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# Convolutional neural networks for Antarctic mesocyclones identification using satellite mosaics data

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Mesocyclones in high latitudes are important atmospheric phenomena. They are characterized by strong wind speeds and surface fluxes despite their small sizes (200 to 1000 km) and short lifetime (6 to 36 hours). These characteristics make their identification and tracking difficult in global reanalyses, thus they are still poorly documented and quantified. Number of studies demonstrated an overview of mesocyclone activity in high latitudes. These studies are based both on automated identification and tracking algorithms and on manual identification and tracking (mostly regional) and show inconsistent assessments.

Satellite imageries of cloud shapes and water vapor fields produce realistic picture of mesocyclone activity. Earlier we have presented the database of manually identified and tracked mesocyclones over the Southern Ocean based on satellite infrared (10.3–11.3 $\mu$m) and water vapor channel ($\sim$6.7 $\mu$m) mosaics. Manual mesocyclones identification is highly time-consuming procedure and needs to be automated.

There are some studies demonstrated the general ability of deep neural networks to identify extreme atmospheric phenomena (tropical cyclones, atmospheric rivers and weather fronts) using geophysical fields of climate simulations and reanalysis products. Due to coarse spatiotemporal resolution of these products, however, they don‘t reliably reproduce mesocyclones in high latitudes.

We present the method for automatic mesocyclones identification based on direct observations – satellite infrared and microwave mosaics, using deep Convolutional Neural Networks. With this model we solve the problem of binary classification on fixed-size image patches of mosaics. Source dataset is created based on the presented database of manually identified mesocyclones and have been balanced by target value – mesocyclone presence in a patch. Several network architectures have been tested. Best accuracy of 98% have been reached on balanced test set.

This technique is a precursor for mesocyclones and other atmospheric phenomena localization and tracking using direct high-resolution satellite observations.

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