Local Weather

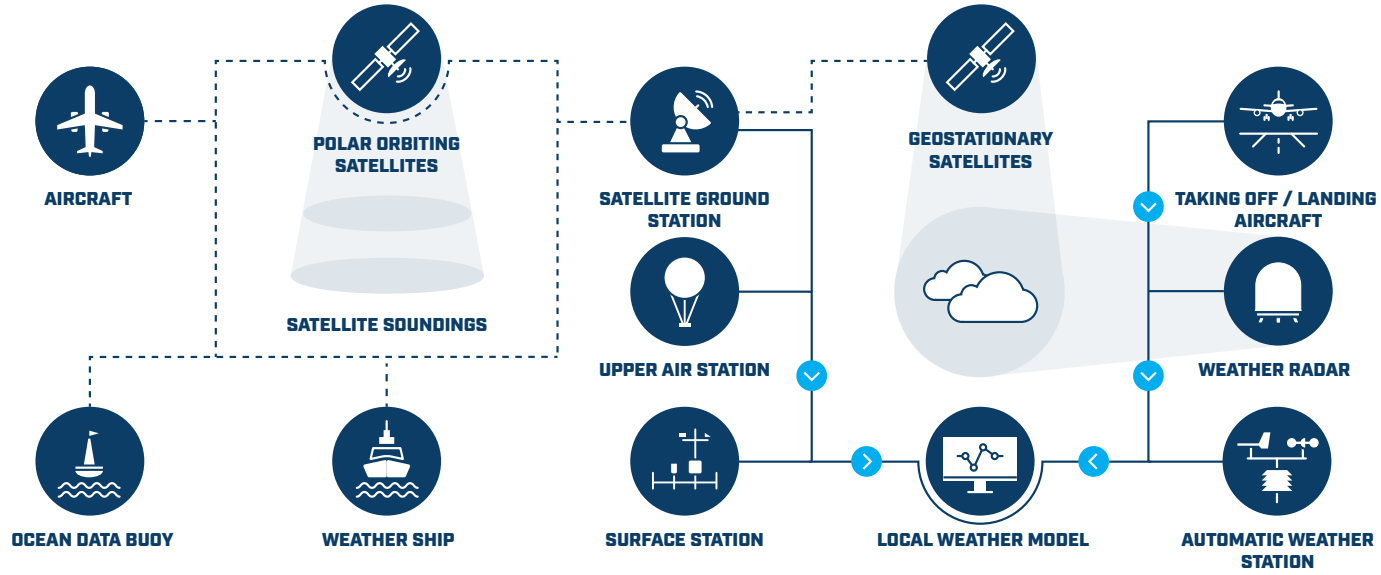
The Weather Research and Forecasting (WRF)

The Weather Research and Forecasting (WRF) Model is a next-generation mesoscale numerical weather prediction system designed for both atmospheric research and operational forecasting applications. It features two dynamical cores, a data assimilation system, and a software architecture supporting parallel computing and system extensibility. The model serves a wide range of meteorological applications at scales from tens of meters to thousands of kilometers. The ARW core is developed and supported by NCAR's Mesoscale and Microscale Meteorology Laboratory.

MicroStep-MIS provides services for selecting optimal model parameters in accordance with client requirements and available resources. to correctly predict local weather features, WRF-ARW has about 90 options, the combination of which forms an even larger number of possible configurations (up to 200,000). WRF model is able to calculate a forecast for a period from a few hours to 1 - 2 weeks with high detail in terms of time - up to 1 hour. The forecast update frequency can vary from 1 to 4 times a day.

At the current stage of the development of numerical meteorology, forecast errors continue to accumulate over time, regardless of spatial resolution. Therefore, to maintain an optimal balance between area size, computational speed, and forecast quality, the model can be limited to a single area with a grid step of 10 or 9 km. If the prediction area is large enough and requires a high resolution, a nesting technique is used: an area of a smaller size (inner) is placed into the parent coarse area. However, the spatial resolution of the inner area is 3 or 5 times higher than the coarse area.

The quality of NWP models can be improved by the post-processing of model data using model output statistics (MOS) and "data mining" methods. The MOS statistical method uses a database of predictions and measurements. The statistical approach is able to predict local weather parameters such as



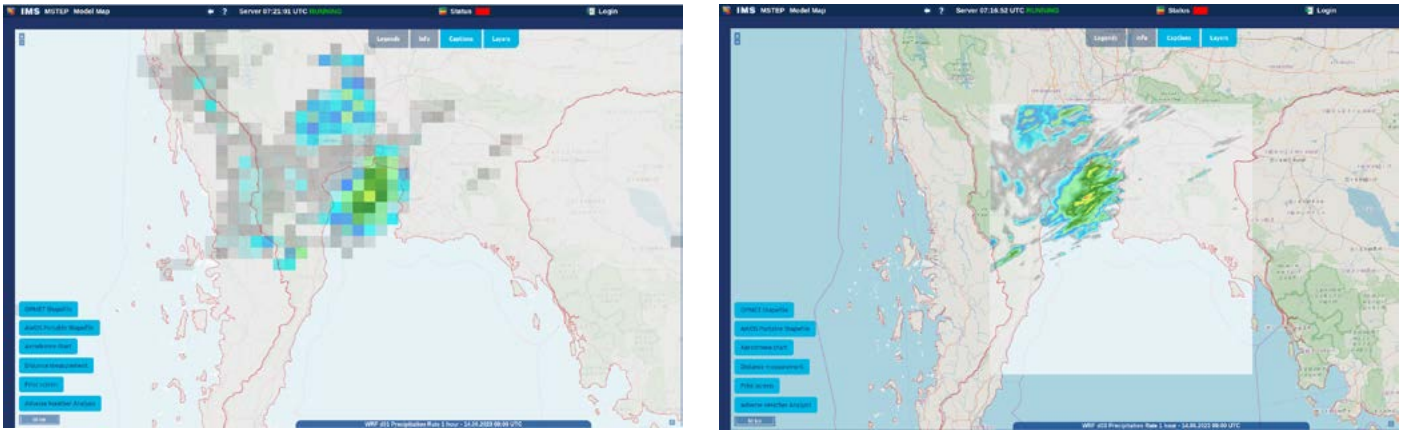
Sources of observational data assimilated by the local model

air pressure, air and ground temperature, relative humidity, dew point temperature, wind speed and direction and gusts, precipitation amount, etc.

The "data mining" method is based on an adaptive machine learning algorithm. The algorithm was developed as part of the joint research project of MicroStep-MIS and the Slovak Academy of Sciences using artificial neural networks and decision trees. This improves the final result based on previous "experience". In MicroStep-MIS, the data mining method has been successfully applied to forecast the probability of fog, predict visibility, and low cloud cover.

The WRF model can assimilate a wide variety of observational data - METAR aviation codes, ship measurements, radar data, and many others. To assimilate data, the technique of three-dimensional variational analysis (3D-Var) is used, but other assimilation methods can be applied according to the customer's request. The assimilation of observation data also allows the WRF forecast to be updated more frequently - up to 8 times per day. If a sufficient number of stations with observation data or meteorological radar data is available, its samples can be assimilated into the model between the main forecast times (00, 06, 12, 18 UTC).

To offset errors in initial data, our specialists can implement the concept of ensemble (probabilistic) forecasting - the calculation of many forecasts for the same period with slightly different initial forecast data. This approach allows you to obtain the probability of a specific forecast scenario and obtain many other valuable results by post-processing of the ensemble. Thanks to the adaptive grid step, the WRF model is able to provide operational forecast calculations of an ensemble consisting of 40 - 60 members. For instance, it takes 17,5 hours to calculate an ensemble forecast with 10 km resolution and 40 members for 7 days ahead, allowing you to generate operational ensemble forecasts every day, which allows you to generate operational ensemble forecasts every day.



Precipitation forecast with coarse grid resolution (left) and detailed precipitation forecast with 1x1 km grid resolution (right)