Deliverable Summary Report: D3.4

Author: *Morten Lybech Thøgersen, EMD International A/S (mlt@emd.dk)*
Date and version: *2020.03.06 (v1.0)*
Work Package: *WP3: Exploitation and Commercialization'*
Deliverable name: *Novel products commercially distributed as 'premium'*
Deliverable status: *Completed*

Deliverable description

This task covers the distribution of 'premium grade' InnoWind products, i.e. products with Innowind generated IPR and a documented high value for end users/customers. These datasets were intended to be unique (originally envisioned as a novel drag force parameter) and linked directly to the WAsP flow model. As such, it would not be available from any other competitors or data providers. The business model was originally envisioned to be 'premium', i.e. pay-per-dataset or pay-per-model execution (like EMD-WRF datasets, Vortex services or USTUN dataset for DK/TR). At the project end (March 2020), the distribution model has been revised into an on-demand (per-site) model. This is due to both technical and business reasons and to reduce risks.

Activities and tasks completed

The successful integration of the InnoWind commercial premium products has been completed as a joint project task. This task has relied on activities primarily belonging to the 'Intermediate' and 'Long-term' tracks. Some modifications to the scope have been needed, as this activity directly depends on input from all project partners. The deliverable is based on input from several Innowind project milestones, deliverables and tasks, including but not limited to:

- Validation: To document that Innowind premium data has a high value for customers (i.e. lower uncertainties in wind energy estimates)
- Model Availability – WasP and windPRO: To ensure that data is consumed by a forest module in software from DTU (WAsP model). This model is to be available in the commercial software of WAsP and windPRO
- Premium data is available from DHI-GRAS as a premium pre-run dataset or as an on-demand service
- Business case with clear understanding of revenue streams and cost structures

Uncertainties and Risks

During the project we have identified the following uncertainties and risks.

- *Potential user uptake:* The ORA forest model has been available in windPRO for some time (years), but still not many users are actively using it – numbers from 2018-2019 (forest data downloads) indicate about 5%-15% based on an EMD analysis from Sweden. If forest data is available, it is typically used through a displacement height approach.

- *Potential user uptake*: As DTU is implementing the forest model in pyWAsP (not classic WAsP) – the difference in potential users is ~20 vs ~2000, however with pyWAsP users are paying a higher license fee and potentially having a 'big' company user-profile.
- *Business:* A pre-run dataset (as originally envisioned) is expensive to make for a region or even globally. EMD analysis has shown that new wind energy projects in established European markets (established downloads from within EMD's windPRO) have decreased from 2018 to 2019 by approximately 20-25% for Germany and Sweden. This makes it hard to identify a market where a pre-run dataset would have a good chance of commercial success.
- *Business:* Data usage in pyWAsP will need to await the release cycle (expected Q3-2020).
- *Business:* The data-layers generated can be replaced with open data from national sources (such as from national forest inventories based on LiDAR data). As such, the offering is not necessarily unique and more affordable (or free) options may become available near term, see EMD offerings on forest data (freely available): http://help.emd.dk/mediawiki/index.php?title=Category%3AForest_Maps
- *Technical:* Current validation study shows a limited effect in reducing uncertainties by using Innowind premium data over free datasets. The high value for end-users still needs to be documented.

With the current uncertainties and risks it is not feasible to offer the service as a pre-run dataset. Thus, in order to minimise risks while still explore business opportunities, the scope of this deliverable has been changed into offering an on-demand from DHI-GRAS. Still with this solution data may be loaded in pyWAsP and windPRO. If user-uptake is positive after project completion, commercial considerations will decide if the original vision is relevant to implement and integrate.

It must be mentioned that the risks materialised above were already discovered and logged in the risk-register in our business case, where also possible contingency measures were recorded. As such, the actual outcome and deliverables for the higher-risk elements in the InnoWind project (belonging to the intermediate and long-term track) are in agreement with the possible scenarios identified, and this deliverable reflects the actions that we have taken accordingly.

Deliverables and outcomes

The following outcome (available now) completes the deliverable D.3.4:

- DHI-GRAS has completed modelling of the DHI-GRAS Premium Innowind Data Layers (forest) and owns IPR to this modelling
- DHI-GRAS can deliver forest layers, i.e. layers of canopy height, leaf area index and land-cover type for most parts of the world
- DHI-GRAS is promoting the data-layers for premium users and clients within the wind-energy community

- DTU will be able to consume DHI-GRAS data layers in their pyWAsP model – as this toolkit have an option for roughness and displacement height generation using the ORA, Scadis and Raupach models. pyWAsP will go into alpha release during Q1-2020 and is expected to be released to end-users by end of Q3 2020.

- EMD has modified windPRO software, so it is now able to use the DHI-GRAS data layers directly. The setup has been tested and documented (see link below). It is easy to export the data into WAsP (classic) format.
- EMD and windPRO are able generate roughness and displacement heights for use in windPRO using the ORA model
- EMD will continue to prospect the premium data layers to potential clients in co-operation with DHI-GRAS
- EMD has generated a webpage promoting the premium-data, available from the windpro data-wiki page. From that page sample data is also available: https://help.emd.dk/mediawiki/index.php?title=DHI-GRAS_Premium_Innowind_Data_Layers
- EMD has documented the workflow for using the premium data layers with windPRO through a cheat-sheet (also available from the wiki-page above): https://help.emd.dk/mediawiki/images/d/d9/CheatSheet_InnoWindPremiumData_WindPRO.pdf

- As part of the dissemination activities, the project, with EMD as the presenter, has disseminated the final findings at an oral session at the Winterwind fair 2020 in Sweden (see the dissemination log).

After project completion it has been agreed:
- DHI-GRAS will prospect their IPR towards larger customers within wind energy. This is also the intended audience of pyWAsP. If the sales effort is successful and the customer is also a windPRO customer, the parties will agree on further co-operation on commercial terms.
- IPR owners will continue to explore business opportunities with their InnoWind generated IPR, individually given the learnings during the project and together through established cooperation channels.
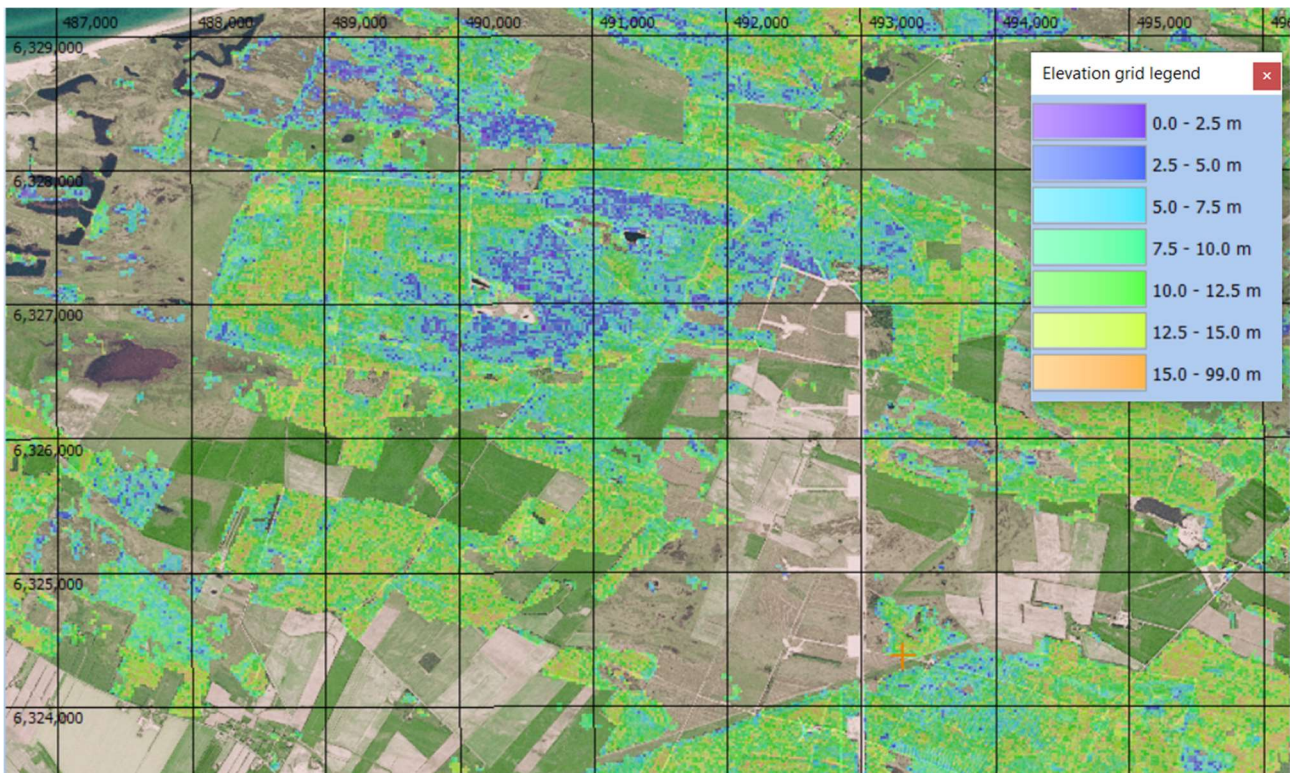

Figure 1: DHI-GRAS InnoWind Premium Data in windPRO.