# Application for computational resources at BerzeLiUs, Valter Fallenius

I am doing a master’s thesis in machine learning towards precipitation forecasting at SMHI on radar composite precipitation fields. The project is due to be finished 3rd of June 2021.

Estimated GPU resources needed: 1080 GPU-h/month

GPU motivation: See project description below. 3D-CNN on trainingdata with dimensions: (1124, 906, 140.000) before downsampling.

Estimated Storage minimum: 160 GB (1MB x 4 x 365 x 24 x 4 + 20GB)

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# Master thesis project description, Valter Fallenius

Today’s meteorological models use Finite Element Methods to partition the atmosphere into a 3D cube grid where every element is given some meteorological data based on measurements (windspeed, temperature, precipitation etc.). Then numerical models based on Navier-Stokes and chemical models are used to predict the future. AI is sometimes used today in the final stage to improve the result of these numerical predictions. I will build a Deep Neural Network that trains directly on the composite radar data (2D-maps). The network architectures I consider are:

1. 2D-Convolutional LSTM-network (easy to implement, hard to parallelize)
2. 3D-CNN including the temporal dimension (easy to implement, easier to parallelize)
3. A state-of-the-art Transformer model (harder to implement, easier to parallelize)

I will investigate which method can give better predictions towards the development of new forecast tools within the scope of my thesis project. I will start with a thorough study of how the forecasts are done today, globally and at SMHI, as well as investigate what work has been done regarding AI and weather forecasting.

An upside to this sort of solution for weather forecasting is that such a network would require less computing power than today’s models once the network is trained, which is a one-time cost. This means that the forecasts then can be based on a larger dataset than those used in conventional methods or be generated much quicker. The challenge will be that the dataset is huge with years of data, thus I will have to consider spatial down sampling, parallelization etc.