

# Online-Material zum Artikel „Potential von Machine Learning bei der kurzfristigen Leistungsprognose innerhalb einer Laufkraftwerkskette“

für das Laufkraftwerk Aschach (BAS)

Inhalt:

- 1) Zeitreihen für 5 Zeitfenster in der Validierungsphase sowie 4 Prognosestufen (4 bis 1h)
- 2) Feature Importance der ML-Modelle „Random Forest“ sowie „XGBoost“

15.12.2021

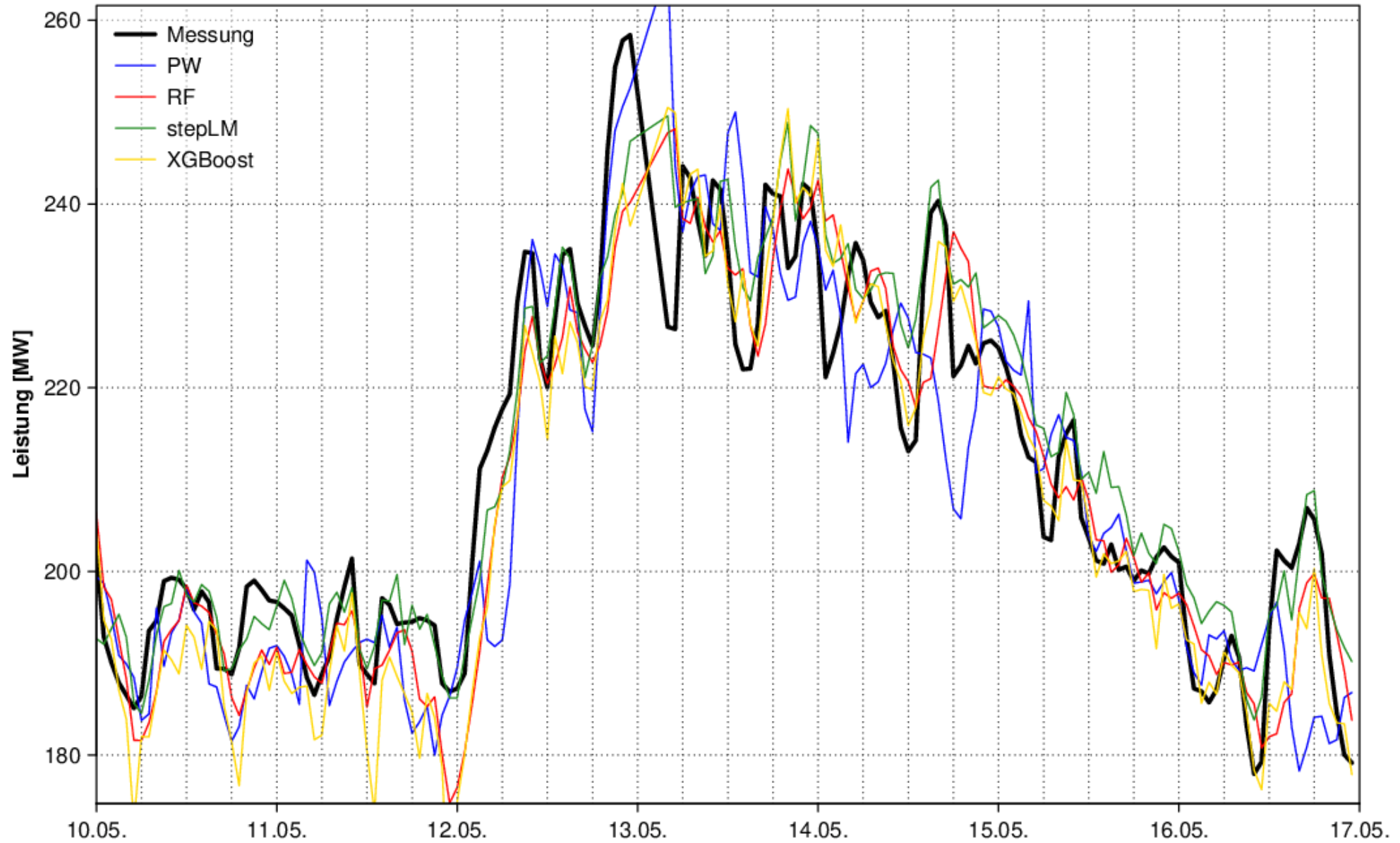
# Laufkraftwerk Aschach (BAS)

- Donau-Kilometer 2162,67
- Engpassleistung 324 MW
- Mittlere Rohfallhöhe 15,3 m
- Ausbaudurchfluss 2480 m<sup>3</sup>/s

*Quellen: Verbund AG, Wikipedia*

# 1) Zeitreihen

- für 5 Zeitfenster in der Validierungsphase sowie 4 Prognosestufen (4 bis 1h)
- des Benchmark-Modells „PW“ sowie der
- ML-Modelle „stepwise multiple linear regression“ (stepLM), „Random Forest“ (RF) sowie „XGBoost“
- im Vergleich zu den Messwerten
- Prediktoren-Kombination BAS3 (siehe Tab. 3 im Artikel)

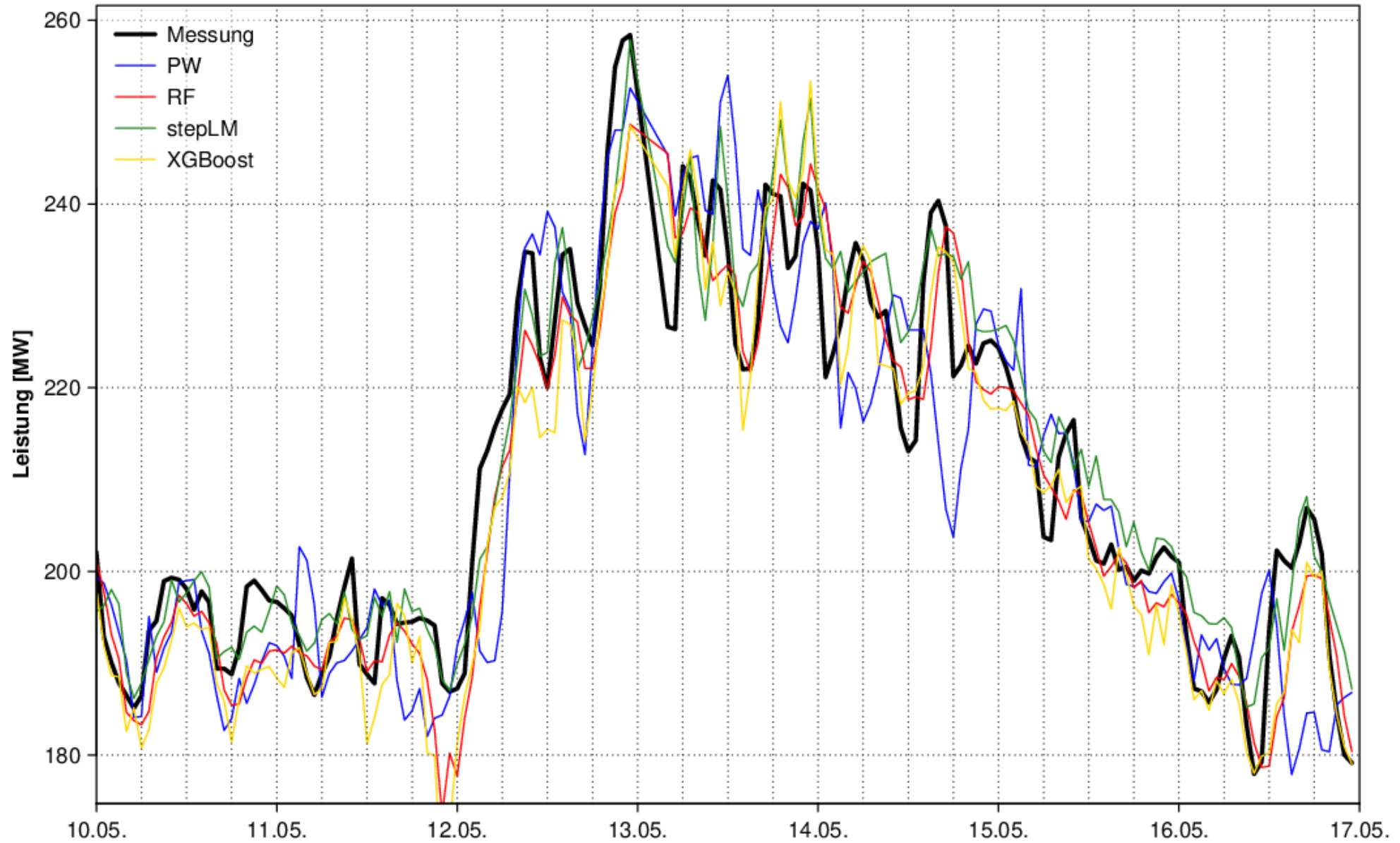


**PW: RMSE = 10.03 MW | MAE = 7.61 MW**

**RF: RMSE = 8 MW | MAE = 6.33 MW**

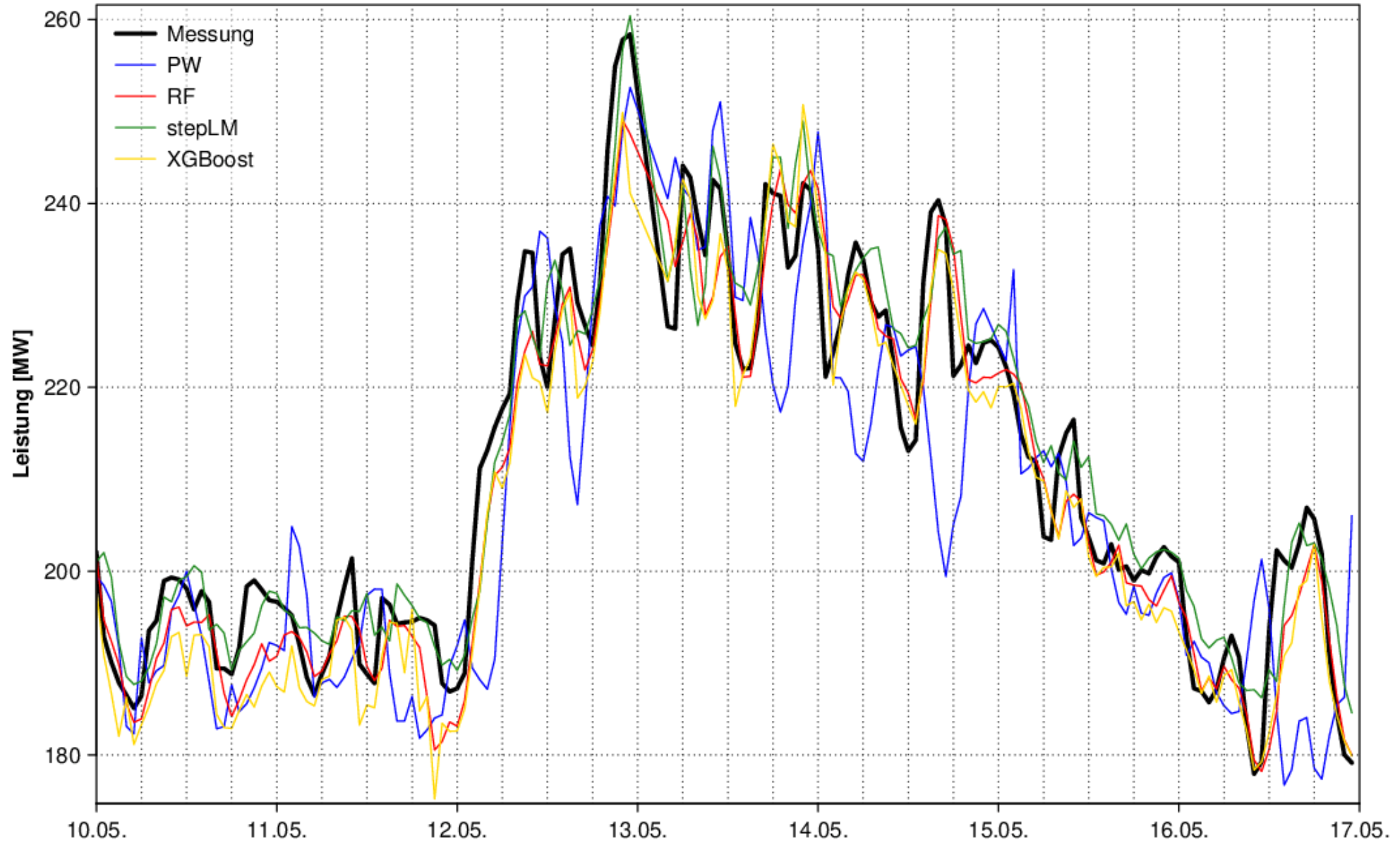
**stepLM: RMSE = 6.49 MW | MAE = 5.01 MW**

**XGBoost: RMSE = 8.29 MW | MAE = 6.43 MW**



**PW: RMSE = 10.2 MW | MAE = 7.9 MW**  
**RF: RMSE = 6.65 MW | MAE = 5.14 MW**

**stepLM: RMSE = 5.87 MW | MAE = 4.83 MW**  
**XGBoost: RMSE = 7.32 MW | MAE = 5.82 MW**



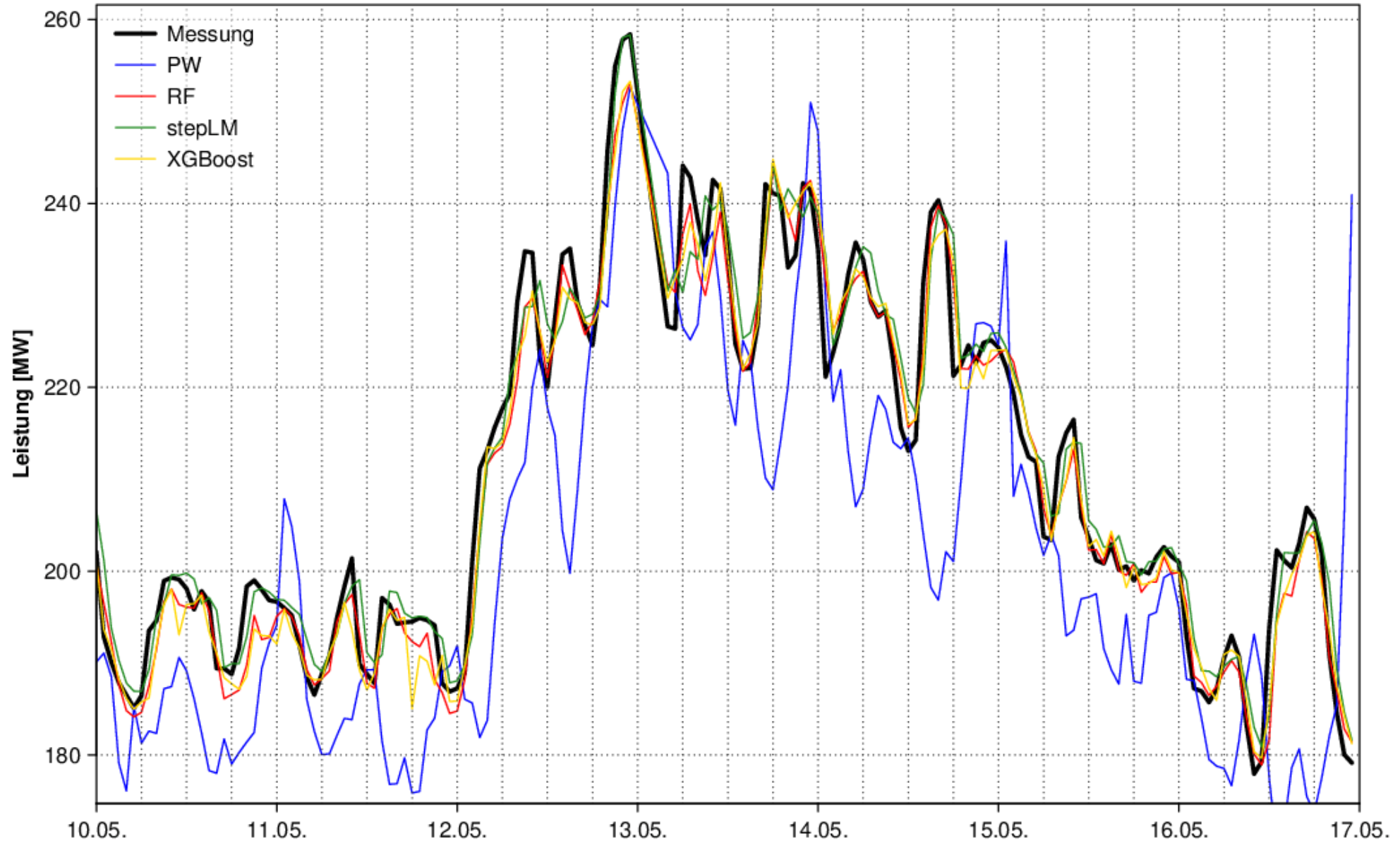
**PW: RMSE = 11.63 MW | MAE = 8.88 MW**

**RF: RMSE = 5.5 MW | MAE = 4.22 MW**

**stepLM: RMSE = 5.54 MW | MAE = 4.4 MW**

**XGBoost: RMSE = 6.36 MW | MAE = 5.17 MW**



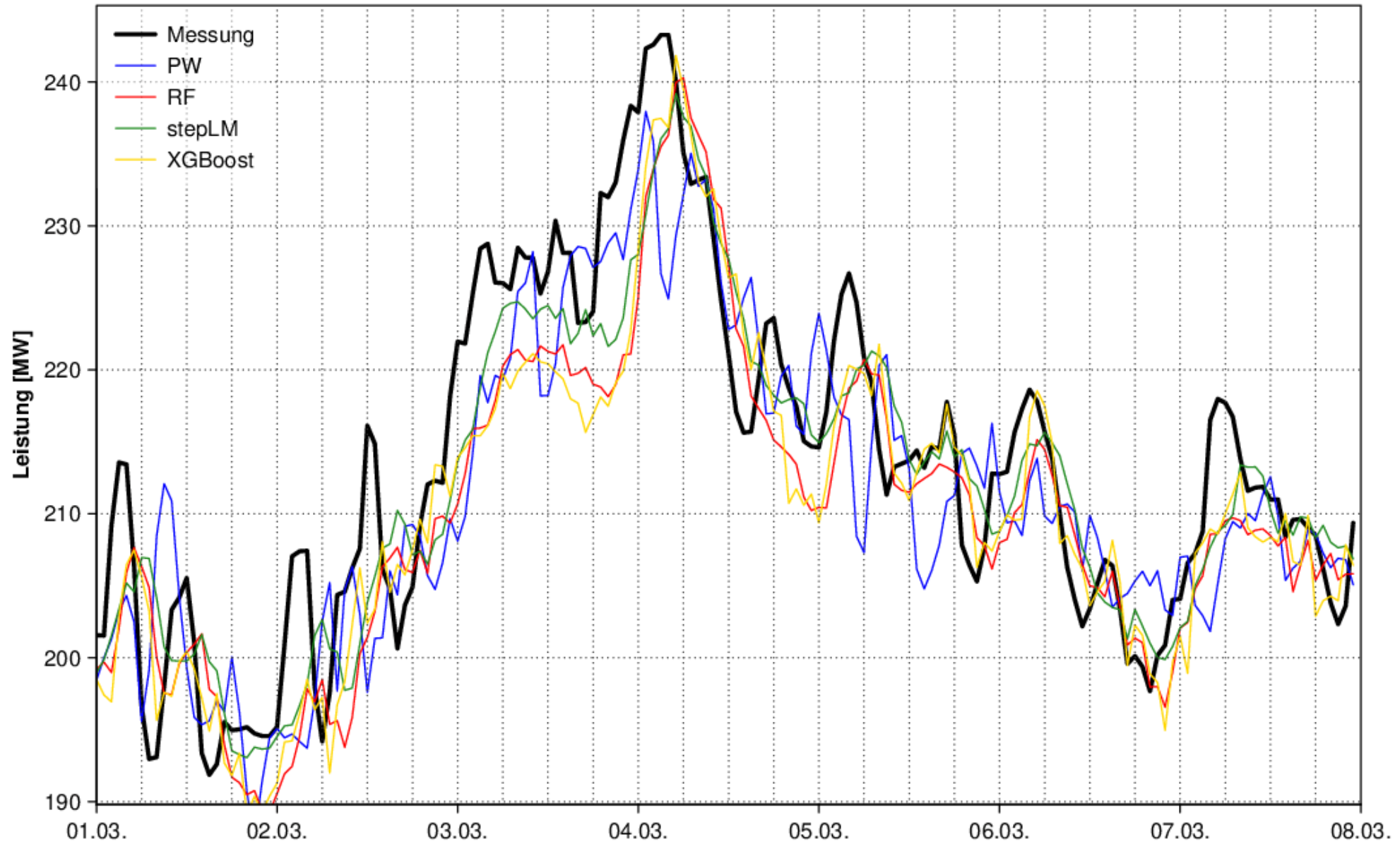


PW: RMSE = 15.75 MW | MAE = 12.26 MW

RF: RMSE = 3.52 MW | MAE = 2.66 MW

stepLM: RMSE = 4.31 MW | MAE = 3.19 MW

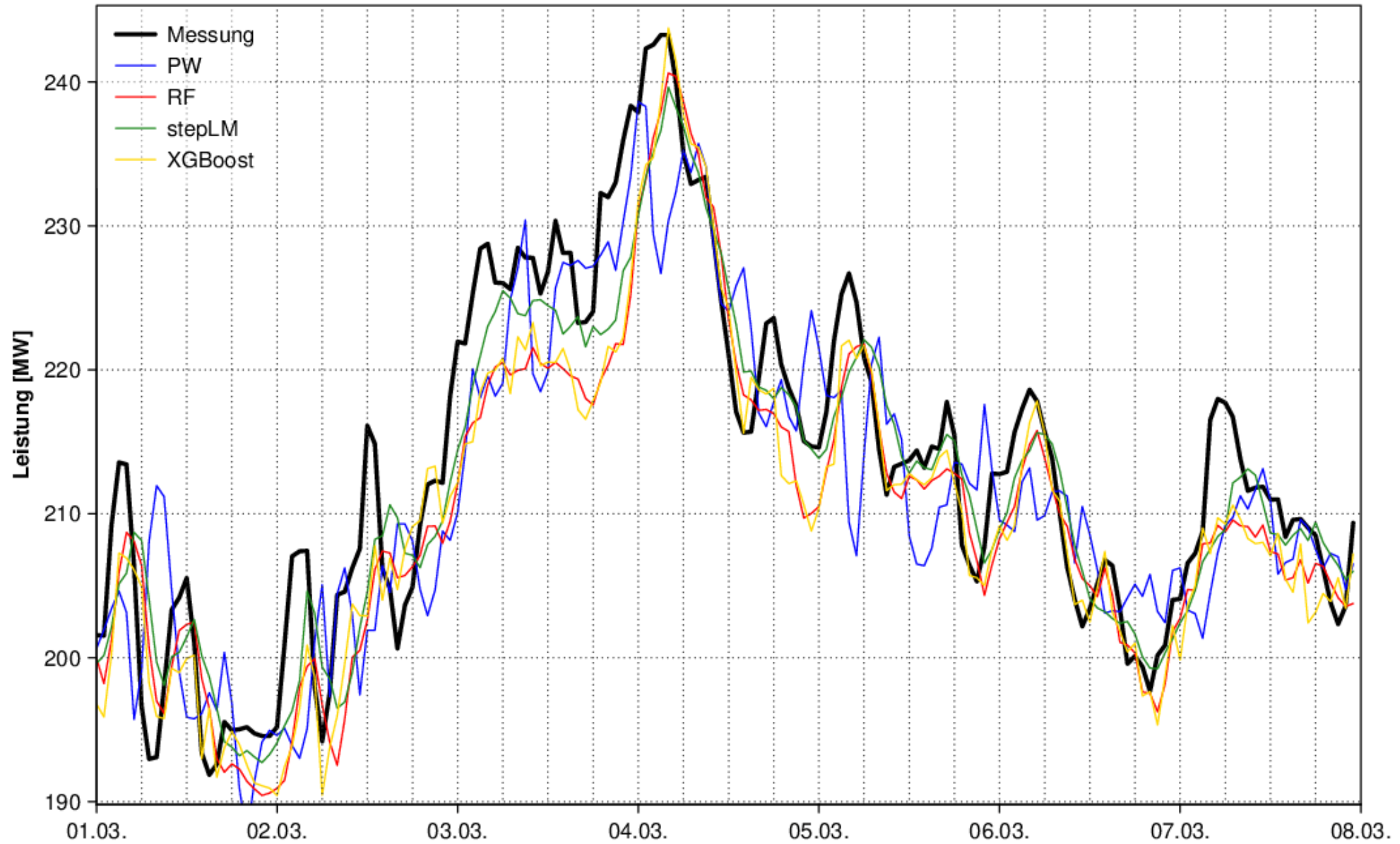
XGBoost: RMSE = 3.86 MW | MAE = 2.89 MW



PW: RMSE = 6.77 MW | MAE = 5.42 MW  
RF: RMSE = 6.37 MW | MAE = 5.19 MW

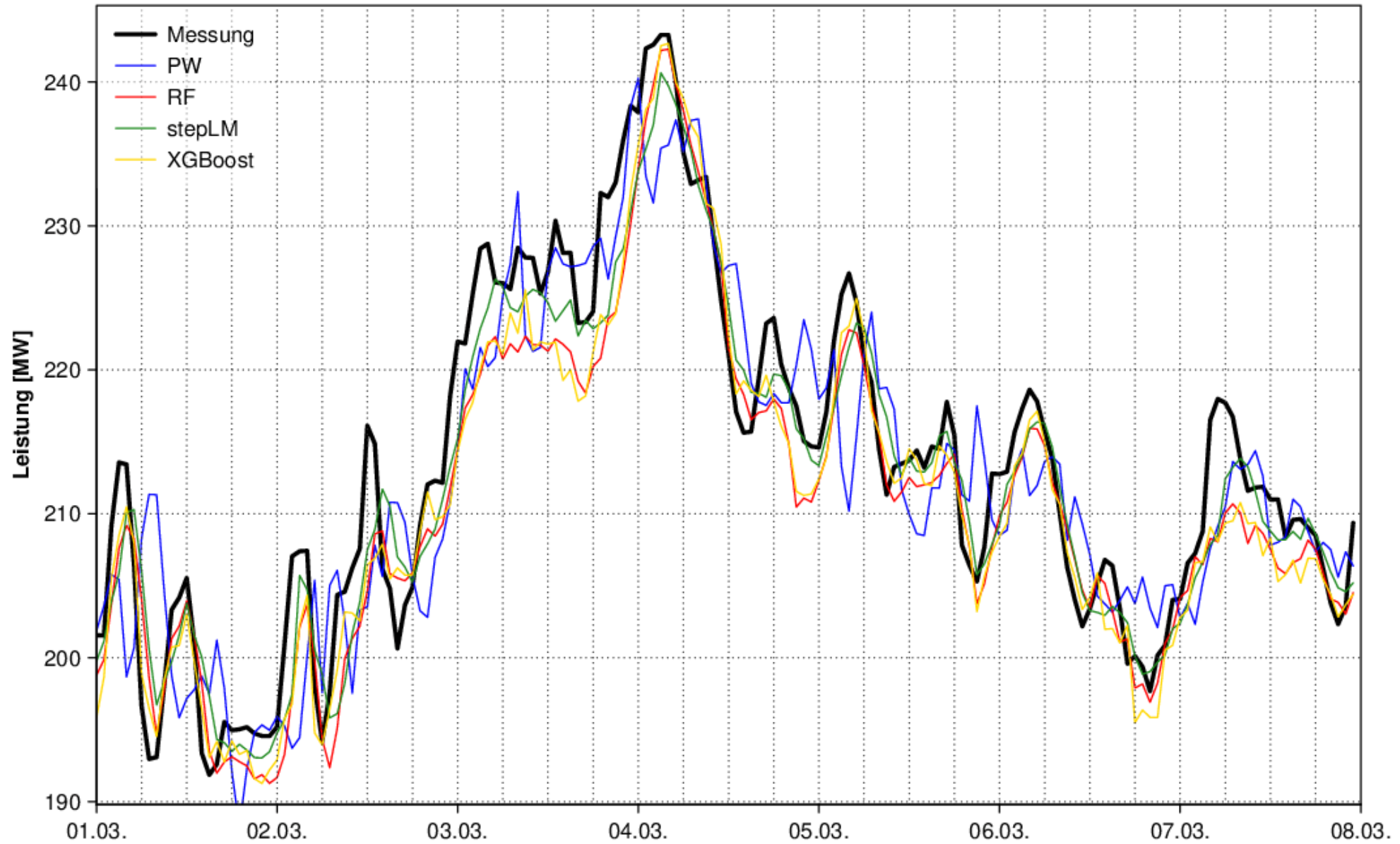
stepLM: RMSE = 5.47 MW | MAE = 4.34 MW  
XGBoost: RMSE = 6.02 MW | MAE = 4.83 MW





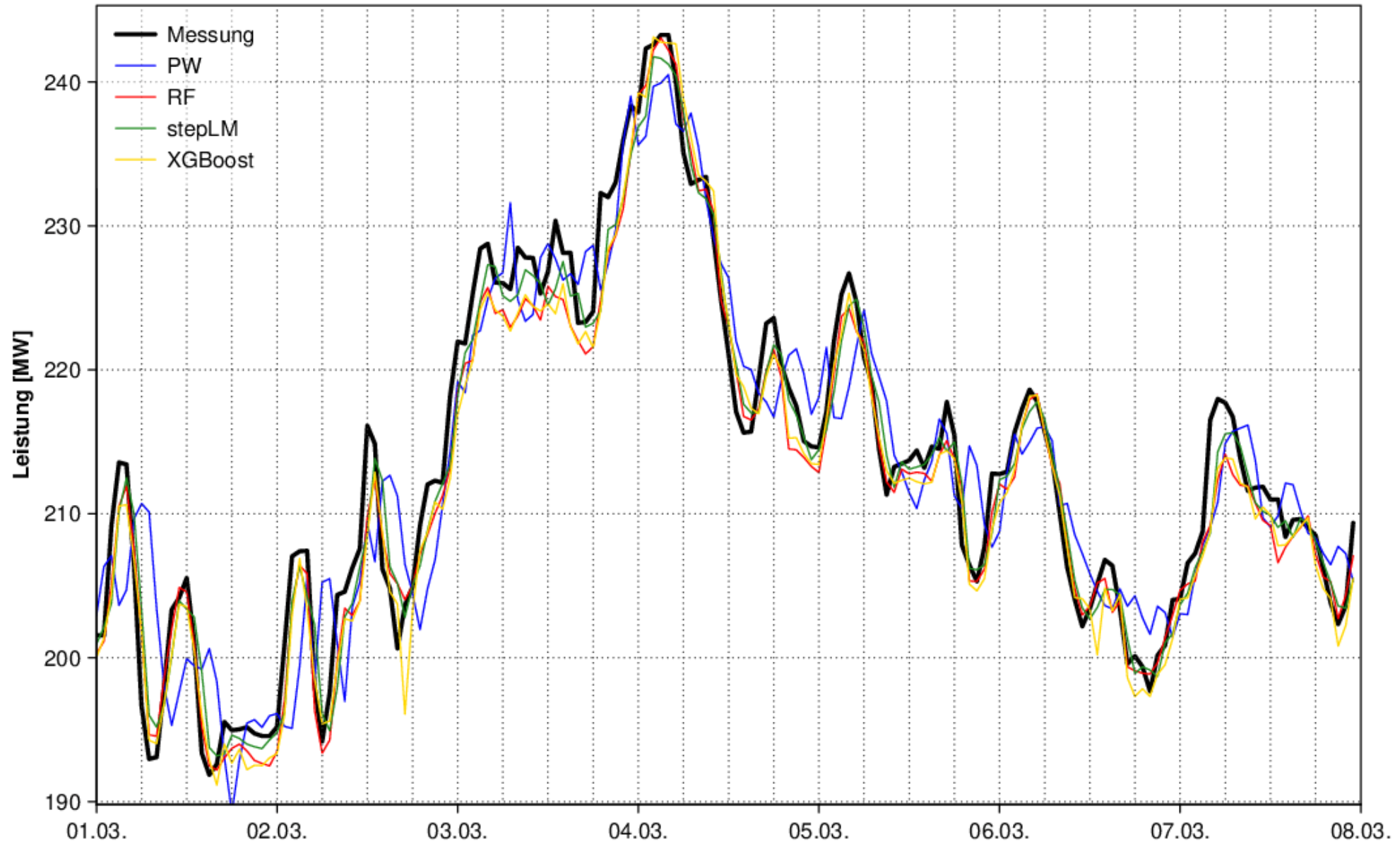
PW: RMSE = 6.67 MW | MAE = 5.25 MW  
RF: RMSE = 5.45 MW | MAE = 4.46 MW

stepLM: RMSE = 4.68 MW | MAE = 3.71 MW  
XGBoost: RMSE = 5.21 MW | MAE = 4.14 MW



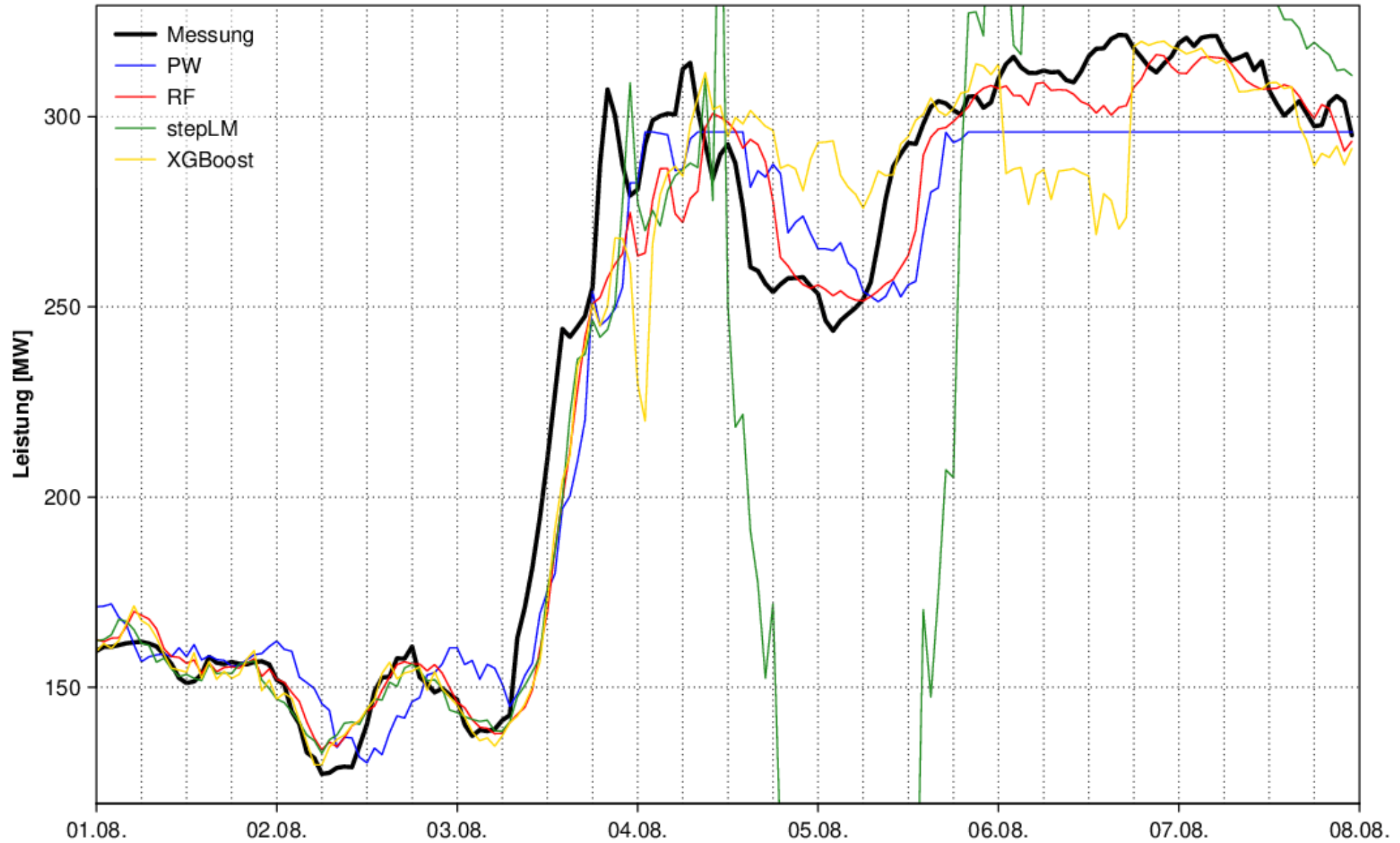
PW: RMSE = 5.88 MW | MAE = 4.67 MW  
RF: RMSE = 4.23 MW | MAE = 3.43 MW

stepLM: RMSE = 3.73 MW | MAE = 2.91 MW  
XGBoost: RMSE = 4.07 MW | MAE = 3.31 MW



PW: RMSE = 4.74 MW | MAE = 3.78 MW  
RF: RMSE = 2.43 MW | MAE = 1.93 MW

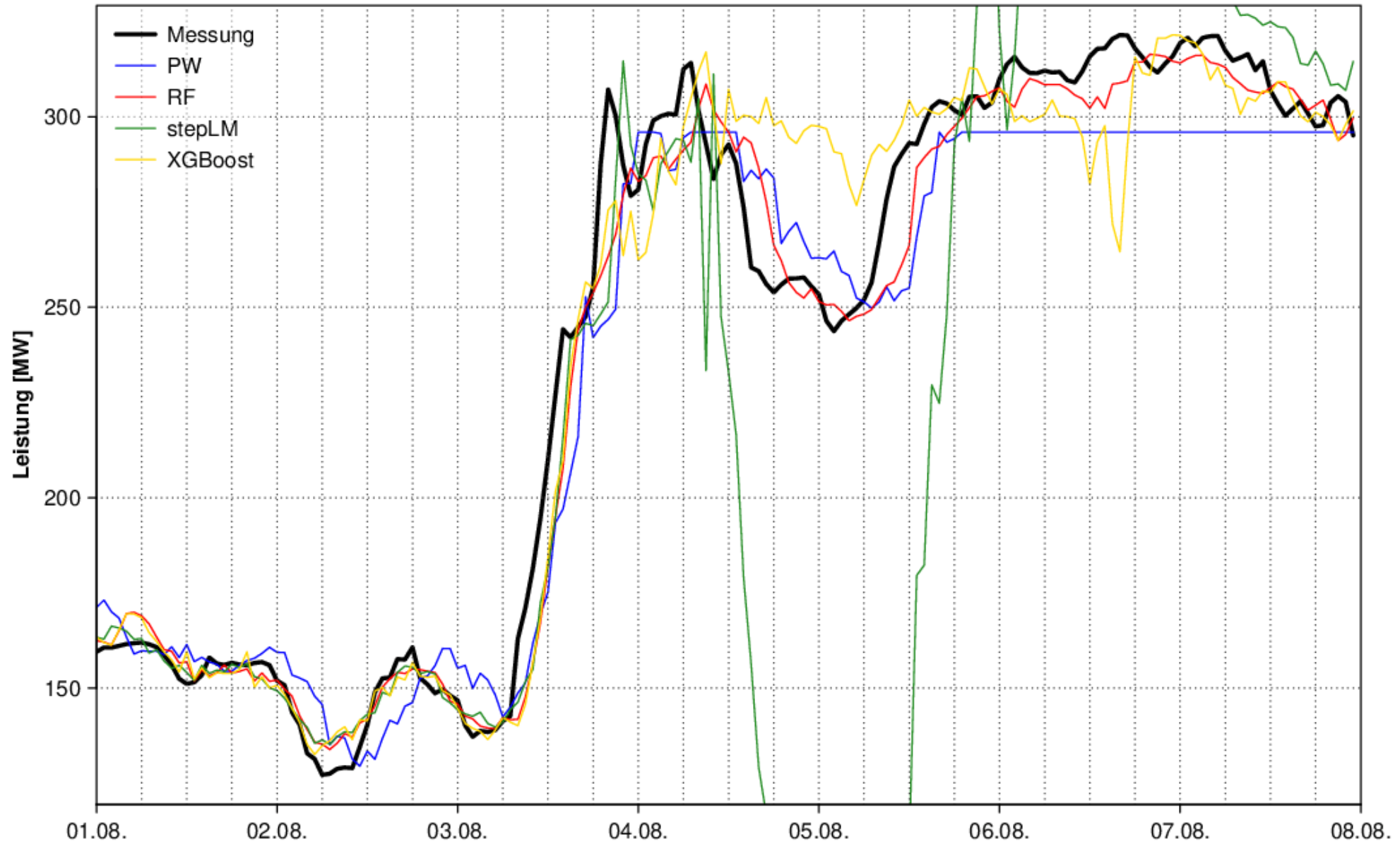
stepLM: RMSE = 2.49 MW | MAE = 1.9 MW  
XGBoost: RMSE = 2.72 MW | MAE = 2.21 MW



PW: RMSE = 18.59 MW | MAE = 14.97 MW  
RF: RMSE = 14.41 MW | MAE = 9.53 MW

stepLM: RMSE = 140.16 MW | MAE = 67.25 MW  
XGBoost: RMSE = 20.92 MW | MAE = 14.37 MW



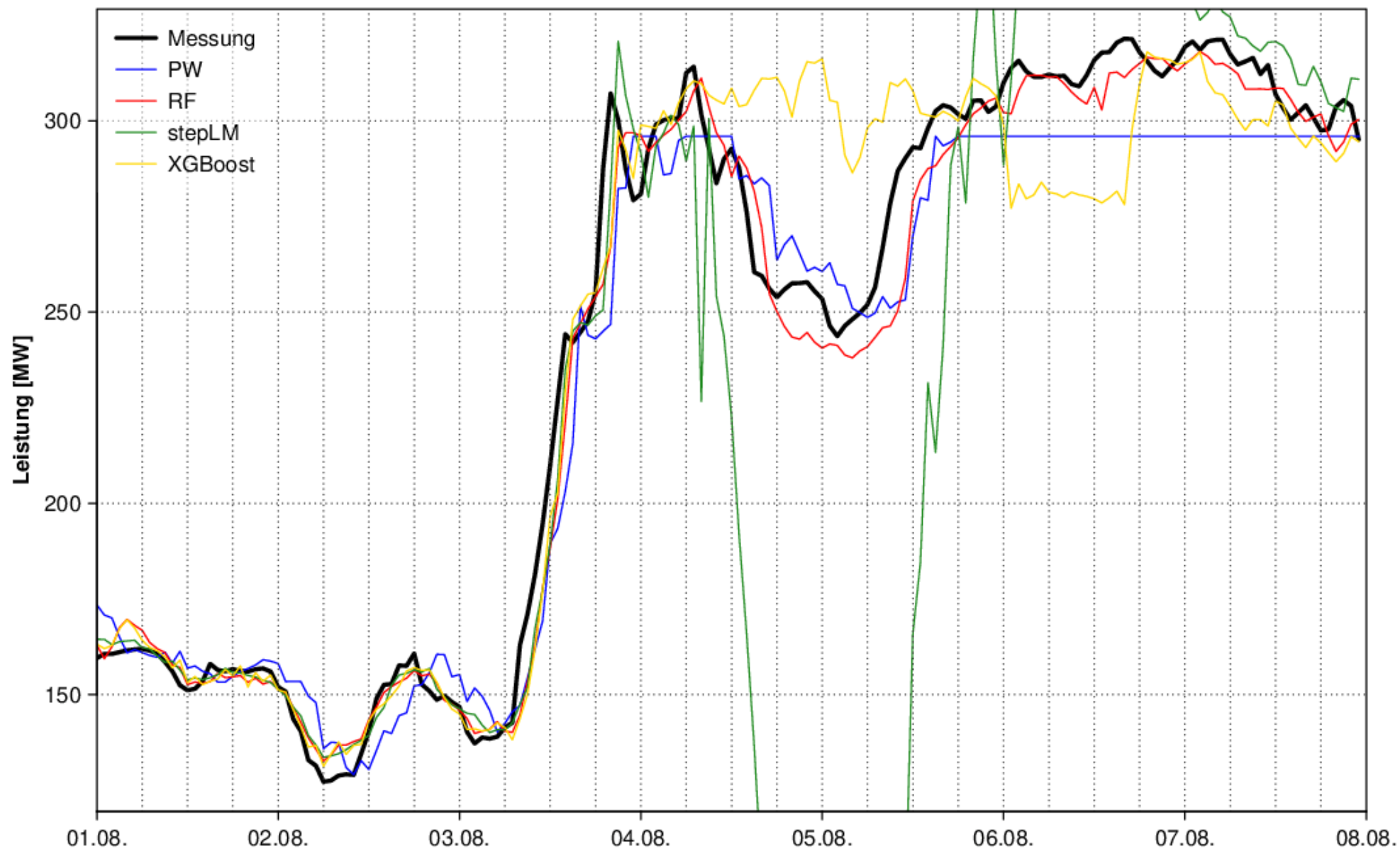


PW: RMSE = 17.17 MW | MAE = 13.67 MW

RF: RMSE = 11.4 MW | MAE = 7.73 MW

stepLM: RMSE = 133.15 MW | MAE = 60.65 MW

XGBoost: RMSE = 17.96 MW | MAE = 12.17 MW



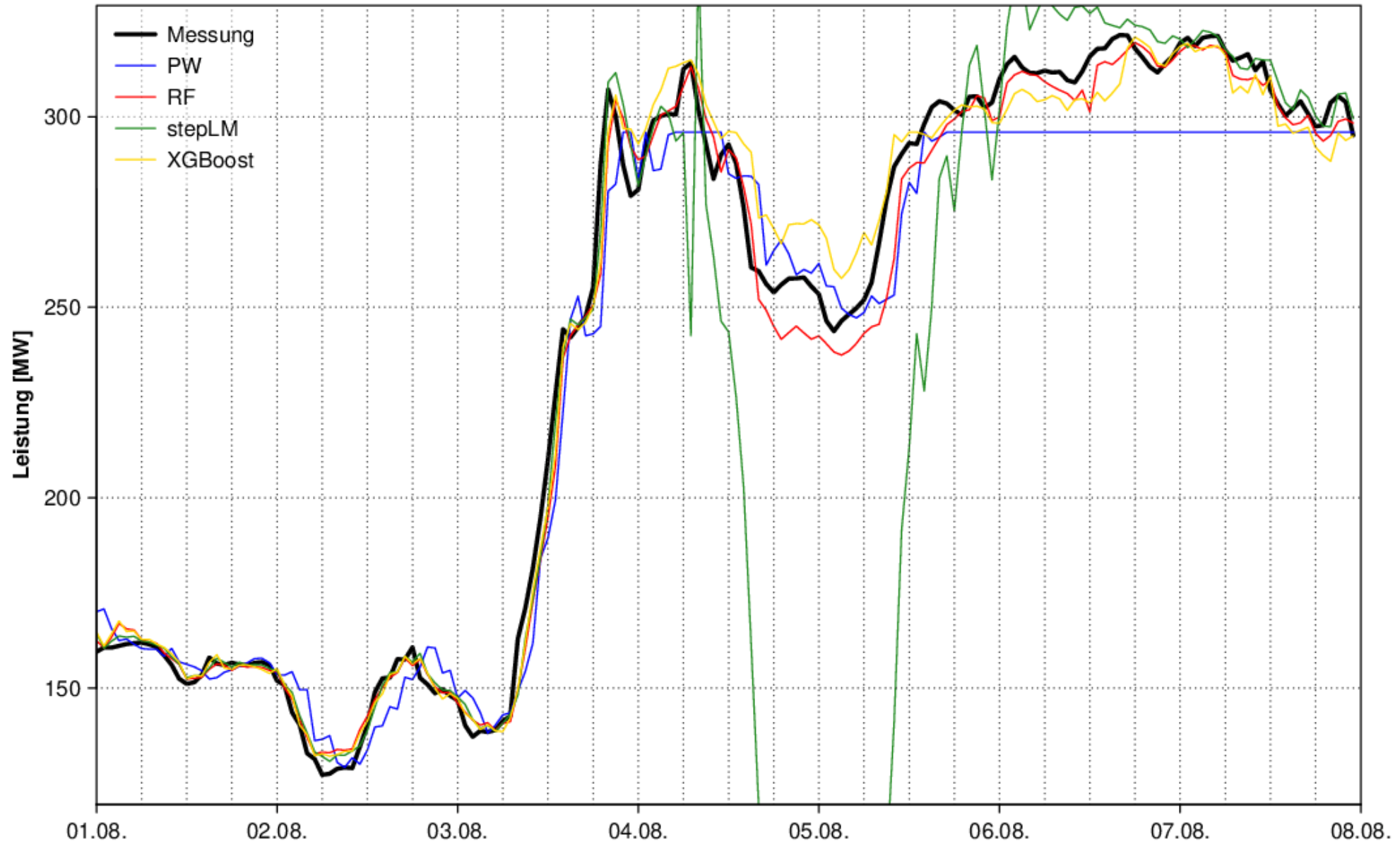
PW: RMSE = 15.42 MW | MAE = 12.19 MW

RF: RMSE = 9.86 MW | MAE = 6.83 MW

stepLM: RMSE = 132.36 MW | MAE = 58.29 MW

XGBoost: RMSE = 21.77 MW | MAE = 14.33 MW



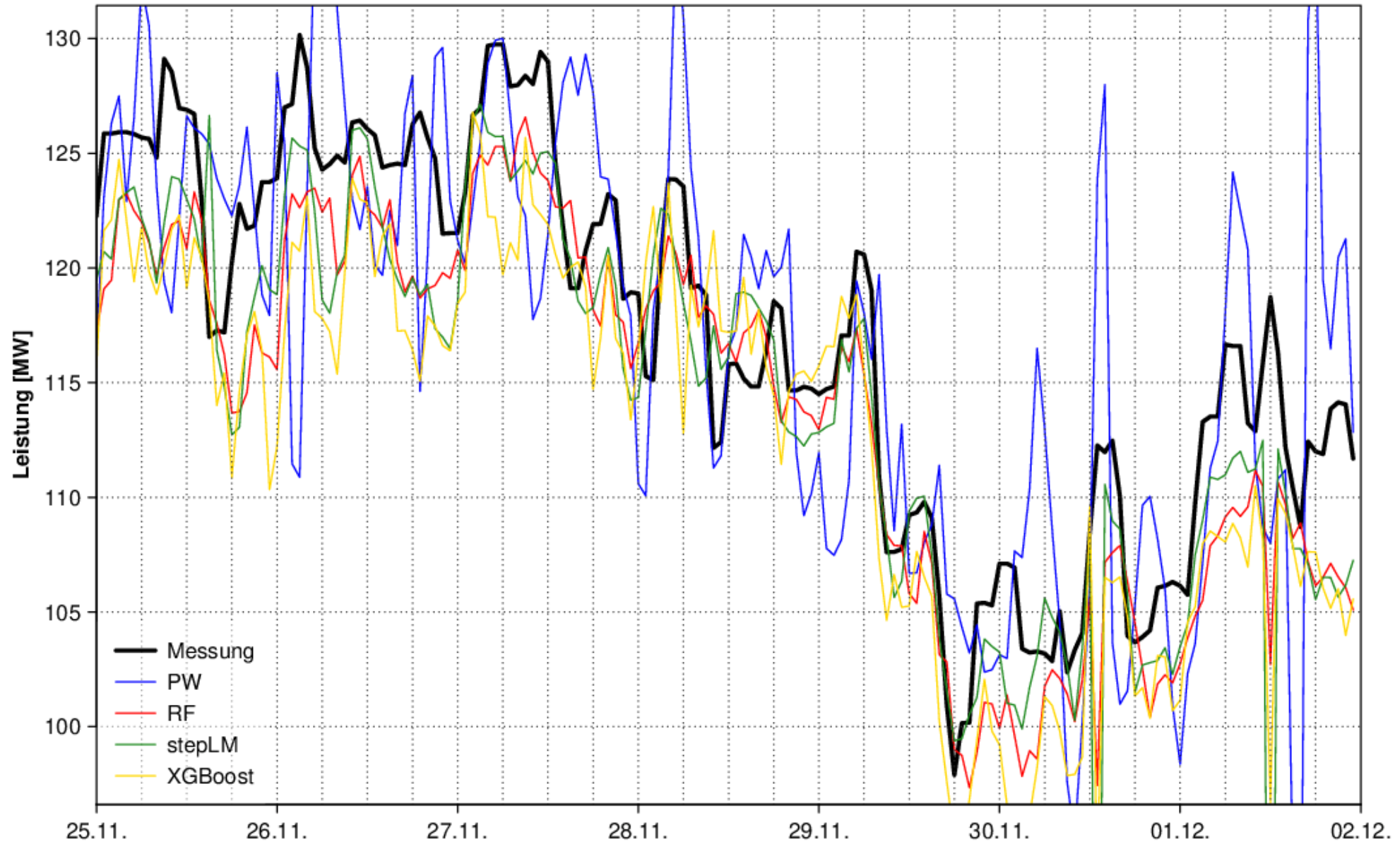


PW: RMSE = 13.23 MW | MAE = 10.45 MW

RF: RMSE = 7.11 MW | MAE = 5 MW

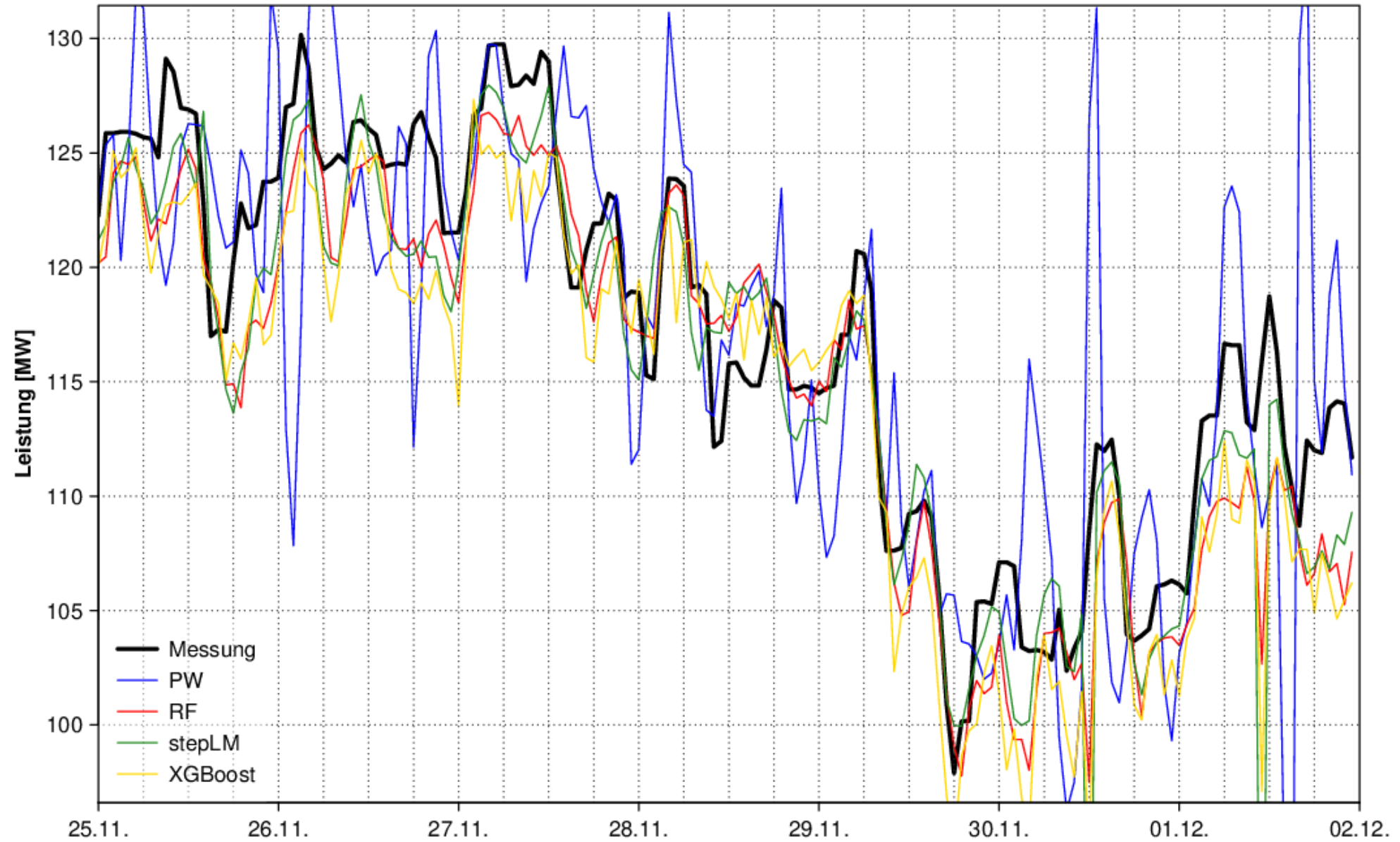
stepLM: RMSE = 85.82 MW | MAE = 36.58 MW

XGBoost: RMSE = 8.29 MW | MAE = 6.18 MW



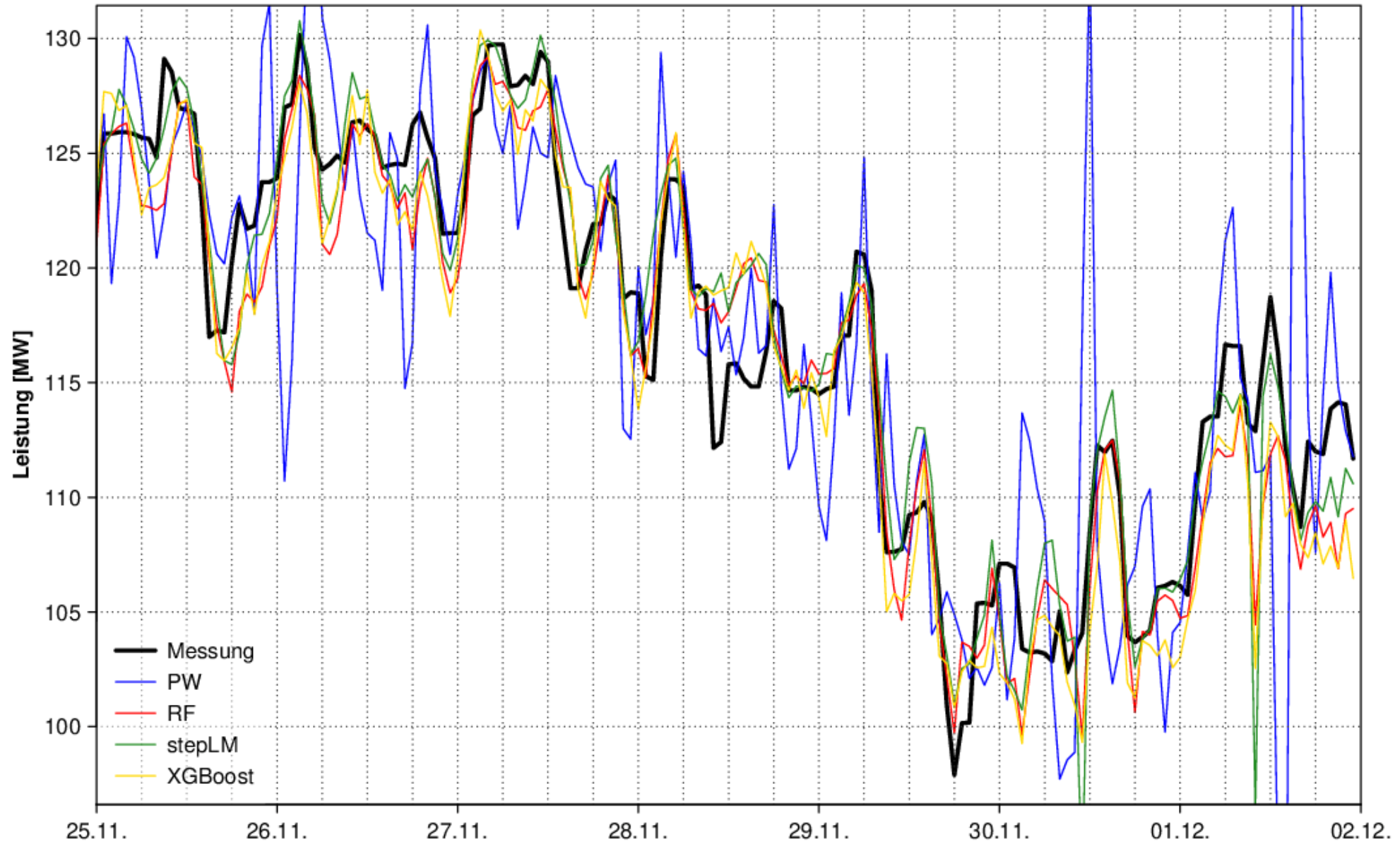
**PW: RMSE = 6.7 MW | MAE = 5.11 MW**  
**RF: RMSE = 4.54 MW | MAE = 3.74 MW**

**stepLM: RMSE = 5.88 MW | MAE = 3.64 MW**  
**XGBoost: RMSE = 5.97 MW | MAE = 4.97 MW**



**PW: RMSE = 6.59 MW | MAE = 4.74 MW**  
**RF: RMSE = 3.7 MW | MAE = 2.95 MW**

**stepLM: RMSE = 4.49 MW | MAE = 2.77 MW**  
**XGBoost: RMSE = 4.53 MW | MAE = 3.69 MW**



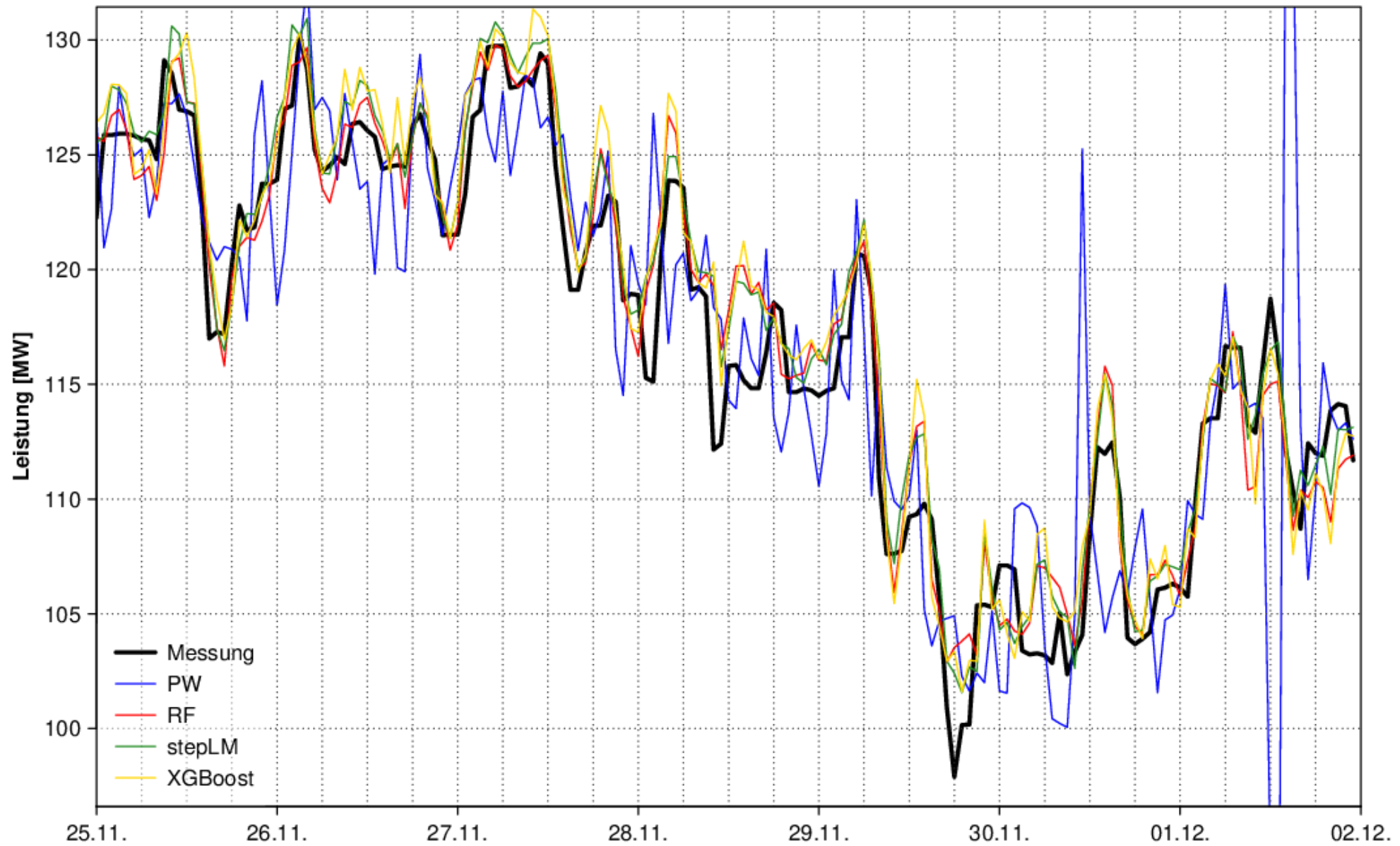
**PW: RMSE = 6.27 MW | MAE = 4.32 MW**

**RF: RMSE = 2.7 MW | MAE = 2.1 MW**

**stepLM: RMSE = 2.72 MW | MAE = 1.83 MW**

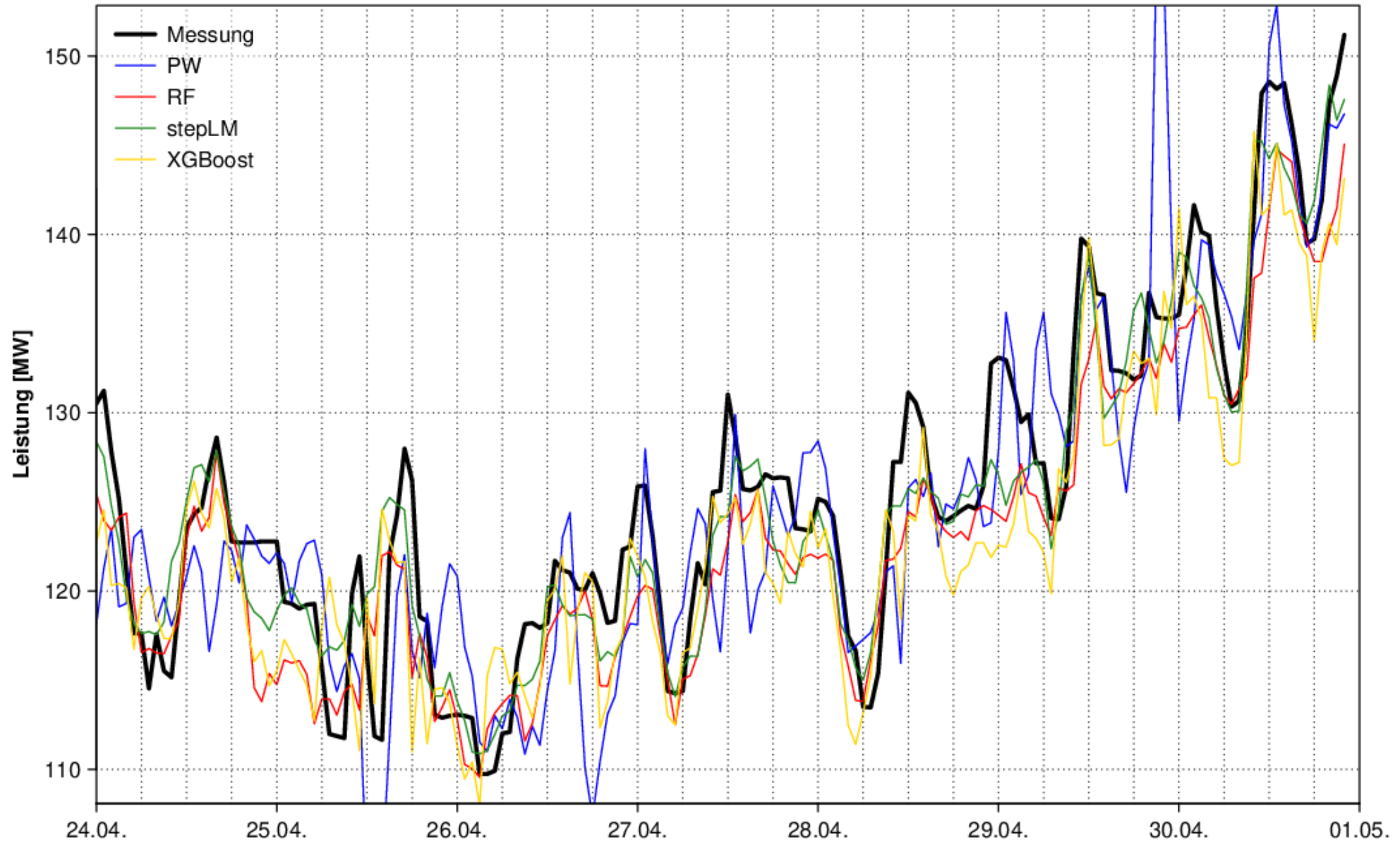
**XGBoost: RMSE = 3 MW | MAE = 2.43 MW**





**PW: RMSE = 5.71 MW | MAE = 3.5 MW**  
**RF: RMSE = 2.11 MW | MAE = 1.66 MW**

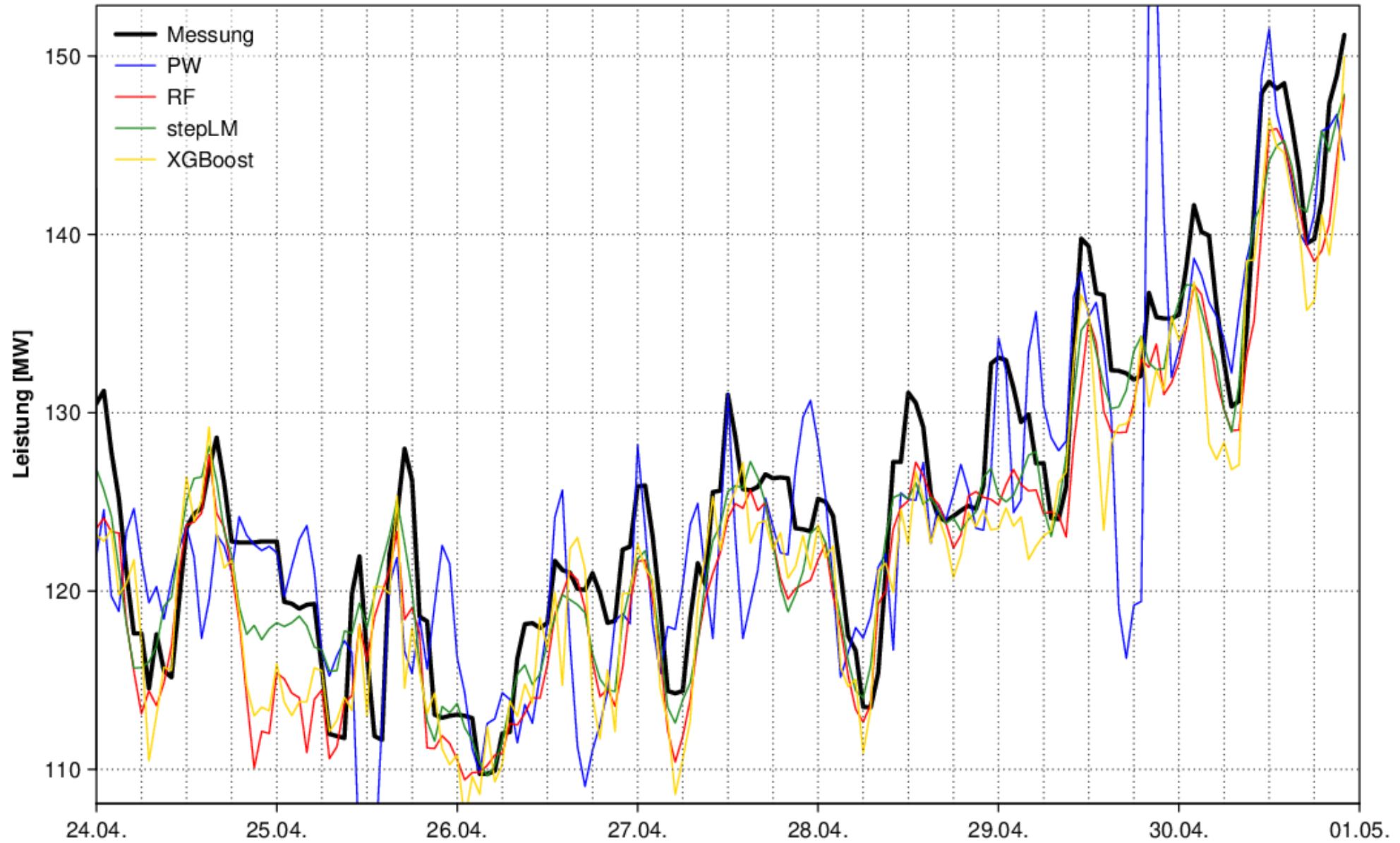
**stepLM: RMSE = 2.04 MW | MAE = 1.59 MW**  
**XGBoost: RMSE = 2.43 MW | MAE = 1.94 MW**



PW: RMSE = 5.3 MW | MAE = 4.06 MW  
RF: RMSE = 4.06 MW | MAE = 3.2 MW

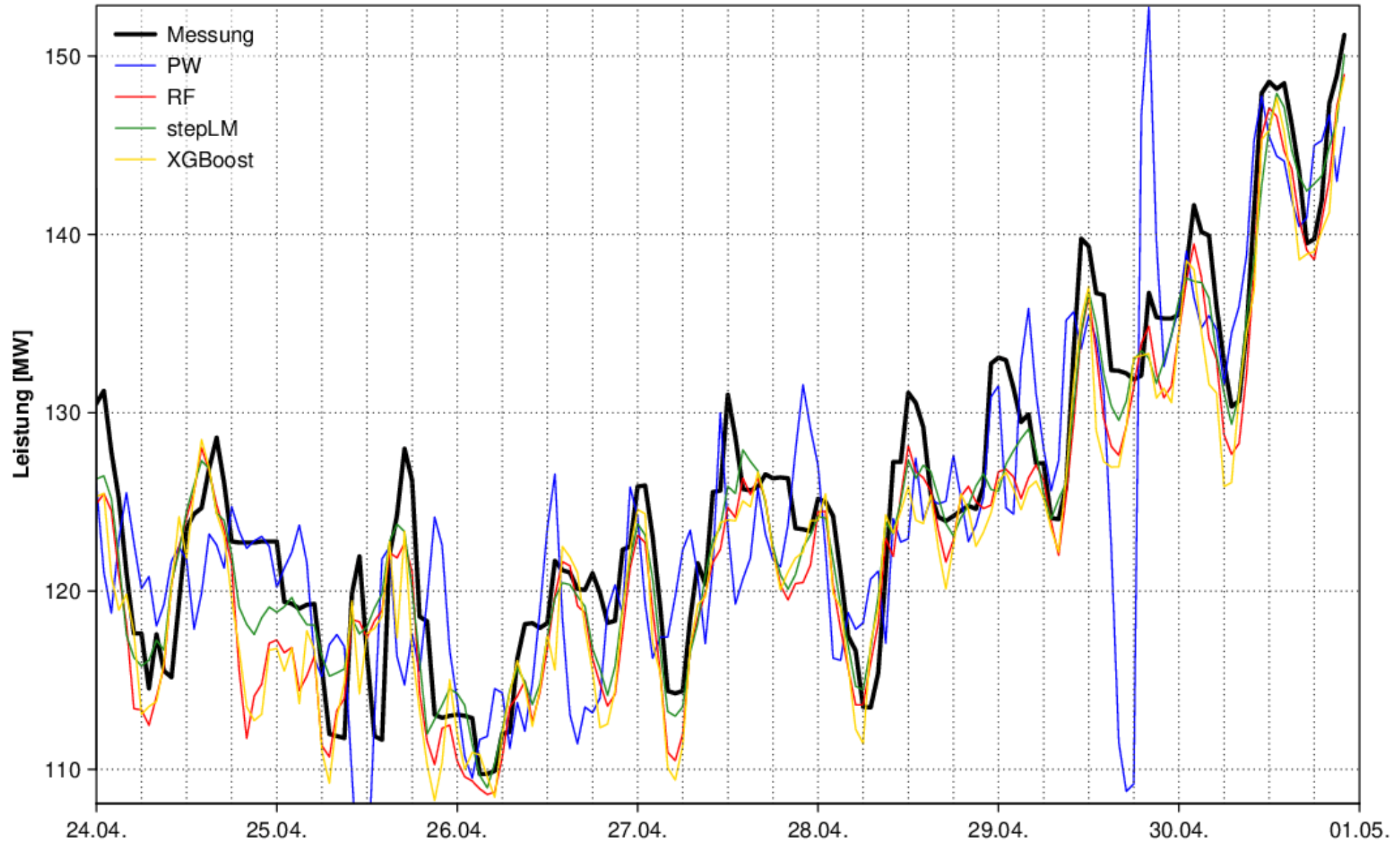
stepLM: RMSE = 3.16 MW | MAE = 2.49 MW  
XGBoost: RMSE = 4.81 MW | MAE = 3.91 MW





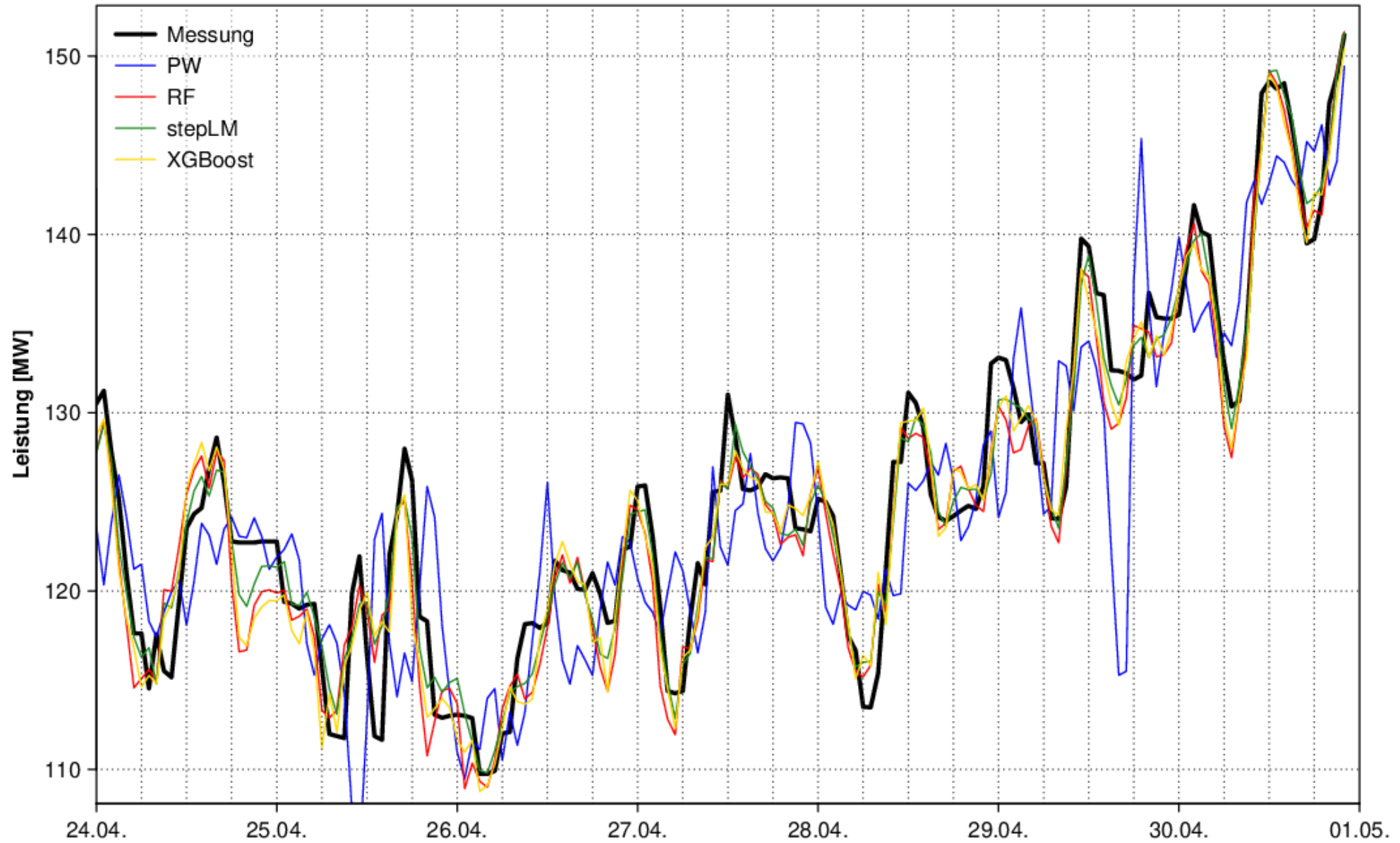
PW: RMSE = 5.53 MW | MAE = 4.19 MW  
RF: RMSE = 4.15 MW | MAE = 3.36 MW

stepLM: RMSE = 3.28 MW | MAE = 2.68 MW  
XGBoost: RMSE = 4.69 MW | MAE = 3.81 MW



PW: RMSE = 6.11 MW | MAE = 4.62 MW  
RF: RMSE = 3.6 MW | MAE = 2.99 MW

stepLM: RMSE = 2.89 MW | MAE = 2.31 MW  
XGBoost: RMSE = 4.17 MW | MAE = 3.41 MW



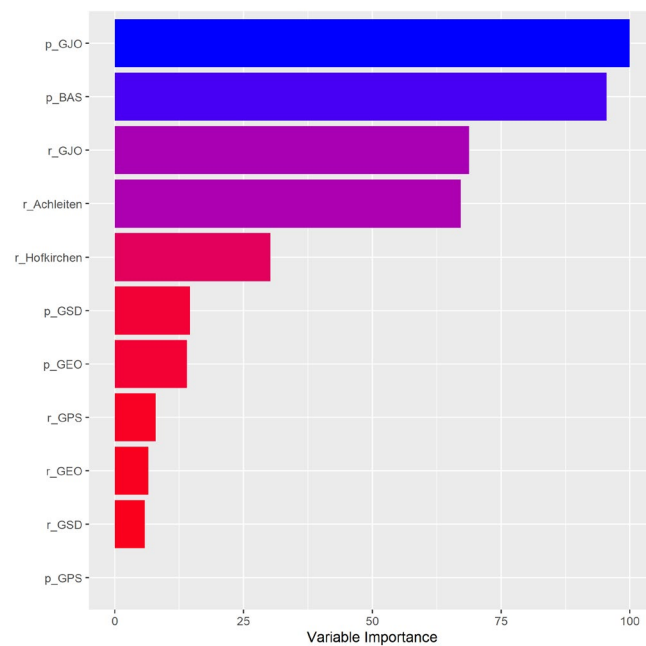
PW: RMSE = 5.43 MW | MAE = 4.31 MW  
RF: RMSE = 2.56 MW | MAE = 2.11 MW

stepLM: RMSE = 2.02 MW | MAE = 1.6 MW  
XGBoost: RMSE = 2.48 MW | MAE = 1.99 MW

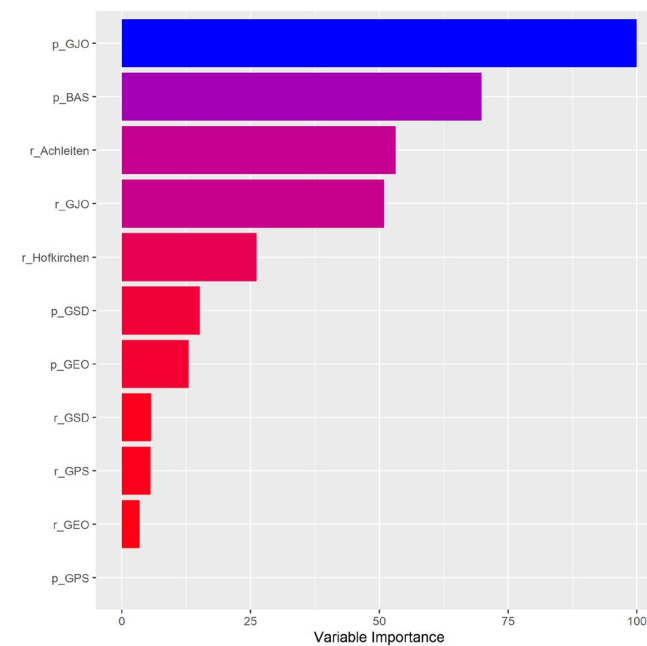
## 2) Feature Importance

- der ML-Modelle „Random Forest“ (RF) sowie „XGBoost“
- für alle 4 Prognosestufen (4 bis 1h)
- auf einer relativen Skala
- Prediktoren-Kombination BAS3
- Kürzel der Variablen siehe Zusatz von Tab. 3 im Artikel

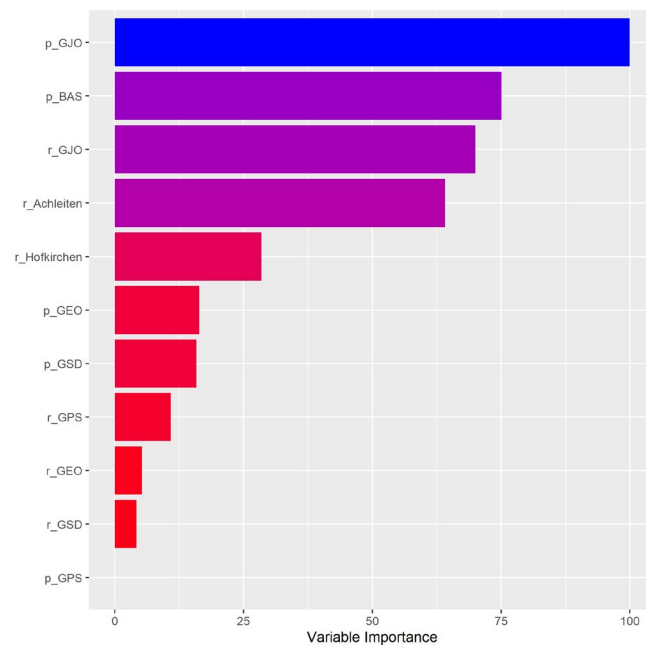
RF | 4h



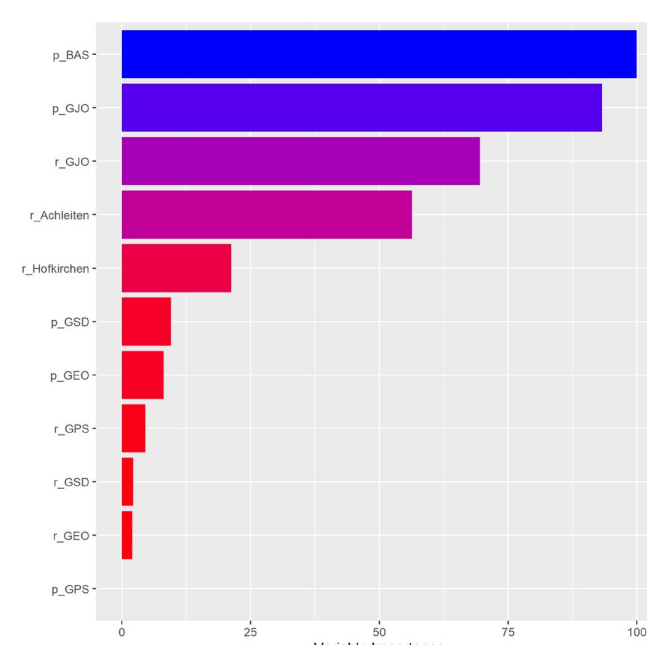
RF | 2h



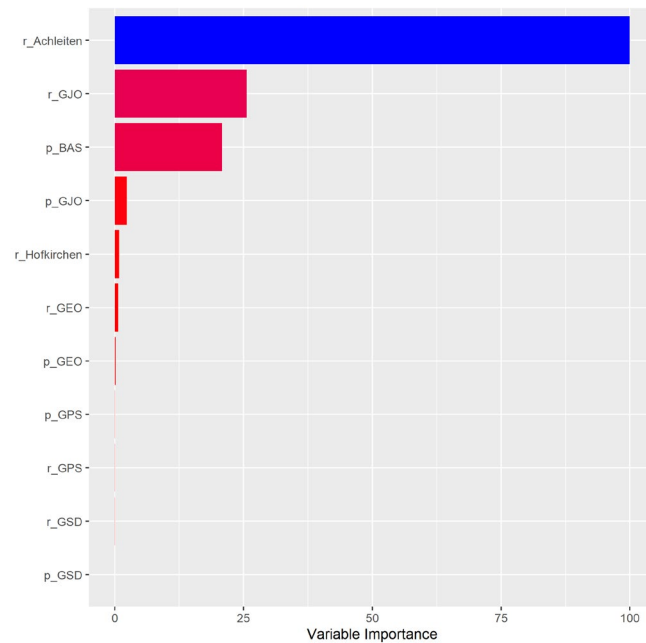
RF | 3h



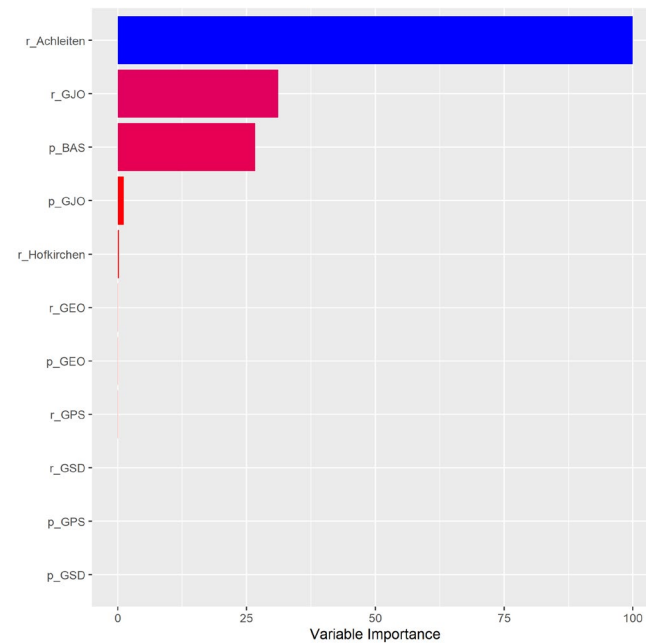
RF | 1h



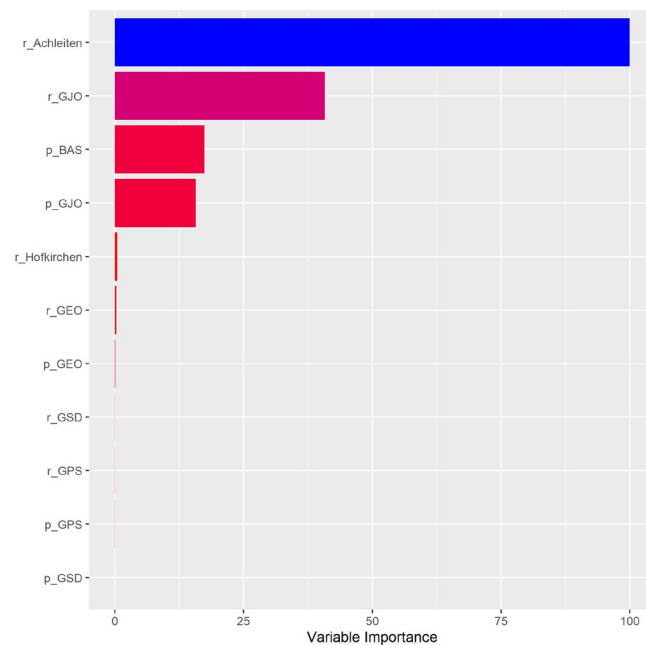
XGB | 4h



XGB | 2h



XGB | 3h



XGB | 1h

