Project idea form - small projects

Version 2.1

Registration no. (filled in by MA/JS only) _____

Project Idea Form

Date of submission 04/06/2025

1. Project idea identification

Project idea name	Mitigation of Wind Turbine Interference in Weather Radar Observations Using Auxiliary Instrumentation
Short name of the project	WINTA
Previous calls	yes ○ no ◉
Seed money support	yes ○ no ◉

2. Programme priority

	3. Climate-neutral societies

3. Programme objective

	3.2. Energy transition

4. Potential lead applicant

Name of the organisation (original)	Ilmatieteen laitos
Name of the organisation (English)	Finnish Meteorological Institute
Website	https://en.ilmatieteenlaitos.fi/
Country	FI

Type of Partner	National public authority
	ministry, etc.
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Which organisation(s) in the planned partnership take part in a project within the Interreg Baltic Sea Region Programme for the first time? Please list the respective partners.

The planned project partners are:
Swedish Meteorological and Hydrological Institute (SMHI) (TBC)
Danish Meteorological Institute (DMI) (TBC)
Offshore wind park operator (TBC)

5.1 Specific challenge to be adressed

The WINTA project proposes a novel proof-of-concept approach to mitigate wind turbine clutter (WTC) from offshore wind parks in weather radar observations using auxiliary low-cost data sources such as microwave links and/or crowdsourced personal weather stations.
Global installed wind power capacity exceeded 1 TW in 2023, with offshore wind growing by 24% year-over-year (GWEC Global Wind Report 2024). This rapid growth creates increasing conflict between two critical infrastructures: renewable energy production and weather radar networks. WINTA directly supports Interreg programme Priority 3 for a climate-neutral society and Topic 3.2 on energy transition by addressing this challenge.
Wind turbines cause radar interference through clutter echoes, beam blockages, and degraded radial wind data. This significantly reduces the quality and reliability of radar-based meteorological products, affecting the ability of National Meteorological Services (NMSs) to monitor and forecast hazardous weather—such as heavy rainfall, hail, storms, and reduced visibility. These forecasts support civil protection, aviation, maritime safety, and energy grid operations.WINTA seeks mitigation strategies that preserve radar data integrity while enabling offshore wind expansion. Project outcomes will benefit NMSs, radar operators, offshore wind developers, telecom providers, and climate resilience

planners in the Baltic Sea region and beyond. By developing compensation methods for radar blind spots, WINTA aims to support the growth of offshore renewables alongside the need for accurate, high-resolution weather data in a changing climate.
The project will explore the feasibility of compensating for lost radar precipitation observations using auxiliary data sources: (1) microwave links (e.g., maintenance or commercial radio links within wind farms) that exploit rain-induced signal attenuation, or/and (2) low-cost rain sensors or crowdsourced weather station data. While promising studies exist, the potential of these observations for operational use remains uncertain. WINTA will assess their suitability and integration into radar data assimilation frameworks using machine learning (ML), enabling more robust nowcasting and short-term forecasting despite WTC-induced data gaps.

5.2 Focus of the call

TThe WINTA project contributes to the cohesive development of coastal and rural communities by supporting the coexistence of two critical infrastructures—offshore wind energy and weather observation networks—both of which directly impact local livelihoods and safety.
Offshore wind farms are typically located near rural or sparsely populated coastal regions, which benefit economically from energy investments but may also face increased risks due to degraded weather radar performance caused by wind turbine interference.
Reliable weather radar data is essential for forecasting hazardous weather events that affect agriculture, fisheries, maritime transport, and civil protection—key sectors in many rural and small communities.
By developing cost-effective mitigation strategies, WINTA strengthens the capacity of National Meteorological Services to deliver accurate forecasts and early warnings in areas that are often more exposed and less resilient to weather extremes.Through transnational cooperation and cross-sector engagement, the project promotes technological solutions that ensure sustainable energy growth while safeguarding the environmental security and climate resilience of vulnerable communities in the Baltic Sea region.

6. Transnational relevance

The weather has no boundaries, thus also the challenge of wind turbine clutter (WTC) in weather radar observations is inherently transnational, particularly in the Baltic Sea region where offshore wind energy development is accelerating across multiple national jurisdictions. Addressing this issue efficiently requires a coordinated, cross-border and collaborative approach.

NMSs operate interconnected radar networks and rely on joint data exchange frameworks such as OPERA (covering all of Europe) and NORDRAD (focusing specifically on the Nordic and Baltic countries). A single wind farm near a border or within shared radar coverage areas can degrade data quality for multiple countries, highlighting the need for harmonized mitigation strategies that ensure interoperability across systems.

The WINTA project brings together expertise in radar meteorology, wind energy development, and data science to develop and evaluate mitigation techniques that can be adopted regionally. By aligning technical solutions, data assimilation methods, and machine learning models across borders, the

project avoids fragmented development and ensures that radar data quality—and the public services depending on it—are safeguarded throughout the region.

Pooling knowledge, infrastructure, and operational experience through transnational cooperation is essential to tackle a challenge that affects the climate resilience, safety, and energy transition efforts of all Baltic Sea countries.

7. Specific aims to be adressed

Building trust that could lead to further cooperation initiatives

The WINTA project supports the specific aim of accelerating the renovation wave by addressing a key technical and regulatory barrier to renewable energy deployment. In current zoning and permitting processes, NMSs are often required to assess the potential impact of new offshore wind farms on radar data quality. If WTC cannot be mitigated, this may lead to objections or delayed approvals, particularly in coastal regions where renewable energy could directly support energy-efficient infrastructure projects.
By developing scientifically sound and operationally feasible WTC compensation strategies, WINTA may enable NMSs to give more positive or conditional statements in planning procedures. This, in turn, builds trust between meteorological authorities, energy developers, and local and regional governments.

Initiating and keeping networks that are important for the BSR

Rather than focusing on human networks, this project emphasizes the importance of national weather radar observation networks—critical and costly infrastructure that form the backbone of real-time precipitation monitoring and short-term forecasting (nowcasting), especially during severe weather. These systems function across borders and depend on coordinated data sharing through frameworks like NORDRAD and OPERA. The WINTA project supports the continuity and performance of these networks by addressing WTC, a growing challenge to radar data integrity.
By safeguarding the quality of radar observations, WINTA helps preserve one of the most vital operational infrastructures in the Baltic Sea Region, directly impacting public safety. It also fosters cooperation among National Meteorological Services, enhancing the region's collective capacity to respond to weather-related risks.

Bringing the Programme closer to the citizens

N/A

Allowing a swift response to unpredictable and urgent challenges

The rapid growth in the number and size of WTs poses increasing challenges to NMSs operating weather radar networks. WTC significantly affects the detection of severe weather, which are critical for issuing timely warnings—especially for aviation and civil protection. WTC can degrade automatic algorithms and delay forecaster response during fast-developing events.
As most European countries actively support wind energy expansion, restricting WT development is not a viable option. The WINTA project addresses this urgent issue by developing compensation

techniques using auxiliary observations. These solutions aim to recover lost data in real time, supporting continuity in weather monitoring and enabling faster, more reliable responses to high-impact weather in an increasingly complex observational environment.

8. Target groups

The WINTA project targets key stakeholder groups that are directly affected by the growing challenge of wind turbine clutter (WTC) in weather radar observations and are essential for implementing and benefiting from the project's outcomes.
National Meteorological Services (NMSs) are the primary target group. They operate weather radar networks, issue forecasts and warnings, and contribute to zoning and permitting processes. Within NMSs, radar operators, data assimilation experts, and radar meteorology researchers maintain data quality and develop processing techniques. These institutions will co-develop and test WTC compensation methods, evaluate the integration of auxiliary observations, and implement solutions in operational forecasting. The project consortium includes three Nordic NMSs. As all are members of the NORDRAD and OPERA radar communities, the results will be disseminated widely across the Baltic Sea Region and Europe.
Offshore wind park developers and operators form a second core group. They benefit for the accurate wind forecast and observations, although this infrastructure contributes to the WTC problem. However, they can support solutions by enabling the use of auxiliary instruments (e.g., microwave links) within wind farms. WINTA aims to involve 1–2 developers directly in the consortium. Broader engagement will take place via renewable energy associations, such as Renewables Finland.
Environmental and spatial planning authorities are another key group. They participate in permitting processes and rely on NMS assessments of WTC impacts. WINTA's outcomes will support more informed decisions and help reduce delays in renewable energy development caused by radar-related concerns.
All groups will be actively engaged through co-design, implementation, and evaluation of mitigation strategies to ensure technically sound and operationally viable results.

	Please use the drop-down list to define up to five target groups that you will involve through your project's activities.	Please define a field of responsibility or an economic sector of the selected target group	Specify the countries and regions that the representatives of this target group come from.
1.	Infrastructure and public service provider	NMSs, who operate the weather radar networks and provide weather forecasts and warnings	Finland, Sweden, Denmark, and additionally dissemination will be to NORDRAD and OPERA communities
2.	Large enterprise	Wind energy sector, who operate and develop wind parks	Denmark, Finland

3.	National public authority	E.g. the national authorities involved in licenses and zoning decisions	TBD
4.	Regional public authority	E.g. the regional authorities involved in licenses and zoning decisions	TBD

9. Contribution to the EU Strategy for the Baltic Sea Region

Please indicate if your project idea has the potential to contribute to the implementation of the Action Plan of the EU Strategy for the Baltic Sea Region (https://eusbsr.eu/implementation/).

yes ◉ no ◯

Please select which policy area(s) of the EUSBSR your project idea contributes to most.

PA Energy

The MA/JS may share your project idea form with the respective policy area coordinator(s) of the EUSBSR. You can find contacts of PACs at the EUSBSR website (https://eusbsr.eu/contact-us/).

☐ If you disagree, please tick here.

10. Partnership

The WINTA project is coordinated by the Finnish Meteorological Institute (FMI), a governmental institute under the Ministry of Transport and Communications. FMI operates Finland's weather radar network (12 radars) and provides essential weather and climate services. The project team includes experts from three FMI groups with the expertise of radar operations, radar observation quality assurance, AI-driven nowcasting, radar data classification, quality precipitation estimation, and radar data processing. The project manager, Dr. Annakaisa von Lerber, has coordinated multiple national and EU projects and currently leads the OPERA Programme since 2019 and chairs the NORDRAD community. FMI will be responsible for the coordination and the development of methods to combine auxiliary precipitation observations (e.g., microwave links or crowdsourced sensors) with radar data using machine learning techniques.
The Swedish Meteorological and Hydrological Institute (SMHI) (TBC) is a government agency under the Ministry of Climate and Enterprise and operates 12 weather radars. SMHI has expertise in using microwave links for environmental monitoring and will be responsible for producing auxiliary-derived precipitation products at a selected offshore wind park.
The Danish Meteorological Institute (DMI) (TBC), under the Ministry of Climate, Energy and Utilities, provides weather services for Denmark, Greenland, and the Faroe Islands and operates network of five

radars. Denmark is a global leader in offshore wind energy, and DMI will provide radar data from the pilot site, potentially within wind farms such as Horns Rev or Anholt.
An offshore wind park developer/operator (to be confirmed) will contribute by enabling instrumentation installation and providing access to site-specific data. Operators of large Danish offshore farms are currently being approached, with smaller parks in the Bothnian Bay also considered.

11. Workplan

The WINTA project is structured into five Work Packages (WPs) with a total duration of 24 months. Estimated resources and a detailed schedule are outlined below. The total budget is €625,000, of which €500,000 is requested from the ESBR programme. Funding covers auxiliary instrumentation costs, travel for three in-person consortium meetings (M1, M12, M22), coordination-related costs, and staff time.
WP1: Project Management (M1–M24) Lead: FMI
Coordination, recruitment, financial management, reporting, and stakeholder communication. Dissemination to target groups will occur through existing networks such as OPERA, NORDRAD, national renewable energy associations, and relevant ministries and authorities. Stakeholders will be invited to the final meeting to discuss results and support an exploitation plan for future implementation.
WP2: Instrumentation of the Pilot Site (M1–M6) Lead: Wind park developer (TBC)
• T2.1: Planning and procurement of auxiliary instrumentation (M1–M3). The technical setup and pilot site requirements are defined, and necessary equipment is procured.
• T2.2: Installation and commissioning of auxiliary instrumentation (M3–M6), such as microwave links or compact precipitation sensors within a wind farm. Data collection begins during this phase.
WP3: Data Acquisition and Processing (M3–M14) Lead: SMHI
• T3.1: Acquisition and storage of auxiliary and radar data across a range of meteorological conditions.
• T3.2: Preprocessing of auxiliary data, construction of precipitation estimates, and selection of representative case studies for algorithm development and validation.
WP4: Method Development (M8–M18) Lead: FMI
• T4.1: Development of a methodology for fusing auxiliary precipitation observations with radar data using machine learning. The method addresses differences in data resolution, timing, and quality. A subset of the dataset will be used for model training, and another for independent testing and validation.
WP5: Implementation and Validation (M18–M24) Lead: FMI
• T5.1: Method implementation adapted to operational constraints. A prototype software tool will be developed, demonstrating the feasibility of integration into weather radar processing chains.
• T5.2: Validation of the method using consistency of radar-observed precipitation patterns and/or high-resolution NWP model data. The aim is to assess whether auxiliary data can improve the consistency and completeness of radar-based precipitation products in the presence of WTC.
Piloting and Target Group Involvement
The pilot site—an offshore wind farm in Denmark or Finland—will serve as a real-world testbed for instrumentation and methodology. Target groups such as NMSs, wind park developers, and permitting authorities will be actively engaged through co-design, review workshops, and result dissemination. The final outputs—methodology, validation results, and a prototype tool—will be directly usable by NMSs and transferable across the OPERA and NORDRAD radar communities.

12. Planned budget

ERDF budget (planned expenditure of partners from the EU)	EUR 500,000.00
Norwegian budget (planned expenditure of partners from Norway)	*EUR XXX*
Total budget (including preparatory costs)	**EUR 500,000.00**

13. Project consultation

Please indicate if you wish to have a consultation (online meeting) with the MA/JS to discuss your project idea

yes ◉ no ◯

14. Questions to the MA/JS

Questions related to the content of the planned project	*(max.1.000 characters incl. spaces)*
Questions related to budgeting and expenditure	*(max.1.000 characters incl. spaces)*
Any other questions	*(max. 1.000 characters incl. spaces)*

15. Additional information

(max. 1.000 characters incl. spaces)

Your account in BAMOS+

Please remember that to officially submit your application you need to access our electronic data exchange system BAMOS+. More information about the process of applying for your account in BAMOS+ you will find here:
https://interreg-baltic.eu/gateway/bamos-account