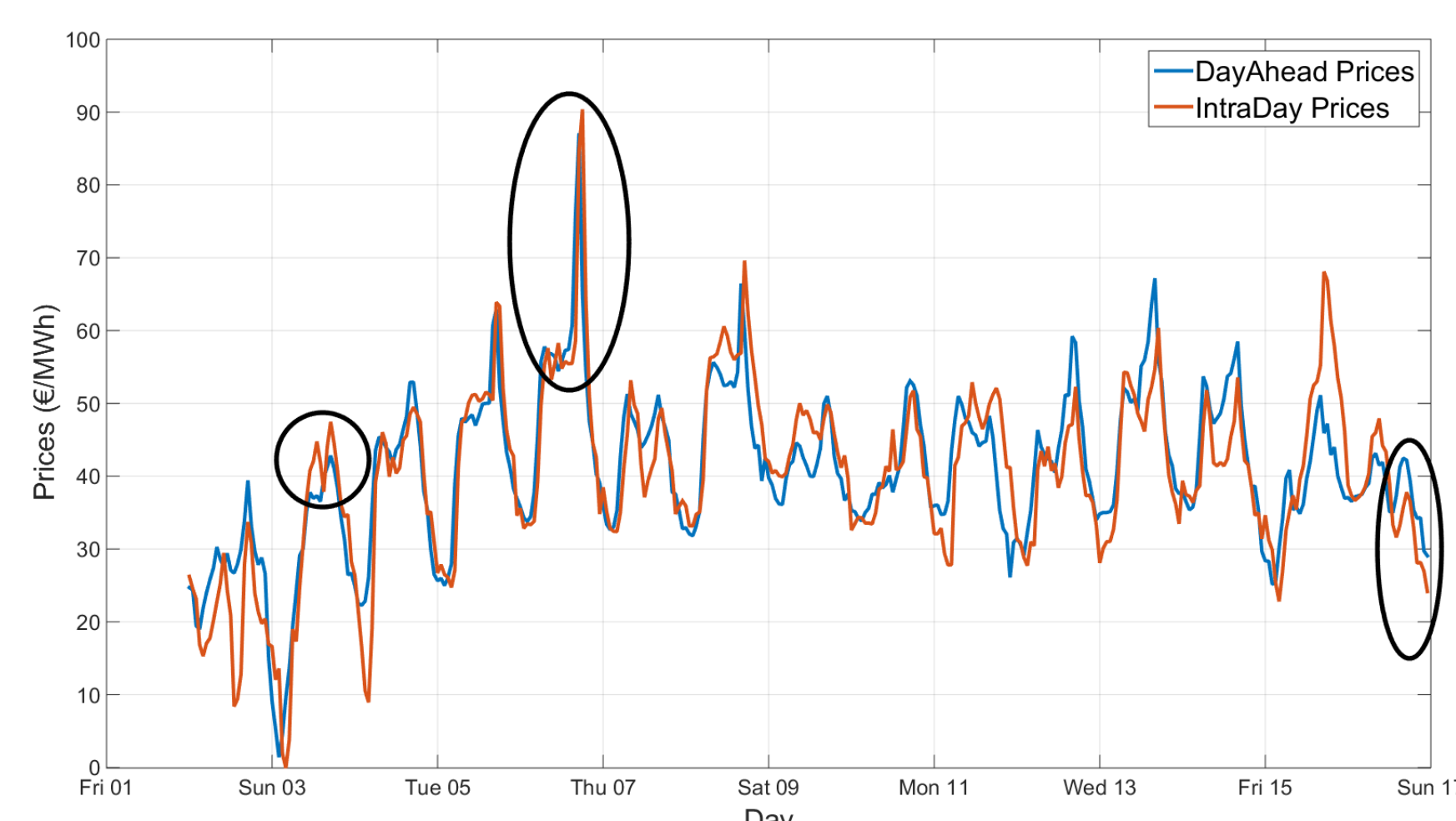


+Abstract

The electricity grid in Europe is highly dependent and influenced by the intermitting renewable energy. In Germany, renewable energy sources and in particular wind power has increasingly been important in determining the energy mix. In 2019, wind power was 24,8% of the total electricity generation mix.

At the same time, wind speed is admittedly one very difficult parameter to forecast, especially given the high installed capacity, reaching in Germany 60,87 GW (onshore and offshore, combined). The errors in the forecast require the grid operators to turn towards secondary and tertiary control energy to balance energy demand and supply in the grid. The cost for the balancing services is carried onto the producers, calculated by the so-called balancing energy price (reBAP) formula. Energy producers and trading houses count on weather models, such as ECMWF, to calculate energy production, energy demand and prices for the next hours, days, weeks. In the following, three case studies are presented, when significant errors in the Day-Ahead Wind Power forecast was seen. Those case studies could be related to Warm Conveyor Belts in the Atlantic.

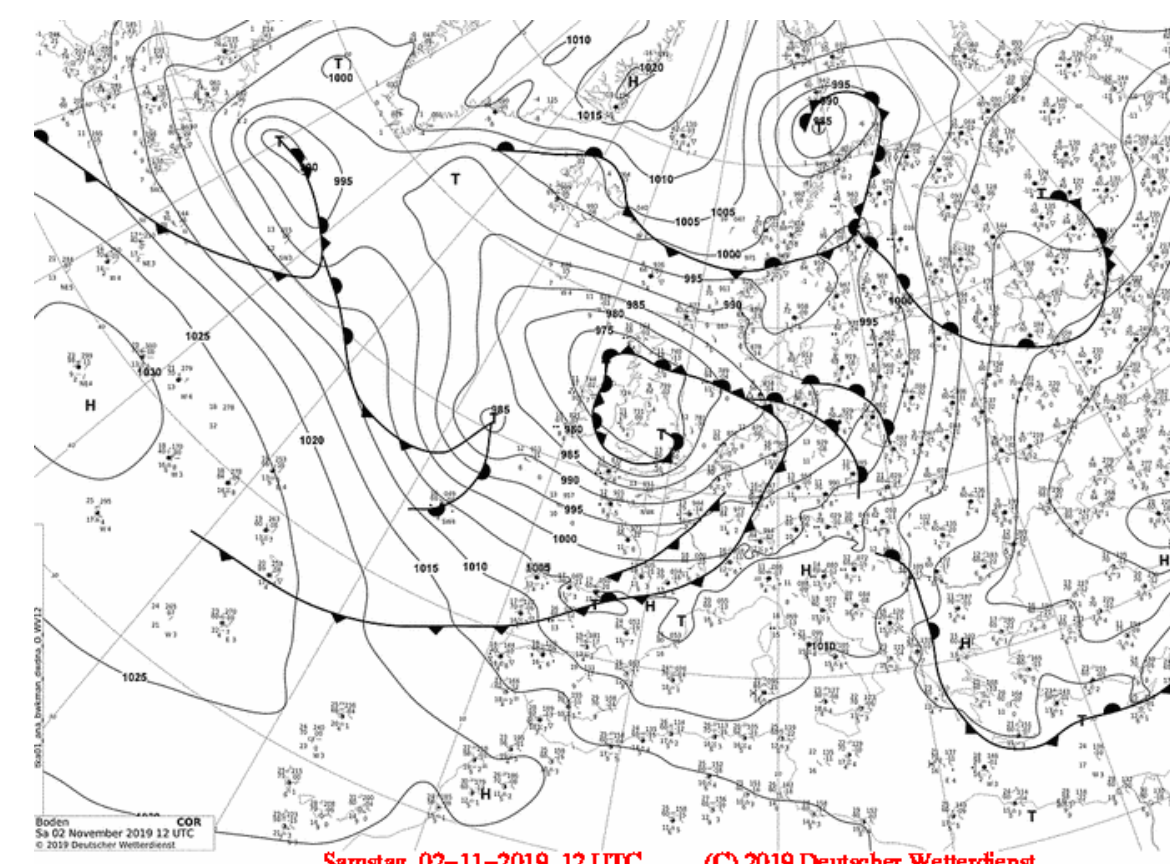
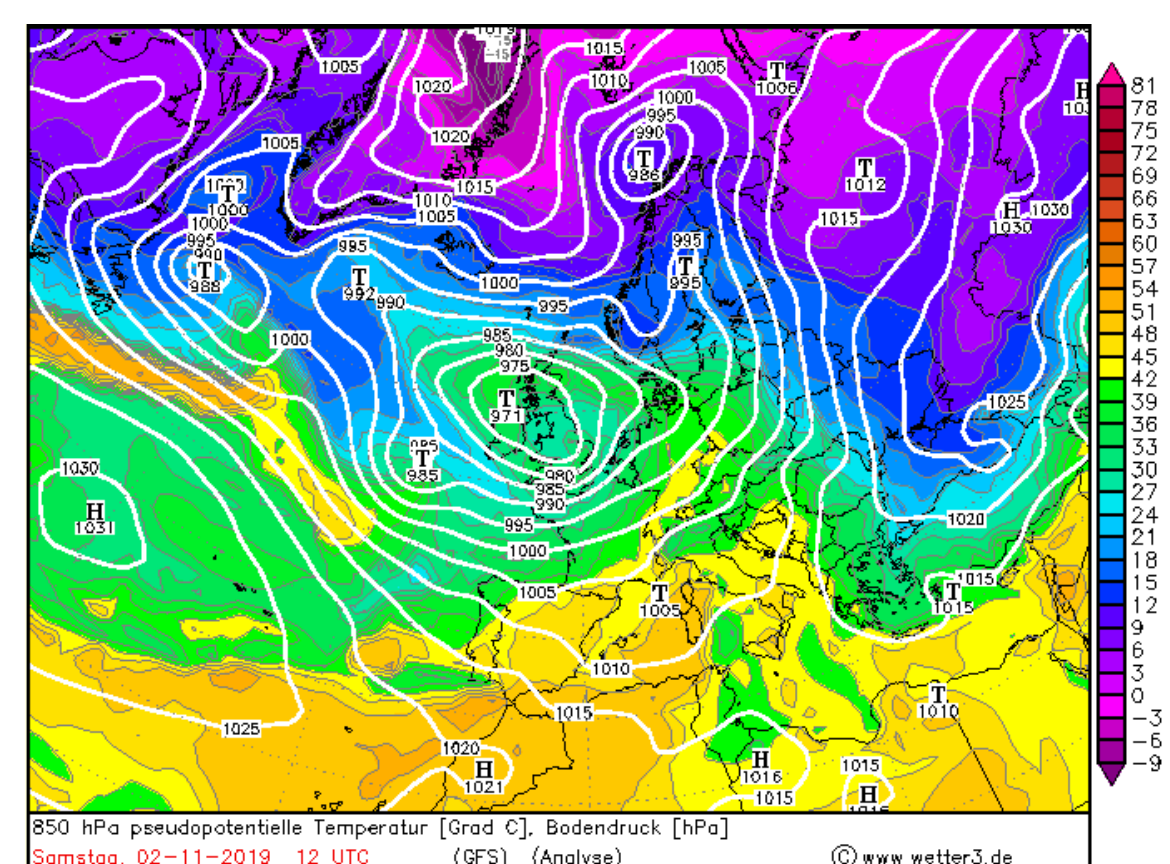
The plot below shows the prices based on the previous day auction and the prices during the Intraday market. Lower supply of energy leads to higher intraday prices and vice versa. In the 3 circles are the time periods linked to the three case studies shown below.



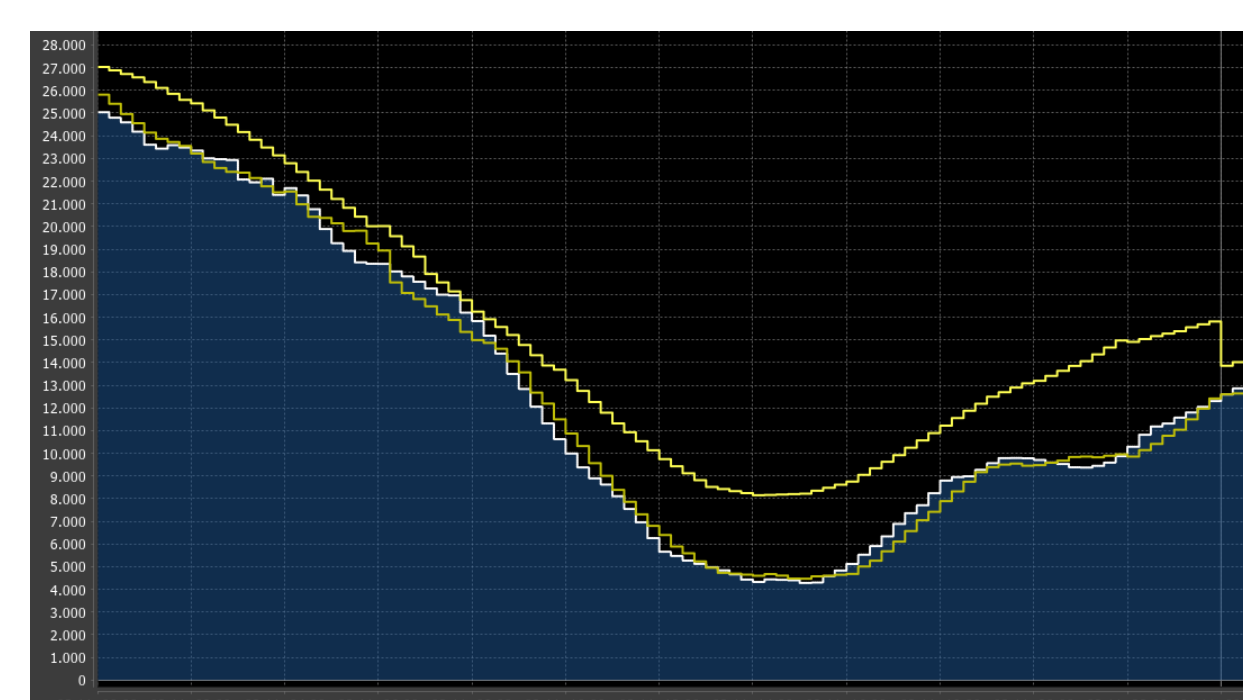
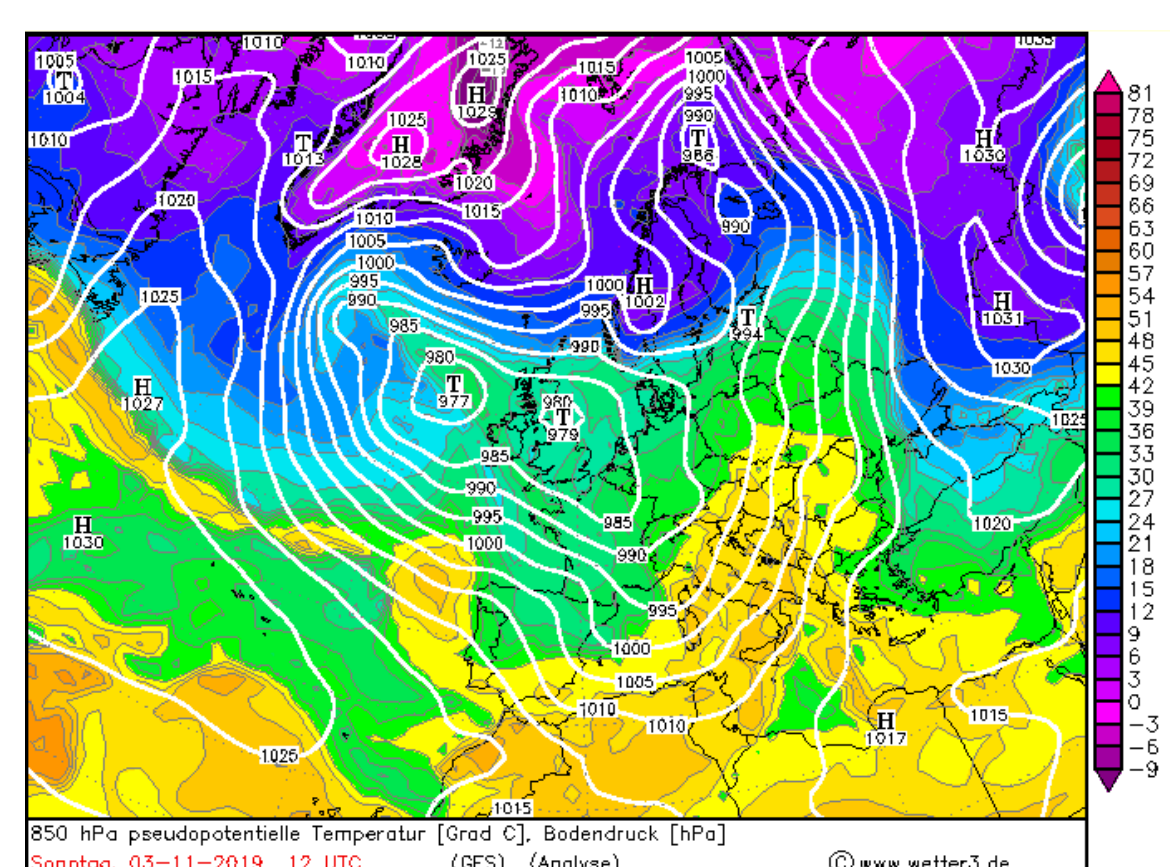
In the following, maps of pseudopotential temperature and surface pressure charts are combined with charts where a direct comparison between Day Ahead and Intraday Wind Power forecast is possible. For the combined three days in the case studies, an amount of ~189,000 € had to be paid from the direct marketing participants (owners and/or administrators of renewable energy portfolio) to the grid operator for the balancing costs.

+Case Study 1, 02/11/2019

On that day, two low pressure centres were seen in western and eastern Atlantic, respectively. The former was a frontal depression with identified warm and cold front and an easterly/southeasterly flow. The latter was at the occluding stage of a frontal system.

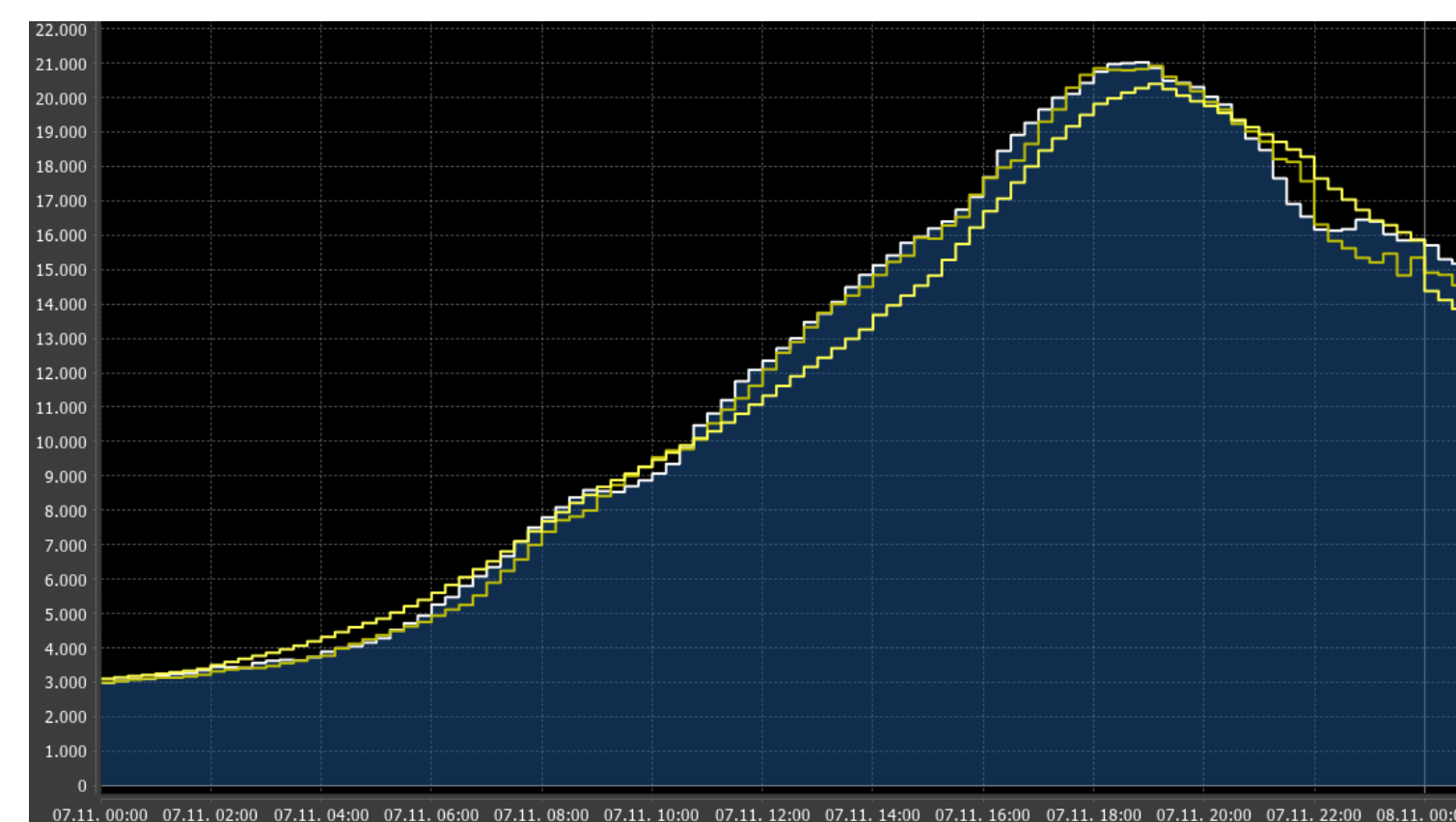
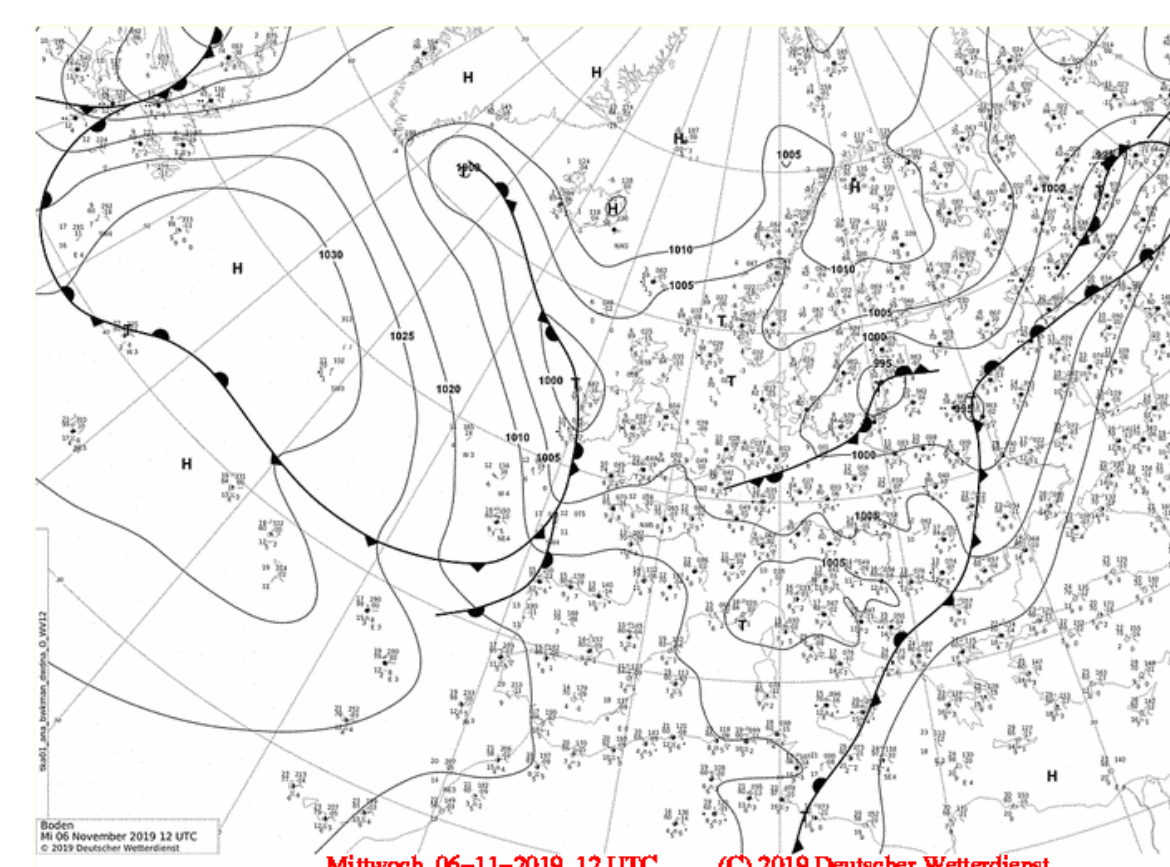
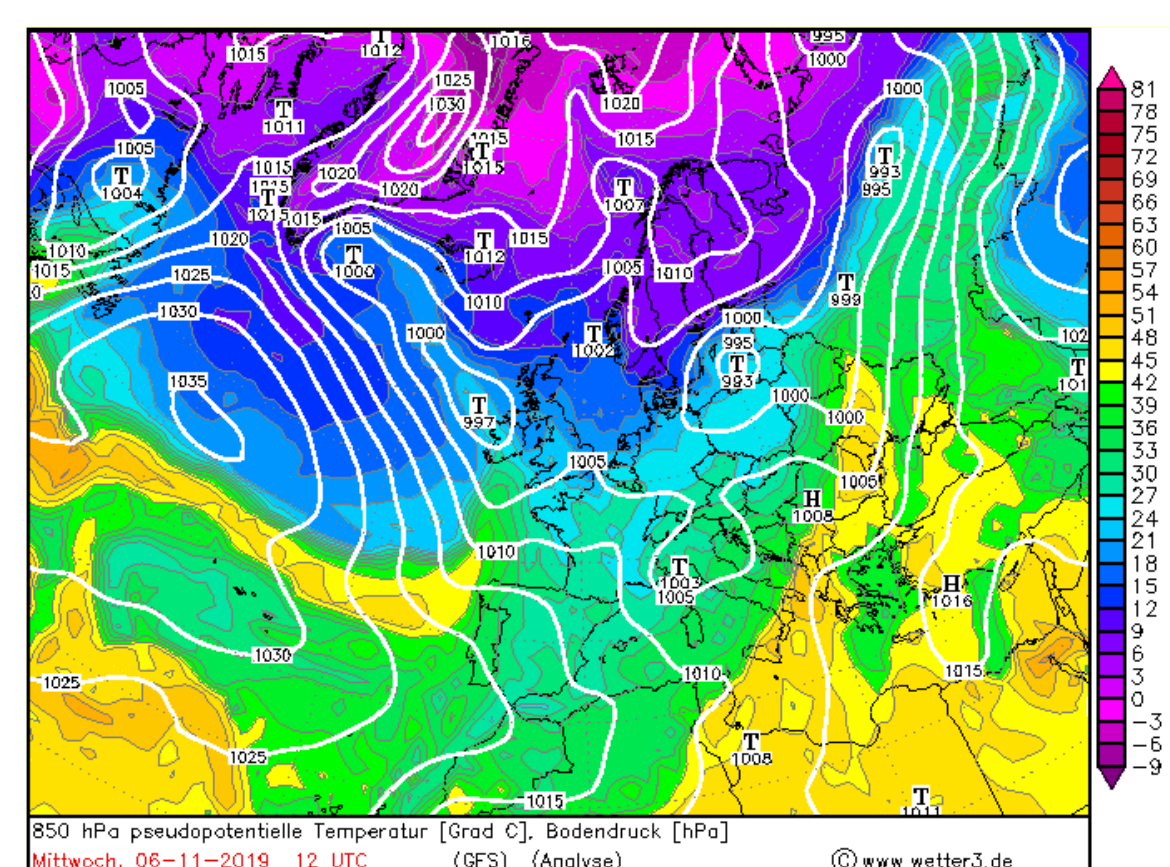


The depression in western Atlantic moved fast towards Europe and almost connected with the previous low over Britain on the following day (03/11/2019). On that day, a significant Day Ahead forecast error was seen (below).



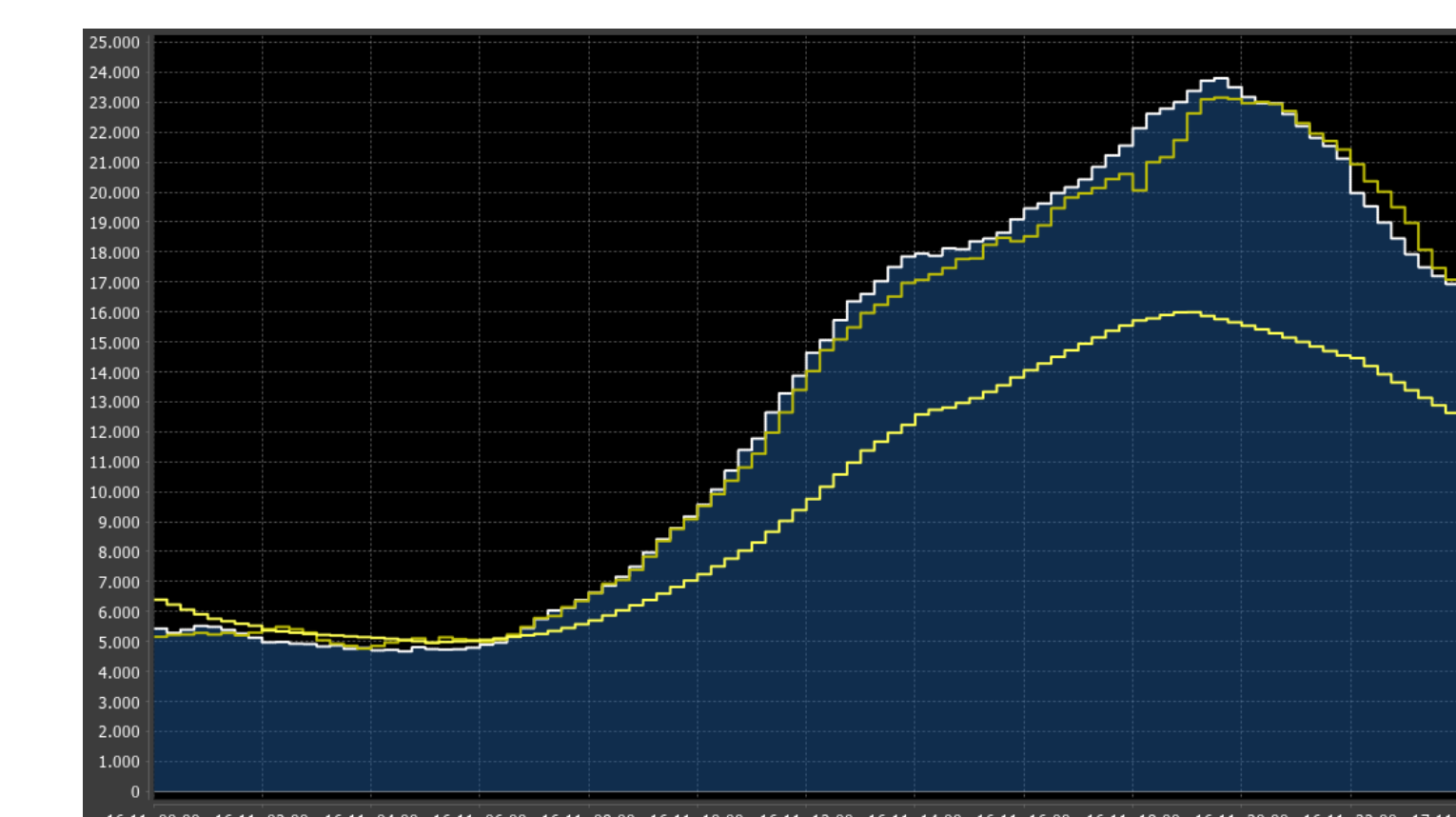
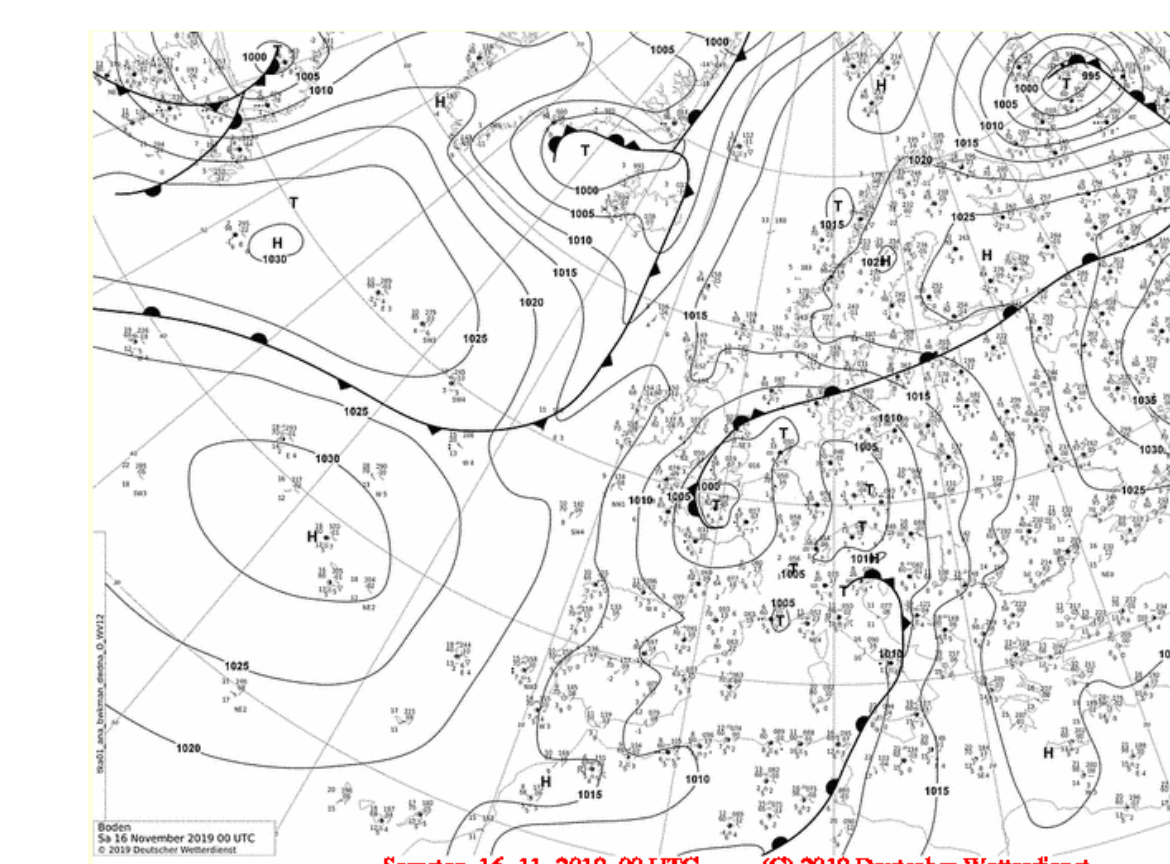
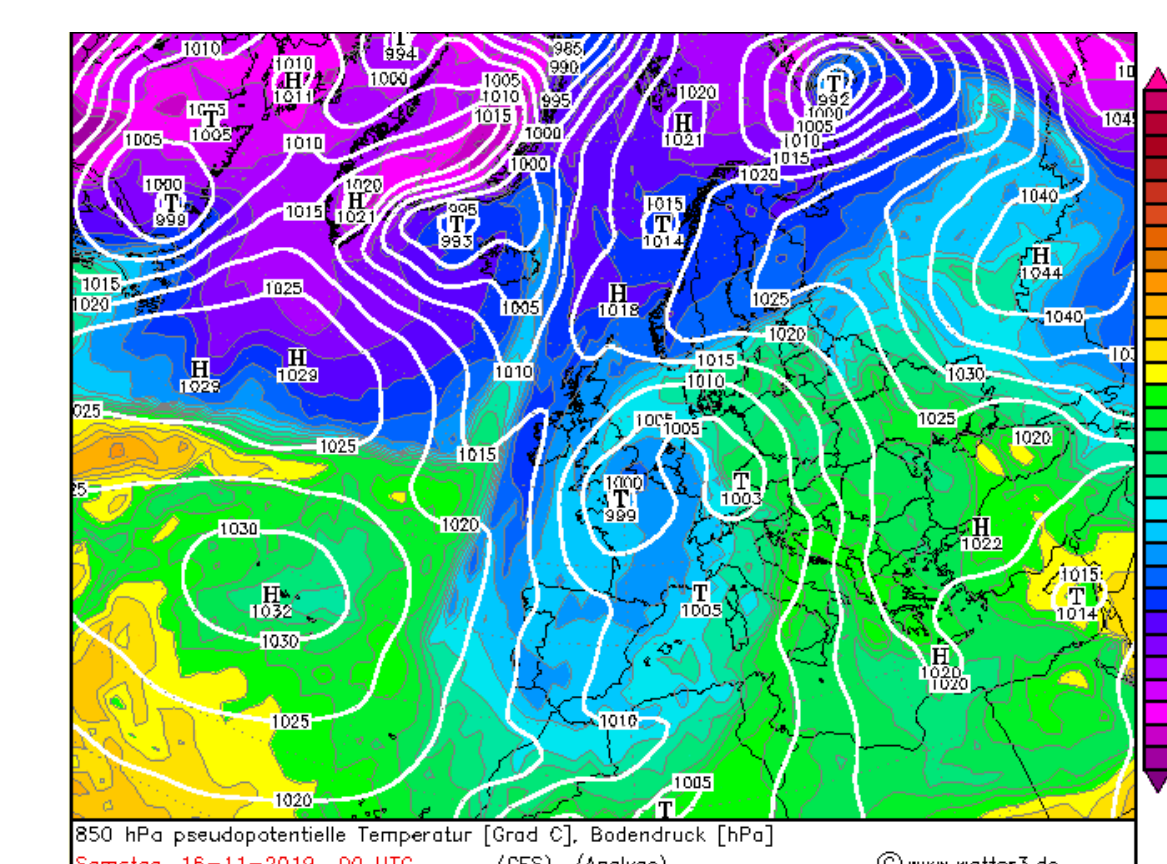
+Case Study 2, 06/11/2019

On that day, a frontal system was evident west of UK. After the occlusion, the low pressure center deepened further and moved towards the wind farms of northern Germany. On this occasion, the Day Ahead forecast (for 07/11) underestimated the wind in its ramping up phase.



+Case Study 3, 16/11/2019

On this case study, another likely case of Warm Conveyor Belt is apparent in eastern Atlantic. It is not clear whether the frontal system west of UK is related to the big DA forecast error, where up to +8 GW additional wind power was observed, in relation to the DA forecast.



+Conclusions

+For the energy market players, accurate renewable energy forecasts are crucial, particularly in the leadtime range of 24 hours to 4-5 days. More accurate forecasts would lead to lower costs for energy grid regulators that could otherwise be used to improve network safety and efficiency.

+References

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