Editor Comment:

The authors have adequately addressed the comments of the reviewers. However, in doing so might have decreased the suitability of the paper for GMD. As the GMD webpage states, papers of interest to GMD include “new methods for assessment of models, including work on developing new metrics for assessing model performance and novel ways of comparing model results with observational data”. The current manuscript certainly meets the journal’s interest in “developing new metrics for assessing model performance”. However, the first iteration of the paper was especially interesting as it went a step further and applied the work to Euro-CORDEX. I understand the reasons that the authors gave for removing it in this iteration of the manuscript; however, in doing so, it loses a clear connection to model evaluation. I suggest that the manuscript be amended to make it more clear throughout the paper the relevance of this work to model evaluation. As it currently stands, it only reads as a tool to take observational datasets and compute a drought index. How will this work help model evaluation (e.g., CMIP models)?, what does it bring to the table that was not there before? The authors already hint at this in the discussion/conclusions where they talk about the WCRP Flagship Pilot Study. I think taking these explaining these types of ideas further would help the paper. My suggestion is to edit/rewrite the introduction and discussion to make this connection more clear and succinct. Note that I am not asking for further analysis or figures, simply to address these sections to make the connection and applicability to climate models, weather models, etc... much more clear. This will benefit the paper as it will help bridge the gap from drought index development to model evaluation more clearly.

We wish to express our gratitude to the editor for the positive and constructive feedback on our study. We believe that the revisions have significantly improved the manuscript and strengthened its connection with model evaluation. The changes made have undoubtedly enhanced the overall quality of the manuscript. Regarding the changes, two sections were added, one in the introduction and another on the discussion Furthermore, some small changes and corrections were performed throughout the entire document.

Introduction, near line 140 of the tracked-changes document: “The introduction of GDI can also be regarded as an important step in the evaluation of climate simulations. This is particularly relevant for high-resolution models such as those from the EURO-CORDEX (Jacob et al., 2014; 2020; Gutowski et al., 2016) or from the CORDEX flagship FPS-Convection simulations (Coppola et al., 2020; Ban et al., 2021; Pichelli et al., 2021), which aim to capture extreme weather events more accurately than their coarser counterparts. With the use of daily datasets and a daily drought index, researchers can more accurately assess a model’s ability in capturing the fast-evolving conditions, characteristic from flash-droughts. Therefore, the GDI allows for a better understanding of drought dynamics, facilitating the evaluation of not only long-term drought events but also short-term variability. Furthermore, with GDI index one can more easily perform studies of co-occurrence with other types of extremes such as heatwaves or fire ignitions (Zscheischler et al., 2020; Shan et al., 2024), all on the same scale.”.

Discussion, near line 690 of the tracked-changes document: “Therefore, GDI could be a viable alternative for computing a standardised index for drought analysis and simulation evaluation with EURO-CORDEX simulations or the large kilometre-scale simulations from the WRCP Flagship Pilot Study on “Convective phenomena over Europe and the Mediterranean”. The assessment of simulations with a daily drought index allows researchers to scrutinise models more rigorously, examining not just their ability to predict

long-term trends but also their effectiveness in capturing short-term variability. With the use of a daily drought index, the assessment of a model's performance regarding frequency, severity and duration of events is thus enhanced. Furthermore, the daily index enhances our understanding of the feedback mechanisms between meteorological droughts and their impacts on sectors such as agriculture and water management. Unlike traditional indices, which might aggregate data over longer periods and potentially smooth out critical variations, the daily index preserves the day-to-day variations in moisture availability. This is crucial for understanding drought onset, evolution and dissipation, as well as for predicting their impact on crop yields, water supply, and other critical resources. As climate simulations evolves, daily drought indices will undoubtedly play a key role in ensuring that the same models are able to meet the challenges posed by a rapidly changing climate.".

With these changes some references were also added:

Ban, N., Caillaud, C., Coppola, E., Pichelli, E., Sobolowski, S., Adinolfi, M., Ahrens, B., Alias, A., Anders, I., Bastin, S., Belušić, D., Berthou, S., Brisson, E., Cardoso, R. M., Chan, S. C., Christensen, O. B., Fernández, J., Fita, L., Frisius, T., Gašparac, G., Giorgi, F., Goergen, K., Haugen, J, E., Hodnebrog, Ø., Kartsios, S., Katragkou, E., Kendon, E. J., Keuler, K., Lavin-Gullon, A., Lenderink, G., Leutwyler, D., Lorenz, T., Maraun, D., Mercogliano, P., Milovac, J., Panitz, H. J., Raffa, M, Remedio, A. R., Schär, C., Soares, P. M. M., Srnec, L., Steensen, B. MM., Stocchi, Tölle, Truhetz, Temprado, J. V., de Vries, H., Warrach.-Sagi, K., Wulfmeyer, V. and Zander, M. J. The first multi-model ensemble of regional climate simulations at kilometer-scale resolution, part I: evaluation of precipitation. Climate Dynamics, 57, 275-302, doi: 10.1007/S00382-021-05708-W, 2021.

Coppola, E., Sobolowski, S., Pichelli, E., Raffaele, F., Ahrens, B., Anders, I., Ban, N., Bastin, S., Belda, M., Belusic, D., Caldas-Alvarez, A., Cardoso, R. M., Davolio, S., Dobler, A., Fernadez, J., Fita, L., Fumiere, Q., Giorgi, G., Goergen, K., Güttler, I., Halenka, T., Heinzeller, D., Hodnebrog, Ø., Jacob, D., Kartsios, S., Katragkou, E., Kendon, E., Khodayar, S., Kunstmann, H., Knist, S., Lavín-Gullón, A., Lind, P., Lorenz, T., Maraun, D., Marelle, L., van Meijgaard, E., Milovac, J., Myhre, G., Panitz, H-J., Piazza, M., Raffa, M., Raub, T, Rockel, B., Schär, C., Sieck., Soares, P. M. M., Somot, S., Srnec, L., Stocchi, P., Tölle, M. H., Truhertz, Vautard, R., de Vries, H., and Warrach-Sagi, K. A first-of-its-kind multi-model convection permitting ensemble for investigating convective phenomena over Europe and the Mediterranean. Climate Dynamics, 55, 3-34, doi: 10.1007/s00382-018-4521-8, 2020.

Pichelli, E., Coppola, E., Sobolowski, S., Ban, N., Giorgi, F., Stocchi, P., Alias, A., Belušić, D., Berthou, S., Caillaud, C. Cardoso, R.M. Chan, S., Christensen, O. B., Dobler, A., de Vries, H., Goergen, K., Kendon, E. J., Keuler, K., Lenderink, G., Lorenz, T., Mishra, A. N., Panitz, H-J., Schär, C., Soares, P. M. M., Truhetz, H. and Vergara-Temprado, J. The first multi-model ensemble of regional climate simulations at kilometer-scale resolution part 2: historical and future simulations of precipitation. Climate Dynamics, 56, 3581-3602, doi: 10.1007/s00382-021-05657-4, 2021.

Shan, B., Verhoest, N.E. and De Baets, B. Identification of compound drought and heatwave events on a daily scale and across four seasons. Hydrology and Earth System Sciences, 28, 2065-2080, doi: 10.5194/hess-28-2065-2024, 2024.

Zscheischler, J., Martius, O., Westra, S., Bevacqua, E., Raymond, C., Horton, R.M., van den Hurk, B., AghaKouchak, A., Jézéquel, A., Mahecha, M.D., Maraun, D., Ramos, A., Ridder, N. N., Thiery, W. and Vignotto, E. A typology of compound weather and climate events. Nature reviews earth & environment, 1, 333-347, doi: s43017-020-0060-z, 2020.