EGU24-15405, updated on 12 Aug 2024
https://doi.org/10.5194/egusphere-egu24-15405
EGU General Assembly 2024


# Analysis of Various Spatial Resolutions for Modelling Sector-Coupled Energy Systems

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Large-scale energy system modelling plays a crucial role in the debate on energy system decarbonisation. It is common to use a bidding zone representation to model the European energy system due to the structure of the electricity market. However, this may underestimate infrastructure constraints at higher spatial resolutions. This question has been investigated in the literature, while methods for aggregating highly resolved data remain a research gap. In this study we explore various spatial resolutions using the sector-coupled energy system model Balmorel with a focus on the Danish energy system. The modelling framework will encompass detailed geospatial data of existing Danish power plants in combination with the atlite module for generating variable renewable energy (VRE) production profiles at different geographical locations. Utilising the further developed modelling framework in Balmorel, the impact of applying various spatial resolutions is thus investigated from a bidding zone, NUTS2, NUTS3, to municipal spatial resolution. Preliminary results indicate that transmission costs are underestimated at low spatial resolution. However, they remain a small part of total system costs at very high spatial resolution. Large operational differences are observed, which will be investigated further. These results will be discussed considering spatial aggregation methods and used to inform further research on a similar investigation at the European scale to advance the modelling of sector-coupled energy system models with high penetrations of VRE.