PO.141

IEA Wind Task 51
Forecasting for the Weather Driven Energy System

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As the world's fastest-growing technology, Artificial Intelligence (AI) is rapidly shaping industries such as Energy and Meteorology. To help address stakeholders' concerns about the impacts of increasingly incorporating AI and Machine Learning into weather and power prediction models, the International Energy Agency's (IEA) Wind Task 51 "Forecasting for the Weather Driven Energy System" invites you to a webinar in Deep Learning for Weather-Based Power Prediction. In this Webinar we will bring together the Energy Meteorology and Machine Learning / Deep Learning (ML/DL) communities to showcase the latest advancements in ML/DL for weather prediction. This event also provides an opportunity to discuss future directions for the integration of these new generation models in the Energy systems.

Thursday, January 11, 2024	
15:30 – 16:25	Welcome and Keynote by Mariana Clare, ECMWF - Welcome by webinar organizers Sukanta Basu and Joana Mendes (5 min) - Keynote presentation "The rise of data-driven weather forecasting" (40 min) - Q&A (10 min)
16:25 – 16:30	Comfort break
16:30 – 17:05	Greg Hakim, University of Washington, Seattle - Dynamical Tests of a Deep-Learning Weather Prediction Model (25 min) - Q&A (10 min)
17:05 – 17:40	Joel Oskarsson, Linköping University - Neural Weather Prediction for Limited Area Modeling (25 min) - Q&A (10 min)
17:40 – 18:15	Florian Achermann, ETH and JUA.ai - A Research Collaboration between ETH Zurich and Jua: Ultra High Resolution Wind Forecasts (25 min) - Q&A (10 min)
18:15 – 18:30	Open discussion and close - Facilitated discussion around the topics presented (13 min) - Concluding remarks and close (2 min)

Learning:

- The models are already quite accurate.
  ECMWF was one of the first to try, and will add AIFS to its suite of models soon, also as part of the ensemble system. ECMWF packages the models for ease of use: https://github.com/ecmwf-lab/ai-models
- The models are easy to work with.
  E.g., Chris Hakim could download the models, do some experiments and write a paper in a few months.
- Some of the models at least seem to get the physics right.
  Chris Hakim did some experiments with a number of the models. None have intrinsic physics, bu tseem to build a good picture anyway.
- The models develop fast.
  Where in conventional NWP models, a model cycle can be years, new AI WP models come every few months, and bring significant improvement.
- Huge ensembles (>1000 members) get possible, probabilistic forecasting is coming.
  Once trained, the running time of e.g. a global 1-km resolution model for 48 hours is 20 seconds, plus 20 minutes for data i/o.
- Currently for global models, though LAMs are coming; not (yet?) for LES or climate
- Start from analysis, or measurements?
  Currently, all models start from a "proper" NWP analysis, e.g. from ECMWF IFS. But there is significant work underway to start the models from measurements alone.
- How to keep outliers under control?
- Watch it on https://youtu.be/t6H7diavQdg.

Largest global discussion forum for renewables forecasting

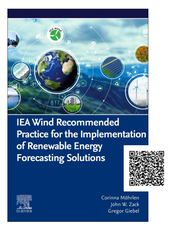
2024: public Workshop on Minute Scale Forecasting, April 10/11, Risø (DK)

Recent workshops on State of the Art, Seasonal Forecasting and AI Weather Prediction on YouTube "IEAWindForecasting"

2025: public workshop "Extreme power system events", Boulder (US)

Work Streams:	WP1 Weather	WP2 Power	WP3 Applications	Deliverable	#, Due	Collaboration
Atmospheric physics and modelling (WP1)	★			List of experiments and data	D1.1, Ongoing	WMO, PVPS T16
Airborne Wind Energy Systems (WP1)	★			Presentations on workshops	Part of D2.1	Task 48 Airborne Wind Energy
Seasonal forecasting (WP1)	★			Workshop / Paper	D1.6 / M19	Hydro TCP, Hydrogen TCP, Biomass TCP
State of the Art for energy system forecasting (WP2)	★			Workshop / Paper RecPract on Forecast Solution Selection v3	D2.1 / M7, M12 M2.1 / M36	PVPS Task 16, Hydro TCP, Hydrogen TCP, …
Forecasting for underserved areas (WP2)	★			Public dataset	D2.4 / M24	WMO
Minute scale forecasting (WP2)	★			Workshop / Paper	D2.5 / M31, M36	Wind Tasks 32 Lidar, 44 Farm Flow Control and 50 Hybrids
Uncertainty / probabilistic forecasting (WP3)	★			Uncertainty propagation paper with data RecPract v3	D 2.6 / M42 M48	PVPS T16
Decision making under uncertainty (WP3)	★			Training course Games	M12 M18	
Extreme power system events (WP3)	★			Workshop	D3.6 / M42	Task 25, ESIG, IEA ISGAN, PVPS T16, G-PST
Data science and artificial intelligence (WP3)	★			Report	D2.3 / M30	
Privacy, data markets and sharing (WP3)	★			Workshop / Paper Data format standard	D3.5 / M15	ESIG IEEE WG Energy Forecasting
Value of forecasting (WP3)	★			Paper	D 3.4 / M33	
Forecasting in the design phase (WP3)	★					Task 50 (hybrids), PV T16, hydrogen TCP

- 13 work streams
- Collaboration with other IEA Wind Tasks (Lidar, Hybrid Power Plants, Wind Farm Flow Control, Large-Scale Integration, Distributed Wind, Airborne Wind, …) and other IEA TCPs (PVPS, Biomass, Hydrogen, Hydro, …) as well as WMO
- Also collaborating with IEC SC8A WG2 Forecasting of Renewable Power, new standard on error measures underway
- Built on IEA Wind Recommended Practice



- Error evaluation frameworks:
  - WE-validate (Juniper package)
  - WE-validate_prob (R package)
  - Forecast Arbiter (formerly Solar Arbiter, now also for wind, load and net load)
  - NCEPU Evaluation and Uncertainty Quantification Framework

For collaboration in the Task or just for the newsletter, **please contact the Operating Agent, Gregor Giebel (grgi@dtu.dk).**
Current member countries are
AT, CN, DE, DK, ES, FR, IE, NL, PT, SE, UK and US.

Forecasts of wind and clouds are important inputs for the control and value of renewable power plants. The forecasts on a time resolution of minutes or seconds are typically data driven, looking at upstream plants, all-sky images of clouds or direct measurements of wind by lidars. Therefore, to facilitate the dissemination of information about minute scale forecasting products, skill, applications, issues, and best practices to members of the electric energy community, we invite you to a Minute Scale Forecasting workshop with the goal of gathering information about methods used to produce the forecasts, the current state-of-the-art skill and uncertainty in forecasting for variables on high temporal resolution, current and planned research activities intended to improve the current level of skill, types of public and private sector operational forecasting products, the range of minute scale applications in the energy community and the quantified or perceived value obtained from those applications, the sensitivity of user's application performance to variations in forecast skill, and the unmet minute-scale forecasting-related needs or desires of the energy user community.

The workshop takes place as the collaboration of the International Energy Agency's (IEA) Wind Task 51, entitled "Forecasting for the Weather Driven Energy System", IEA Wind Task 52 Lidars, IEA Wind Task 50 Hybrid Power Plants, IEA Wind Task 44 Wind Farm Flow Control and IEA Photovoltaic Power Systems Programme (PVPS) Task 16 Solar Resource. The venue is Risø, Denmark, on the campus of the Technical University of Denmark (https://www.dtu.dk/om-dtu/kontakt-og-besoeg/find-vej/dtu_risoe_campus).

April 10/11, 2024 | Risø, DK — DRAFT AGENDA
All times are Central European Summer Time (UTC+2)

Wednesday, April 10, 2024	
09:00 – 10:30	Welcome and Keynote Chair: Gregor Giebel - Welcome by workshop organizers and local hosts - Keynote(s) on History, Current Status and Challenges of Minute Scale Forecasting - Is there a good definition of "Minute scale forecasts"? - Q&A discussion with input from participants and their expected benefits of this workshop
10:30 –10:45	Networking Break
10:45 –12:15	Methods of minute scale forecasts and their uncertainty Chair: Aeishwarya Baviskar Presentations by forecast producers or researchers - Artificial Intelligence / Machine Learning methods - Probabilistic forecasts - Uncertainty of the forecasts, and maximum useful horizons for minute scale resolution - Numerical Weather Prediction based methods - Correlations between solar and wind forecasts
12:15 –13:15	Lunch
13:15 –14:45	Applications of minute scale forecasts for control, ramps and extreme events Chair: Jie Yan Presentations by forecast producers or researchers - Ramps and extreme event forecasts - Control for wakes, power plant control and power system control - Energy management system for hybrid power plants including storage - Accuracy requirements for different applications - Valuation of the accuracy of the forecasts
14:45 – 15:00	Networking Break
15:00 – 16:30	Open Space Discussion Facilitated discussion around the presented topics, discussing research gaps
18:30	Informal dinner gathering

Thursday, April 11, 2024	
9:00 – 10:30	Data driven solar forecasting Chair: Andreas Kazantzidis Presentations by academia, companies - Sky cameras and sky-camera networks - Input from satellites - Use of surrounding solar plants for input - Hybrid methods
10:30 – 10:45	Networking Break
10:45 – 12:15	Data driven wind forecasting Chair: Frauke Theuer Presentations by academia and companies - Lidars and radars - SCADA based forecasts - Combination of observers - Spatio-temporal correlation of wind farms
12:30 – 13:15	Conclusions and Lunch

Registration:

- Send a mail to aeish@dtu.dk.

www.IEA-Wind.org/task51/

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windeurope.org/annual2024
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Meet us at

DTU booth 1-D70

Watch this presentation

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