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# Can cloud properties provide information on surface wind variations using deep learning?

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Recent studies have shown that the increasing sizes of offshore wind farms can cause a reduced energy production through mesoscale interactions with the atmosphere. Therefore, accurate nowcasting of the energy yields of large offshore wind farms depend on accurate predictions of the large synoptic weather systems as well as accurate predictions of the smaller mesoscale weather systems. In general, global or regional forecasting models are very well suited to predict synoptic-scale weather systems. However, satellite or radar data can support the nowcasting of shorter, smaller-scale systems.

In this work, a first step towards nowcasting of the mesoscale wind using satellite images has been taken, namely the coupling of the mesoscale wind component to cloud properties that are available from satellite images using a deep learning framework. To achieve this, a high-resolution regional atmospheric model (COSMO-CLM) was used to generate one year of high resolution cloud en hub-height wind data. From this wind data the mesoscale component was filtered out and used as target images for the deep learning model. The input images of the model were several cloud-related fields from the atmospheric model. The model itself was a Deep Convolutional Neural Network (a U-Net) which was trained to minimize the mean squared error.

This analysis indicates that cloud information can be used to extract information about the mesoscale weather systems and could be used for nowcasting by using the trained U-Net as a basis for a temporal deep learning model. However, future validation with real-world data is still needed to determine the added value of such an approach.