY

This study evaluates the effectiveness of the Noah-MP Land Surface Model integrated into the WRF v3.9.1 framework for high-resolution climate modeling across the Iberian Peninsula (IP), focusing on its parameter sensitivity for accurately depicting the region's varied climate conditions. The study uses the ERA5 reanalysis data to drive WRF simulations at two resolutions: a broader 50 km domain aligning with the Euro-CORDEX area and a more detailed 10 km domain concentrated on the IP. The methodology incorporates a preliminary spin-up phase consisting of 30-year simulations to ensure soil variable stability, followed by a series of 52 one-year experiments over 26 different parameter settings aimed to improve the model's precision for both wet and dry years. Critical parameters, including vegetation dynamics and soil heat transfer processes, are adjusted to determine their optimal configurations. This approach seeks to improve the model's capability in capturing the climate dynamics and land-atmosphere interactions processes in the IP.

For high-resolution climate modelling using coupled Land Surface Models (LSMs), selecting appropriate parameterization schemes is crucial for model accuracy, especially in regions with diverse climates and complex topography. This study embarks on an in-depth evaluation of the sensitivity of the Noah-MP LSM to various parameter combinations within the Weather Research and Forecasting (WRF) model v3.9.1 framework, specifically focusing on the Iberian Peninsula (IP). Using WRF configured in two distinct domains: the broader Euro-CORDEX area at 50 km of spatial resolution and a more detailed, nested domain centered on the IP at 10 km of spatial resolution, we aim to determine the most effective parameterization schemes to represent the climatic conditions of this region. The methodology involves different experiments from WRF driven by ERA5 reanalysis, leveraging different combinations of Noah-MP parameters to determine the optimal configuration for accurate climate simulation over the IP.

The research is structured around two fundamental phases: initial spin-up simulations to ensure that soil variables reach equilibrium, followed by specific experiments to select the most suitable Noah-MP parameters. As soil-related variables require a long spin-up period to reach their equilibrium [1, 2], this phase encompasses two 30-year simulations under consistent conditions with the decadal experiments, employing those parameters set in WRF Noah-MP by default. These simulations, guided by the procedure proposed in [3], are strategically chosen to include one dry and one wet year, reflecting contrasting climatic conditions to be thoroughly examined in subsequent analyses for years 2005 and 2010, considered as dry and wet years, respectively, in the IP.

In the next phase, we carried out 52 1-year simulations from 26 different combinations of parameters for each climate scenario (wet year and dry year), meticulously analyzing variations in the representation of precipitation and minimum and maximum temperature. We incorporated a variety of WRF configurations from previous studies [4, 5], focusing on specific parameter settings including dynamic vegetation, canopy resistance, soil heat transfer and others. This comprehensive evaluation aims to enhance the understanding and selection of parameterization schemes and ultimately improve the performance of the NOAH-MP model in accurately representing the climate dynamics of the IP. This is particularly relevant as the IP is a transitional region where land-atmosphere interactions are especially significant.

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