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EUPORIAS

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EUPORIAS

D43.1: Workshop reports including objectives, comparison of data supply and demand, feedback and conclusion

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Deliverable Title	Workshop reports including objectives, comparison of data supply and demand, feedback and conclusion	
Brief Description	Deliverable D43.1 gathers the results from different sector-specific workshops which have been conducted with organisations and stakeholders groups to present three of the prototypes developed in WP42.	
WP number	43	
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v1	31.03.16		Initial first draft
v2	06.04.16	Predictia	Inclusion of some minor changes suggested by BSC
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V4	13.04.16	Predictia	Minor changes and inclusion of a new section called “Lessons learnt”
V5	27.04.16	Predictia	Very minor change

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1. Executive summary

Within WP43, deliverable D43.1 is associated to task 43.1, entitled *"Run workshops and meetings with key sectors stakeholders to present the service prototypes developed in WP 42. Participants will provide their experience in stakeholder engagement in the different sectors: energy, agriculture, water, infrastructure and transport"*. This deliverable gathers the outcomes of different sector-specific workshops which have been conducted to present three of the operational service prototypes developed in WP42 to the relevant organisations and stakeholders groups. It aims to illustrate the way in which a climate service can be developed to address specific users' needs. In particular, here we focus on three workshops which have recently taken place to present the LMTool (land management sector), SPRINT (transport sector) and RESILIENCE (wind energy sector) prototypes. As stated in the DoW, some of these workshops included practical training sessions to teach users on how to deal with the new sort of data generated.

2. Overall objectives of the project and the WP43

2.1. Project objectives

With this deliverable, the project has contributed to the achievement of the following objectives (DOW, Section B1.1):

No.	Objective	Yes	No
1	Develop and deliver reliable and trusted impact prediction systems for a number of carefully selected case studies. These will provide working examples of end to end climate-to-impacts-decision making services operation on S2D timescales.	x	
2	Assess and document key knowledge gaps and vulnerabilities of important sectors (e.g., water, energy, health, transport, agriculture, tourism), along with the needs of specific users within these sectors, through close collaboration with project stakeholders.	x	
3	Develop a set of standard tools tailored to the needs of stakeholders for calibrating, downscaling, and modelling sector-specific impacts on S2D timescales.		x
4	Develop techniques to map the meteorological variables from the prediction systems provided by the WMO GPCs (two of which (Met Office and MeteoFrance) are partners in the project) into variables which are directly relevant to the needs of specific stakeholders.		x
5	Develop a knowledge-sharing protocol necessary to promote the use of these technologies. This will include making uncertain information fit into the decision support systems used by stakeholders to take decisions on the S2D horizon. This objective will place Europe at the forefront of the implementation of the GFCS, through the GFCS's ambitions to develop climate services research, a climate services information system and a user interface platform.		x
6	Assess and document the current marketability of climate services in Europe and demonstrate how climate services on S2D time horizons can be made useful to end users.	x	

2.2. WP43 objectives

• To engage with EU citizens about the use of S2D data in everyday decisions.

• To demonstrate ways in which a climate service can be developed to address specific users' needs.

• To facilitate clear communication and exchange of information with stakeholder groups.

• To empowering SMEs, and allow them to develop their own climate services.

3. Detailed report

Deliverable D43.1 gathers the results from the three workshops which have recently taken place to present the LMTool (land management sector), SPRINT (transport sector) and RESILIENCE (wind energy sector) prototypes to a set of stakeholder groups. These workshops are detailed in the following sections.

3.1. LMTool prototype workshop

Introduction and objectives

The Met Office, the University of Leeds, Predictia, KNMI and the University of Exeter (not EUPORIAS partner) are working closely with Clinton Devon Estates (CDE) and the National Farmers Union (NFU) to develop prototype seasonal weather forecasts for UK land managers. Seasonal weather forecasts (typically for 1-3 months ahead) are currently only skillful during the wintertime, so initial work on the prototype has focused on providing winter forecasts.

Production of the first draft forecasts during winter 2014/2015 was based around the UK contingency planners forecasts (CPF), which provides 3 month outlooks for temperature and precipitation for the UK as a whole each month, and we used a simple downscaling method to scale the UK forecasts to Devon. We provided these outlooks for the county of Devon, working with a small representative group of farmers (4-5) from CDE, and collected feedback on them via email and post. The outlooks were provided each month from October to March. The prototype began with several meetings, and a workshop, between CDE and Met Office partners to help determine the initial offering.

During winter 2015/2016, we have been using a web microsite (http://lmtool.euporias.eu/en) to provide 14 day site-specific forecasts for temperature and precipitation alongside three month outlooks, across the wider area of South West England, working with a larger stakeholder group (about 20, covering both CDE and NFU).

Further work is continuing to develop a mobile app (http://demo.predictia.es/lmtool-app/show/) based on this service, and to further develop the forecasts based on feedback from the farmers, including a) additional weather variables (tmin, tmax, wind speed and direction), b) improved presentation and c) including information on county-scale climatology and tercile categories to improve understanding. The prototype has benefited from considerable interaction with the users throughout the project, as well as a student project at the University of Exeter (Natural Sciences) investigating forecast skill and improving communication of 3 month outlooks. Figure 1 illustrates the general approach taken in the prototype.

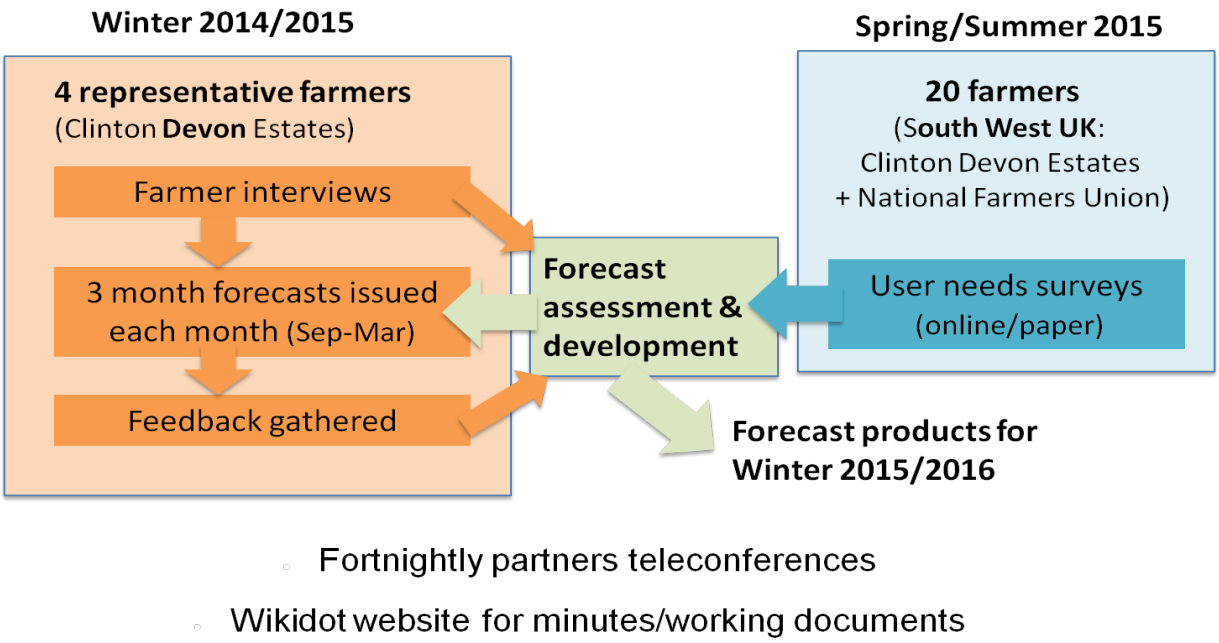

Figure 1: Summary of approach and progress in the LMTool prototype.

More specifically, we held a workshop on 11th January 2016, at the Met Office in Exeter. The workshop involved the University of Leeds, the Met Office, and farmers/land managers and representatives from CDE and the NFU. The aims of the workshop were to:

1. Assess farmer/land manager understanding of the forecasts and related decision-making, through relevant exercises/activities.
2. Understand ways in which we could improve forecast content, presentation and relevance, and
3. Discuss results from the Exeter students project.

The workshop gathered 8 attendees from NFU/CDE and 7 from Met Office. The project paid travel costs for attendees and provided lunch, and activities to make the workshop generally attractive and break up the day, including tours of the operations centre and High Performance Computer.

Comparison of data supply and demand

There are several aspects to data supply and demand issues related to the prototype, covering spatial and temporal scales of data, and the variables needed. Most of these elements had already been defined and discussed with the user group before the workshop, through the previous workshops, questionnaires, visits and survey and feedback forms. Key remaining data requirements, above and beyond the service provision at the time of the workshop included:

1. Potential interest in additional variables for the 14 day forecasts (wind speed/direction, minimum/maximum temperatures).

2. Supply of information on recent climatology for the variables in 14 day forecasts (e.g. 3-5 year averages for the period in question) to allow comparison to recent years.

Following discussions at the workshop, it was agreed that it would be possible to provide these additional requirements.

Feedback

A summary of feedback from the farmers and land managers during the workshop is given below, primarily focusing on the second objective above. Further work in the prototype is building on the exercises related to the first objective above, and will be reported separately. In addition, many of the attendees showed willingness to take part in a brief follow-up interview on forecast value and decision making.

14 day forecasts

- Original format temperature graphs were seen as useful and preferred.
- Minimum and maximum temperatures could be useful - in winter minimum more so, in summer maximum more so. Can we investigate adding lines to the 14 day forecasts for min/max temperature, or provide separate graph panels?
- It would be useful to have previous yearly averages from climatology (3-5 years), or the previous year.
- Soil temperature may be important for drilling - influences cover crop choice and timing to avoid soil erosion (but seen as a low priority).
- Generally suggested smoothing of data (suggested in one response to the survey) would not be useful.
- Wind speed, and possibly direction could be useful (during February/March and June) for spraying decisions, though this may be needed all year round when mild. Could this be coded? e.g. red >40mph, orange <20mph, green <20 mph? Show arrows for direction, colour coded, with value of speed inside.
- Precipitation - could have this as a line but may be less effective as it falls in blocks; hence original format preferred. Agreed to look into adding the average (of ensemble) line.
- Precipitation - can we spread out the y axis to make it clearer - cap rainfall at a certain value, and add the value to the bar if capped? Agreed to cap values but only if one very extreme value occurs, and add the actual value to the capped bar.
- Precipitation - the blue colours used may be too similar? Provide more contrast.
- Overall, for the precipitation graphs:
    - the original format is preferred, using blocks
    - adding a mean line
    - more contrast in blue colours
    - cap values but only if one very extreme value occurs, and add the actual value to the capped bar
- Overall, for the temperature graphs:
    - the original format is preferred but would like tmin and tmax added somehow (needs investigation to maintain clarity)

3 month outlooks

- Need to know when regime changes are likely to happen, not just that they will (e.g. wet/warm -> cold/dry in the Jan-March forecast); need information on the context and reasons - however, don't want to go to other pages etc. for more information (e.g. follow links to contingency planners pages). Post note - there are conflicting views on this, on the one hand farmers need for quick interpretation; on the other that seasonal forecasts are more an activity for sitting down and planning once a month, not acting on immediately from a mobile device.
- Meaning of the tercile probabilities was not clear in the split case mentioned above.
- Low probabilities/differences from normal do not give much confidence to act; on the other hand, if the deviation is predicted to be far from the average (e.g. very wet) then the farmers would need more confidence in the probabilities.
- Matt Fry mentioned the issue of cooling grain in stores, to kill bugs - if there is a better chance of cold weather then they would make use of sub optimal conditions to turn on fans (using electricity) which is a fairly marginal decision compared to a more catastrophic case of getting it wrong due to a bad decision made based on a forecast such as planting a crop. If no cold weather was indicated at all, they would not store the crop.
- Farmers may need several years of information to get confident using it to make decisions; in some cases the gains could be marginal but losses huge.
- Pete noted that given the current skill of Glosea5, they might need to use it for 10 years to get a benefit (6-7 out of 10 correct outcomes).
- Farmers may hold cattle in the sheds until good grass is available; with better knowledge they could release animals earlier, saving on heating fuel and silage etc.
- Sunshine hours could be useful in both 14 day and 3 month outlooks, but mainly around grain filling time (June), and would not necessarily change decisions
- Overall, for the three month outlooks:
    - Have a more concise statement
    - add bar graph with the actual values inside
    - provide "drill-down" additional information, suggest a) punchy text plus bar chart seen first; click on a title to get a paragraph explanation; click again to get a page or so - use text from UKCP pdfs.

Conclusions

The workshop held with CDE and NFU representatives was an invaluable opportunity to improve the content and relevance of the prototype. The workshop provided several actionable points for prototype development which are currently in progress, or have already been implemented. For instance, the following aspects have already been incorporated:

- 3 month outlooks – add “drill down” information with brief headline message and bar chart, followed by a more detailed context section available when clicked.
- 14 day forecasts – added mean line, and improved colour contrast on precipitation plot.

3.2. SPRINT prototype workshop

Introduction and objectives

A project closure and evaluation workshop was held on Thursday 10th March 2016, for the project "Winter forecasting for UK transport". The project is co-funded by the UK Government Department for Transport (DfT) and the EU FP7 project EUPORIAS. Under EUPORIAS, the project is known as "SPRINT" (Seasonal Prototype: Risk of Impacts of the NAO on Transport) and referred to as the "[EUPORIAS] transport prototype". This project involves a large stakeholder group, coordinated by DfT, covering multiple transport modes and functions.

The aims of workshop were:

- To remind the stakeholder group about the nature of the service provided during the project.
- To gather feedback from the stakeholder group about the service, in addition to what already gathered during the project, and
- To assess the appetite for the service to continue beyond the project.

Workshop discussions

Participants were present at the workshop (either by phone or in person) representing DfT, rail, road, local authority, urban transport, and devolved administration organisations. There were no attendees from specific aviation organisations (e.g. airports or airlines), though this sector was represented through DfT.

The discussion below reflects the comments that were made by stakeholders at the meeting. Stakeholders were asked not to limit their feedback to what they thought was feasible (either scientifically, technically or financially), but on what they really needed from a service. The views expressed here are those of the individual stakeholders and do not necessarily represent the views of DfT.

Temporal coverage & lead time of forecasts

To date, the forecasts have been delivered in ~Oct-Feb, covering the period ~Nov-Apr, i.e. with lead times of 1-3 months. Extended coverage of the service (e.g. Sep-Apr) was suggested by many, to cover the end of the stakeholders' "winter" which extends 2-3 months beyond the meteorological winter. With regard to the forecast lead time, some felt that information at the 3-month lead time was too uncertain to be useful; others appreciated receiving this information to help set the scene, even though it was uncertain. Most participants found the 1-month lead time information accurate and useful for planning decisions. Many users refer to a suite of services across different time frames to help refine decision making, with mention of tactical decision

making services such as the Met Office's "Open Road" service to help decide when to grit roads.

Frequency, communication & format of forecasts

To date, the forecasts have been delivered via an in-person briefing at DfT (London) at the start of the season (Oct/Nov), and thereafter monthly teleconferences supported by briefing material (slides and papers) circulated in advance. Briefings comprised two main parts: publicly-available material based on the Contingency Planners' Outlook (http://www.metoffice.gov.uk/publicsector/contingency-planners) and bespoke material in the form of the impact forecasts. Additionally, in the run-up to Christmas 2015, a 10-day weather outlook was also presented. Ad hoc briefings were issued in the event of any high-profile events being anticipated at comparatively long lead times (e.g. risk of cold spells arising from SSWs). A monthly briefing was deemed appropriate by most. It was suggested that four-weekly briefings would be appreciated in the rail sector, to tie in with reporting periods. Some people disliked the initial in-person briefing being held in London; travel to this was impossible for some for logistic and/or budgetary reasons. Initial briefings in other locations around the country were proposed as a useful addition. The issue of teleconference etiquette was raised (e.g. people not muting their lines / dialling in from somewhere noisy). This improved in later teleconferences, when participants were more firmly requested to mute their lines. Some felt that they did not receive the briefing papers sufficiently far in advance to consult these prior to the teleconference. Others also mentioned technical problems as an obstacle.

There was considerable interest from some participants regarding the science behind the forecasts, and the briefing material was in general very positively received, with several participants saying the language used was appropriately pitched for general consumption. Others wanted "plainer English" or "clear and concise" material and requested more of a focus on clear messaging rather than the underlying science. Hearing directly from the scientists involved in the work was also appreciated by most. However, many felt that –although providing the background scientific information was important– the focus was too much on the underlying science and not enough on the messages for stakeholders. "% accuracy" was suggested as a useful metric to accompany the forecasts. "Error bars we can trust" were also mentioned, though the specific element of the forecast material to which this statement pertained was not clear.

The verification of this winter's forecasts was also discussed. Reference was made to the November forecast, which referred to the winter starting off mild/stormy and changing to colder later. One person felt that, although the second half of winter was certainly cooler, it was not perceived as cold in

absolute terms, meaning that any mitigating actions taken based on the November forecast would have been costly. Another noted that, at the start of the season, they planned for cold anyway and that forecasts for the latter half of winter were more useful in terms of helping to make their in-season decisions. A further participant had received positive feedback from his senior colleagues, for whom he had used the CPO material to provide briefings; his colleagues had found these forecasts accurate in Winter 2015/16.

Regarding the impact forecasts specifically, one stakeholder preferred to infer their own impact information from the CPO element rather than considering the impact forecast specifically (even though there was an impact forecast tailored towards their specific impact). Others said they found the impact forecasts very useful as a "heads up", and more relevant than the CPO materials. There was some support from the group for further development of the impact forecasts. Opinions were expressed that the forecasts were too focused on England or even SE England and that the conditions in other parts of the country were not adequately represented by these forecasts. *[Post-workshop note: since the CPO is UK-wide, it is assumed that these comments referred to the impact forecast component, which was necessarily focused on providing forecasts for impacts/locations for which stakeholders could share their impact data, rather than on providing geographically balanced coverage.]*

Several suggestions were made for improving the service technically:

- Use of Webex or similar for the slide presentation element
- Use of YouTube to create clips that people could refer back to
- Use of "pearls of wisdom" style clips

However, other users pointed out that their local IT restrictions prevented them from viewing content via such channels.

Use of forecasts in decision-making

Discussions centred on the following ways of using the forecast information:

- To support tactical/planning decisions:
    - An example from the road sector: some tactical decisions –such as ordering an initial stock of salt– are made ahead of the current forecast briefing period. Providing information earlier, even if the forecast skill were lower, would be useful.
- To support operational decisions:
    - An example from the rail sector: good forecasts around mid-December at long lead times would help train operators switch effectively from leaf-fall mitigation to ice mitigation (the same trains are used for both operations), with the switch always occurring around 12th Dec (in the

absence of any other supporting information). Knowing whether colder weather was anticipated earlier or later than this would be helpful, as the switching process takes about five days to complete.

- Onward briefing of peers, senior colleagues within same organisation, and other stakeholders (e.g. ministers):
  - Some found it hard to use the briefing material to prepare their own material for onward briefings to others within their organisations. Others simply shared the briefing material with their colleagues.
  - Others had received positive feedback for their onward briefs to senior colleagues and ministers.
  - There was some support for “headline messages”/“what looks like press messaging” (i.e. bullet point summaries) to be circulated.

Conclusions

Stakeholders were supportive of a continuation of the service in future, and made many useful suggestions for improvements to the service they have already received. On many topics, opinions were diverse across the group, but the following themes emerged as relevant to all:

- The service should span a larger part of the year, even if the skill of the forecast is lower for some of this period.
- The group would like to receive different types of briefing material, at different levels of technical detail, to enable them to drill down to their desired level, and/or pass to others for wider dissemination.
- A better technical solution for delivery of the briefings is required, but this should take into account the limitations of some users’ local IT arrangements.

3.3. RESILIENCE prototype workshop

Introduction and objectives

RESILIENCE is a semi-operational prototype that aims to provide robust information on the future variability of wind power resources based on probabilistic climate predictions. In order to reach this objective, the RESILIENCE prototype operates at seasonal time scales providing seasonal wind speed predictions for the energy sector.

The primary user of RESILIENCE is the energy trading sector. However, understanding and quantifying wind resources is a key element to multiple user profiles in the wind energy sector both in pre-construction (e.g. wind farm developers, financial teams) and post-construction (e.g. O&M teams, grid operators). Over the EUPORIAS project, the BSC (formerly IC3-Climate Forecast Unit) has had close interactions with energy stakeholders with different profiles to develop the RESILIENCE prototype.

The main goal of the prototype was to provide one operational prediction with one month lead for the winter period. In November 2015 RESILIENCE launched its operational forecast for the winter season (from December 2015 to February 2016) that was available for all partners on-line through Project Ukko (www.project-ukko.net), an interactive interface developed within WP44 to allow wind industry users an easy exploration of probabilistic predictions.

Besides showcasing RESILIENCE and Project Ukko in individual meetings and different for a of relevance for the wind industry, a workshop jointly organized by EUPORIAS and SPECS projects was conducted to present the main results of the prototype.

The workshop

The Workshop was held on Thursday 19th of November in a meeting room at the EWEA Annual Event 2015 in Paris. The event was coordinated by BSC (EUPORIAS and SPECS partner) and Vortex (SPECS partner) with the collaboration of EDF (EUPORIAS partner).

The EWEA annual event is an event of reference to the wind energy industry. Therefore it was selected as the right context to hold a workshop involving as many interested users as possible.

Users were invited previously to the meeting. During the two days previous to the workshop users in the exhibition where also contacted and invited to participate in the workshop. Among the participants in the exhibition the main target user that showed interest in the workshop and climate predictions where intermediary companies that already provided weather and short term weather predictions for wind resource assessments.

The workshop gathered 11 attendees from: General Electric Spain, EDF R&D, AWS Truepower, ZSW, WeatherTech, SIEMENS, ENECO, Iberdrola Renovables, Casa dos Ventos and Meteo-France. The number of attendees was affected by the Paris attacks on 13th of November. Many exhibitors and companies decided not to attend to the EWEA event due to security reasons and some confirmed participants withdrew from the workshop.

Workshop aims and agenda

In order to attract as many users as possible the focus of the workshop was on Seasonal Predictions for wind in general, making reference to el Niño 2015 and its impact on wind resource anomalies. The work in the RESILIENCE prototype and the operational prediction available in Project Ukko was thus introduced within this context.

The ultimate aim of the workshop, entitled *"Working Group on Seasonal Predictions for Wind (SP4Wind)"*, was to build a collaborative forum to support the dissemination

of seasonal prediction information for the wind industry and to facilitate the exchange between experts and stakeholders from the climate prediction and wind resource communities.

It was organized as an informal, round-table conversation with the following agenda:

1. Introduction and justification of the SP4Wind Working Group initiative (by Gil Lizcano: Vortex);
2. Presentation of all participants;
3. Presentation of the RESILIENCE prototype developed under EUPORIAS and the novel visualization tool Project Ukko, which provides an online interface access to wind resource operational seasonal forecasts (by Isadora Jiménez: BSC);
4. Browsing of seasonal wind speed predictions for the 2015/2016 winter worldwide (moderated by Isadora Jiménez: BSC);
5. Revision and analysis of the 2015 anomalies in wind speed and its relationship with the current El Niño event (moderated by Gil Lizcano: Vortex).

The points in the agenda were the start point for an open discussion about the integration of climate predictions in the wind industry workflows: Are the predictions reliable? Are they better than climatology? How do the predictions integrate the El Niño or NAO information? How can the probabilistic predictions improve the analysis of anomalies and extreme events?

Feedback

A summary of the feedback provided by the attendees to the workshop is given below and can be sorted in three main topics: i) feedbacks on user's opinions and attitudes towards seasonal predictions for the wind industry; ii) feedbacks on the usability and understanding of Project Ukko interface; and iii) feedbacks on the operational prediction provided.

i) Potential interest in seasonal predictions:

- In general, most of the participants indicated that they had a poor knowledge on the stat-of-the-art of seasonal predictions and one of the reasons to attend the workshop was to hear more about the topic.
- In general there was concern about the quality and the predictive capacity of the forecasts and if it could actually outperform the current practice. They were interested in receiving more information about this particular issue.
- All participants expressed willingness to be engaged in a periodic (biannual) working group to discuss further on issues related to seasonal predictions for the wind industry. A suggestion was to alternate these workshops/meetings with on-line webinars.
- Two participants indicated that their main interest would be on decadal predictions; however, they also wanted to follow the advances on seasonal time scales.

ii) Project Ukko – technical aspects

- The technical conditions of the room (with open ceiling to the exhibition and a lot of light from the exhibition illumination) made almost impossible to show the laptop screen in the projector. The dark background of Project Ukko was a major handicap to carry out the presentation of the interface.
- To show the visualisation we had to directly show the laptop screen and turn it around the table. To overcome this technical issue some users accessed the webpage with their smartphones or tablets. This highlights the potential interest to ensure a good responsive design that allows the visualisation of the data in portable electronic devices.
- Even being able to see the prototype in the screen more than half of the assistants stated their preference to see the same information in a white or light background. Some highlighted that the dark background was quite attractive but they would like to have a button to switch from dark to light background depending on the needs of the moment.
- The definition of the prediction in the interface made reference to winter 2015/16. The representative from Casa dos Ventos (a Brazilian company) remarked that being a global prediction that includes the Southern hemisphere the description of the season should better be stated with the months.
- There was initial confusion about the line tilt, which was understood as wind direction before the explanation. It needs a clear explanation and some users questioned the reason behind keeping the tilt given the potential to misunderstandings.
- There was a discussion about the redundancy of colour and tilt to indicate the most probable category. There wasn't a consensus among the attendees on it being positive or negative.
- One of the assistants, that had colour blindness, made a comment regarding the difficulty of dealing with opacity as a variable. He could differentiate the colour scale but he perceived the changes in opacity as changes in colour not opacity. This affects the interpretation of the skill.
- There were almost no comments about the probability cone to communicate the distribution of the probabilities. Only one user asked about the horizontal noise of the dots in the probability cone and if it was data driven (N.B. this noise was included only for visualisation purposes for a better assessment of the density of the points).

iii) RESILIENCE prototype – seasonal prediction of winter 2015/2016

- The lack of skill in Europe is a drawback of seasonal predictions of wind speed. However there were no direct comments about this limitation between the attendees that focused in skilful areas.

- Due to the wind anomalies during the winter of 2014/2015 in the area of United States, there was interest in knowing the prediction for the next season in this region.
- The marked pattern of predicted wind speed changes (below the average wind in USA and over the average wind in Brazil) were regarded and commented as an interesting pattern. However no direct implication or actions were foreseen from seeing/having this prediction.
- At least one attendee in the workshop aroused the question about how to make an interpretation of the categories probabilities, i.e. how much larger should be a probability in a category for a user to take action based on the prediction?

Conclusions

The global attitude of the attendees was of curiosity and interest but they showed no formal intention on finding a way to include seasonal wind speed predictions as an information service for their professional activities.

Around the wind industry supply chain outlined below we can differentiate groups of stakeholders with different levels of interest and engagement towards wind speed seasonal predictions.

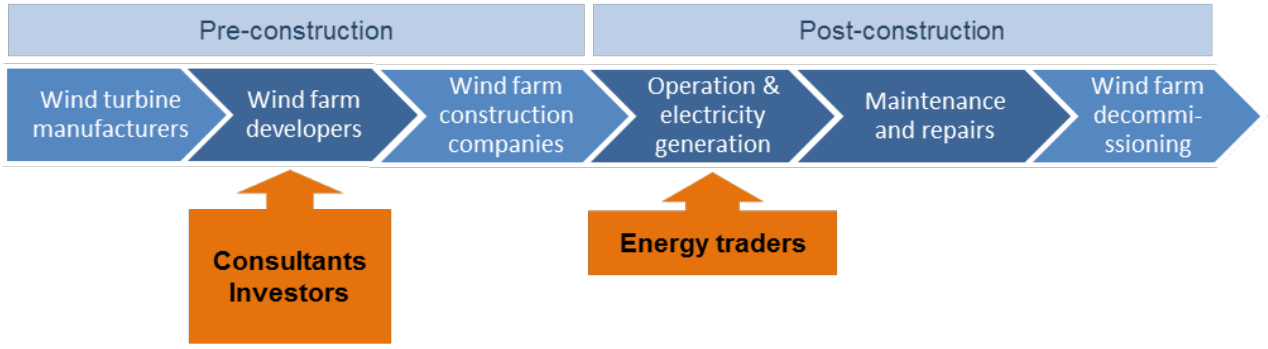

Figure 2: Wind power industry supply chain.

Despite acknowledging the potential value of climate predictions on post-construction phases, wind farm owners and operation and maintenance teams showed lower interest and more reluctance to the idea of using new methodologies. Wind farm developers were more prone to accept new methodologies for resource assessments or site-selection, however the current development of climate predictions is not mature enough for them. In general the users with more interest in the economic potential of seasonal prediction were wind resource assessment consultancies. These companies had a more open predisposition to see climate predictions as a complementary service in their portfolio.

This conference is one of the largest events in Europe for the energy sector, but it is biased towards wind turbines manufacturers, providers of O&M services and consultancies. Energy traders, investors and insurance companies had a very limited

presence and therefore could not be reached to assist the workshop. The feedback reported here is thus not representative from this sector within the wind energy industry.

3.4. Lessons learnt

As a result of the three above described workshops, a number of important general conclusions have been extracted.

In first place, these workshops are useful to assess the users' understanding of the products delivered (basically forecasts) and provide an invaluable opportunity to understand ways in which we could improve forecast content, presentation and relevance. In particular, these workshops are essential to understand which the users' needs are in terms of spatial coverage, lead-time and skill of the variables needed, helping therefore to provide more relevant forecasts which properly support their decision making. In this context, the workshops provided several actionable points for prototype development which have already been implemented or are currently in progress. For instance, the LMTool prototype is now providing 14-day forecasts of wind speed and direction on the corresponding microsite as well as on the mobile application. Likewise, climatological information for each county has been added, which helps to understand what the 3-month outlooks mean a particular location. Additionally, in the case of RESILIENCE, several improvements for visualization purposes (background colour, tilts, opacity, etc.) were aroused by the attendees.

Besides this, not all the participants had a good knowledge on the stat-of-the-art of seasonal predictions. In fact, the workshops provided evidence of the inadequacy of some of the ways in which the prototypes provide information about skill (some participants felt that the focus was too much on the underlying science and not enough on the messages for stakeholders). The attendees indicated the necessity of going for a “clear and concise” language, appropriately pitched for general consumption. In this sense, the users showed their willingness to receive some briefing material, which should be delivered in a way suited to their preferences.