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Tracking of mesoscale atmospheric phenomena in satellite mosaics using deep neural networks

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Polar Lows (PLs) are intense atmospheric vortices that form mostly over the ocean. Due to their strong impact on the deep ocean convection and also on engineering infrastructure, their accurate detection and tracking is a very important task that is demanded by industrial end-users as well as academic researchers of various fields. While there are a few PL detection algorithms, there are no examples of successful automatic PL tracking methods that would be applicable to satellite mosaics or other data, which would as reliably represent PLs as remote sensing products. The only reliable way for the tracking of PLs at the moment is the manual tracking which is highly time-consuming and requires exhaustive examination of source data by an expert.

At the same time, visual object tracking (VOT) is a well-known problem in computer vision. In our study, we present the novel method for the tracking of PLs in satellite mosaics based upon Deep Convolutional Neural Networks (DCNNs) of a specific architecture. Using the Southern Ocean Mesocyclones database gathered in the Shirshov Institute of Oceanology, we trained our model to perform the assignment task, which is an essential part of our tracking algorithm. As a proof of concept, we will present preliminary results of our approach for PL tracking for the summer period of 2004 in the Southern Ocean.