



INTRODUCTORY NOTE

IEA WIND TASK 11 TOPICAL EXPERT MEETING #111

ON

REANALYSES FOR WIND ENERGY

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A. VALUE FOR IEA WIND TCP

BACKGROUND

For more than two decades^{1,2} reanalysis datasets³ have been used for wind energy applications, mainly:

- For characterizing large scale spatial variations and long-term fluctuations of the wind resource;
- For driving hydrodynamic and spectral wave models and characterizing site conditions for offshore sites;
- As input to mesoscale and microscale flow models (downscaling).

The value of reanalysis datasets for wind energy applications has been demonstrated and communicated to reanalysis providers in many studies⁴. This document outlines the current state of collaboration / relationships between reanalysis providers and the Wind Energy communities, identifies challenges and opportunities and then proposes a Topical Expert Meeting (TEM). This TEM will aim at discussing these topics with a broad Wind Energy audience and pave the way for the possible creation of an IEA Wind Task dedicated to Reanalyses for Wind Energy.

¹ (Giebel, 2000) “Equalizing Effects of the Wind Energy Production in Northern Europe Determined from Reanalysis Data” <https://www.osti.gov/etdweb/servlets/purl/20119757>

² (Schartz, George and Elliot, 1999) “The Use of Reanalysis Data for Wind Resource Assessment at the National Renewable Energy Laboratory” <https://www.nrel.gov/docs/fy99osti/26152.pdf>

³ See <https://reanalyses.org/> for an introduction to reanalysis.

⁴ WRAG, 2022) “Wind Energy practitioners, ERA5 and the Copernicus Data Store” <https://groups.io/g/wrag>

MOTIVATION

Despite the vast adoption and the routine use of reanalysis datasets for Wind Energy purposes, the communication and knowledge sharing between reanalysis providers and Wind Energy scientists/practitioners remains sporadic and uncoordinated; see Figure 1:

- Most knowledge sharing between reanalysis providers and Wind Energy stakeholders takes place during meteorology-focused conferences and workshops;
- Wind Energy-specific knowledge sharing about reanalyses takes places in Wind Energy-specific conferences and workshops;
- Faint, industry-led initiatives have established independent connections with some reanalysis providers, mainly for providing one-way feedback.

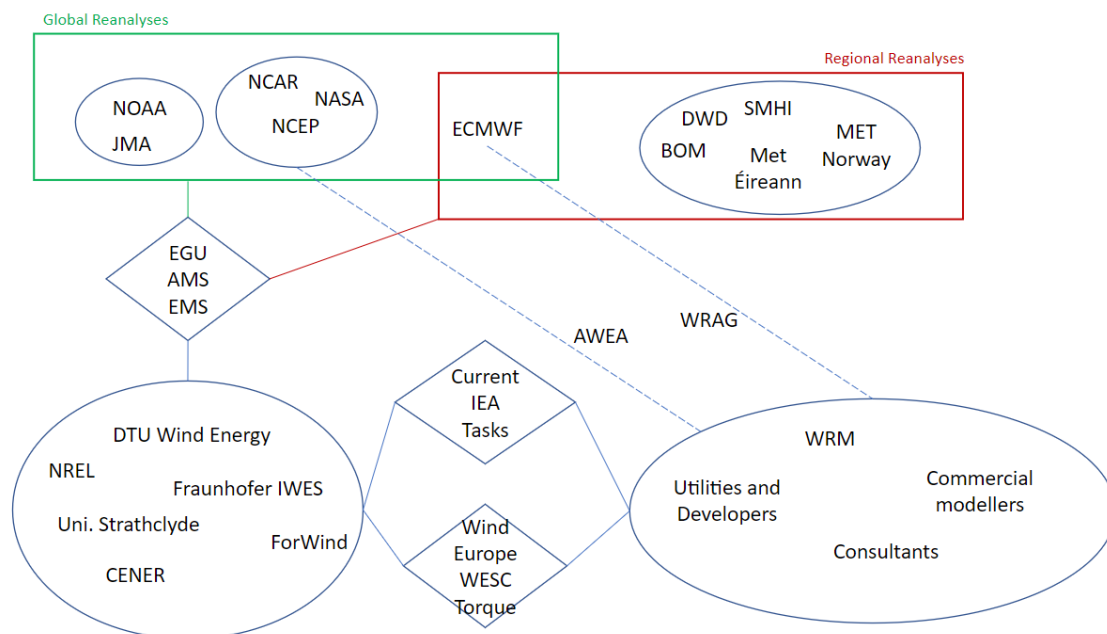


Figure 1: Current state of collaboration between Wind Energy communities and reanalysis providers. Dashed lines indicate faint, sporadic discussions.

This current situation leads to several missed opportunities and poses risks to the Wind Energy projects. In effect:

- 1) As communicated in public forums⁵, there is often no long-term funding for reanalysis projects. Thereby, the continuous development (and improvement) of reanalyses is not guaranteed and should not be taken for granted.
- 2) Reanalysis providers are not always aware of Wind Energy use cases, and of the value of reanalysis datasets. This leads to misunderstandings and/or sub-optimal data deliverables^{4,6}.
- 3) A wealth of high quality, Wind Energy specific datasets can be used for validating and improving reanalysis products. However, these validations – albeit of very good quality – are carried out years *after* the reanalysis datasets are produced. As

⁵ (Dec, 2023) “Introduction to reanalysis”. ECMWF Annual Seminar 2023. <https://ecmwfevents.com/assets/presentations/as2023-dee1693842347.pdf>

⁶ (Gandoin, 2023) “Added-value and shortcomings of ERA5 for Wind- and Metocean Site Conditions Assessments” https://eo-winds.net/wp-content/uploads/2023/09/ECMWF_Seminar_2023_Poster_R_Gandoin_v1.pdf



this is done routinely for Wind Energy projects, early validations during the pre-production phase of the reanalysis dataset would de-risk their applications and increase their value.

- 4) For future reanalyses such as ERA6 and ERA7, some coordination with ECMWF is taking shape; yet, it should be supported and sustained. At the moment this is done mainly through the Wind Resource Assessment Group (WRAG) and it involves a few individuals only (i.e., this group lacks legitimacy and representativity).

We propose to present, address and discuss a way forward on these issues during a Topical Expert Meeting (TEM) to be held during Q1 or latest Q2 2024. If deemed relevant by the participants, this meeting will also pave the way for the creation of a “Reanalyses for Wind Energy” IEA Wind Task. The task would serve both as:

- Knowledge-sharing platform within the Wind Energy community (as, e.g., the IEA Wind Task 52 for Lidar applications) and as
- Active collaboration forum between the Wind Energy community and the Reanalysis data providers.

A sketch of the envisaged central role of the IEA Wind Task is provided in Figure 2. The TEM and task’s objectives are specified in Section B.

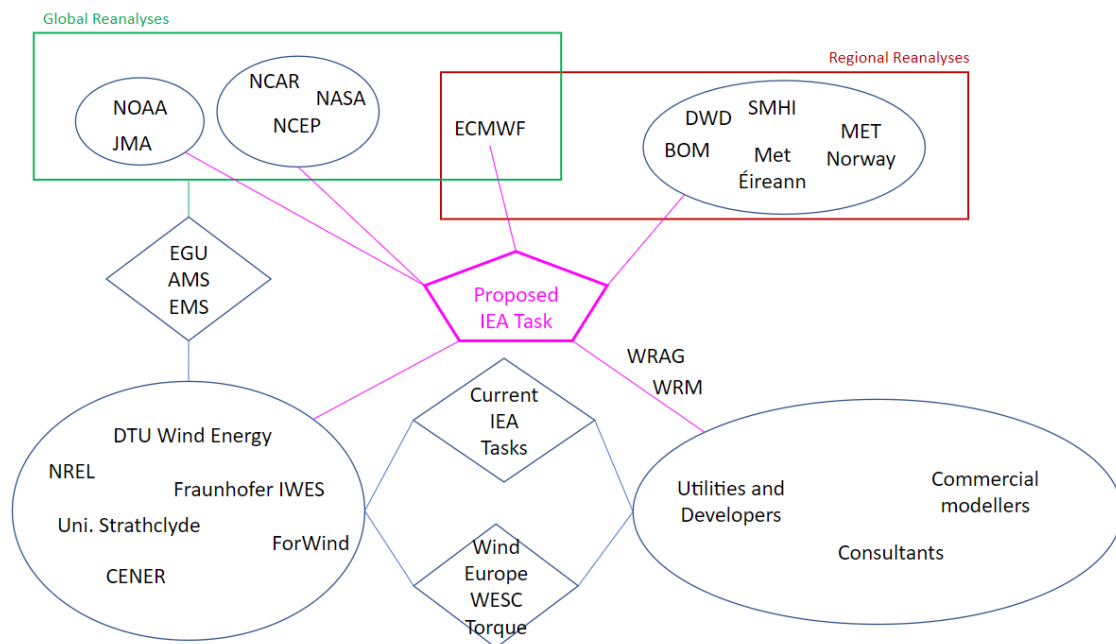


Figure 2: Desired/future state of collaboration between Wind Energy communities and reanalysis providers, after the IEA Task has been created.

ADDED VALUE OF COLLABORATION

The proposed IEA Task would form a unique collaboration forum. To the best of our knowledge, there exist no such mid-to-long term, formal collaboration initiative between Reanalysis providers and Wind Energy scientists and -practitioners.



ALIGNMENT WITH IEA WIND STRATEGY

To the best of our knowledge, there were no past TEM on this topic. As Reanalysis data feed into a great number of Wind Energy models and applications, improving Reanalysis datasets fits well with the IEA Wind strategic objectives, and the following Grand Challenges⁷ (GC) in particular:

- GC1: the atmosphere:
 - Impact of atmospheric turbulence on performance and loads of wind turbines: knowledge gaps and research challenges
 - Mesoscale wind plant wakes
 - Scientific challenges to characterizing the wind resource in the marine atmospheric boundary layer
- GC3: the plant and grid:
 - Grand Challenges of wind energy science – the grid

B. MEETING FORMAT AND GOALS

OBJECTIVES

The TEM will aim at addressing the issues listed above as 1) to 4). Specifically, the TEM will aim at:

- Collecting experiences and suggestions on these issues, from a wide range of Wind Energy stakeholders (academia, utilities, developers, consultants, data providers). This will be done via:
 - An online questionnaire sent out prior to the event (see an example in footnote 4)
 - A set of presentations given during the event by the participants.

The discussions will be logged and condensed into a publicly available compendium document.

- Paving the way for future actions aiming at improving/solving these issues. A proposal for the creation of a dedicated IEA Wind Task will be brought forward and discussed. Actions will be agreed upon.

The proposed IEA Task will serve the following objectives:

- Improve access and documentation of reanalysis datasets. While some providers have set up user-friendly data platforms such as the Copernicus Data Store (CDS), other reanalysis datasets remain under-valued because of some difficulty in accessing and/or processing the data. For the already well functioning platforms such as the CDS, the Task would act as a knowledge sharing forum to improve best practice and understanding of the datasets.
- Promote and foster validation and advertise successful applications of reanalysis datasets for Wind Energy applications, and thereby improve their value.
- Act as a point of contact / collaboration forum between reanalysis providers and the Wind Energy communities. For instance, contributions to the making and

⁷ (Veers et al, 2022) “Grand Challenges: wind energy research needs for a global energy transition”
<https://wes.copernicus.org/articles/7/2491/2022/>



validation of ERA6 and ERA7 can take place within this forum. The forum will actively seek to connect both communities.

SPECIFIC OUTCOMES

After the TEM, a compendium document will be produced. It will include:

- A summary of the above-listed issues 1) to 4).
- A summary of the presentations given during the meeting.
- A summary of the online questionnaire and the discussions which took place during the meeting.
- A list of actions addressing the issues raised during the meeting, in relation to the creation of a dedicated IEA Task in particular.

INTENDED PARTICIPATION

The primary target group are participants from Wind Energy academia and industry, listed in Figure 1 and Figure 2. Selected contacts within the Reanalysis community will be asked for their interest in participating actively, or as listeners.

TENTATIVE PROGRAM

TEM#111 will take place over 1.5 days at DTU Lyngby (Denmark), on 25th and 26th of April 2024. A preliminary agenda follows.

- During the first day, presentations will be held and a broad audience of online and in-person participants will be invited.
- For the second day, the discussions will focus on the way forward and the IEA Task proposal. Only pre-selected / interested participants will be invited, for the sake of efficiency. We expect the interested parties to coordinate with their (national) organizations prior to the TEM, in order to propose participants for Day 2.

	Day 1: Thursday 25 th of April
09:15-09:30	Intro
09:30-10:30	Presentations #1
10:45-11:45	Presentations #2
11:45-13:00	
13:00-14:00	Presentations #3
14:15-15:15	Presentations #4
15:30-16:30	Online questionnaire discussion and Q&A
	Day 2 (in-person): Friday 26 th of April
09:30-10:30	Way forward with TEM and IEA Task - #1
10:45-11:45	Way forward with TEM and IEA Task - #2
11:45-13:00	Wrap-up and lunch