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Barcelona
Supercomputing
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Centro Nacional de Supercomputación



EXCELENCIA
SEVERO
OCHOA

What happens to the data after they are produced?

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Head of Knowledge Transfer team, Earth Sciences Department

Multi-annual to decadal climate
predictability in the North
Atlantic-Arctic sector

Building on the knowledge of **many BSC colleagues**: Albert Soret, Marta Terrado, Dragana Bojovic, Diana Urquiza, Konstantina Chouta, Andria Nicodemou, Sara Octenjak, Jose Canovas, Miguel Segura, Marina Conde, Ilaria Vigo, Asun Lera St. Clair, Luz Calvo, Guillermo Marin, Fernando Cucchietti, Francisco Doblás-Reyes

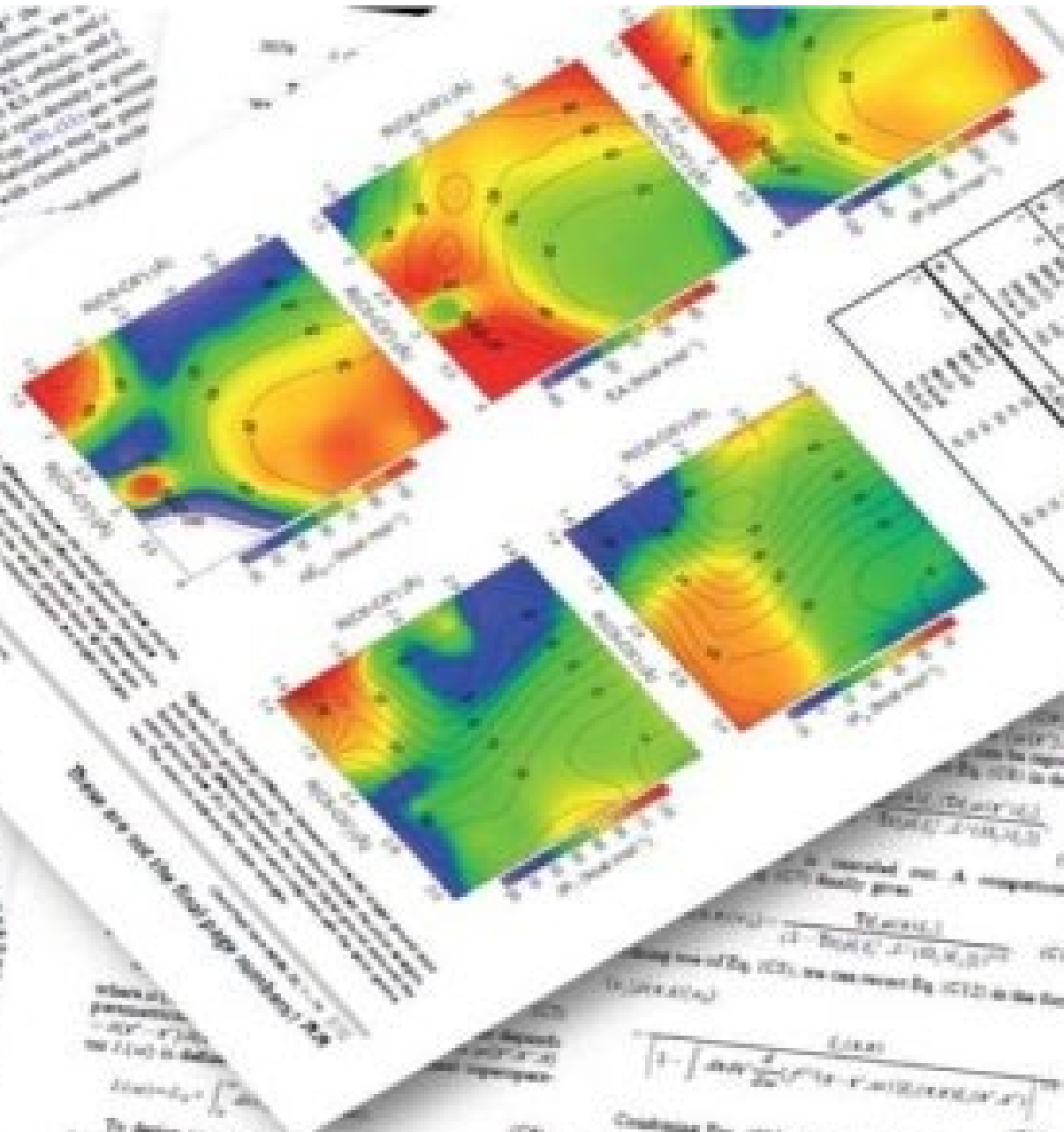
22/09/2021

Handwritten notes and printed text on the top left page, including mathematical symbols and diagrams.

GREENPAPER FROM ARTICLES

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6	7	8	9	10
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51	52	53	54	55
56	57	58	59	60
61	62	63	64	65
66	67	68	69	70
71	72	73	74	75
76	77	78	79	80
81	82	83	84	85
86	87	88	89	90
91	92	93	94	95
96	97	98	99	100



Handwritten notes and printed text on the bottom left page, including mathematical symbols and diagrams.

GREENPAPER FROM ARTICLES

such as those caused by spin-orbit effects between states of different multiplicity and those caused by interaction with other fields.

Early in the 1970s, Marshall and Kaplan investigated the spin-orbit interaction during the ion-ion interaction of beams, using a simple TMI model.¹¹ The interactions of the TMI model with ion-ion interaction energy processes have been reported since then.¹²⁻¹⁴ Most of them are based on the comparison of helicity probabilities based on London-Zener approach. Recently, interactions involving TMI based on an extension of the formalism proposed by us have been proposed.¹⁵

In the 1980s, Yamashita and Murakami extended the TMI approach to deal with states shared by the electrons and the ions in ion-ion interaction.¹⁶ Field-induced TMI was also applied in the investigation of electron-ion interaction in laser¹⁷ and of laser-induced fluorescence.¹⁸ More recently, field-induced TMI dynamics has been proposed and applied to a variety of systems.^{19,20}

Further generalization of the TMI model was proposed by Yamashita and Murakami.²¹

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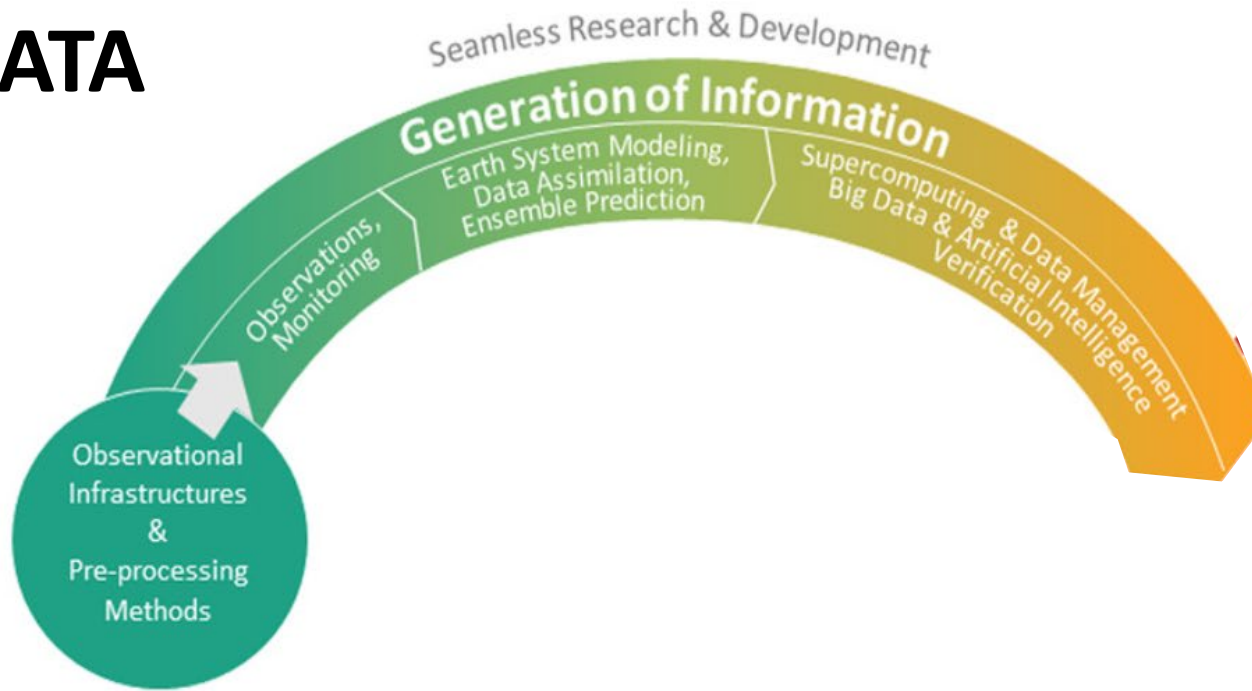
The above is a summary of the TMI model proposed here. In the next paper, we shall discuss the application of the theory to the study of the interaction of the ion-ion system with the laser field.

$$\frac{d}{dt} \left[\frac{1}{2} m v^2 + \frac{1}{2} I \omega^2 \right] = \dots$$

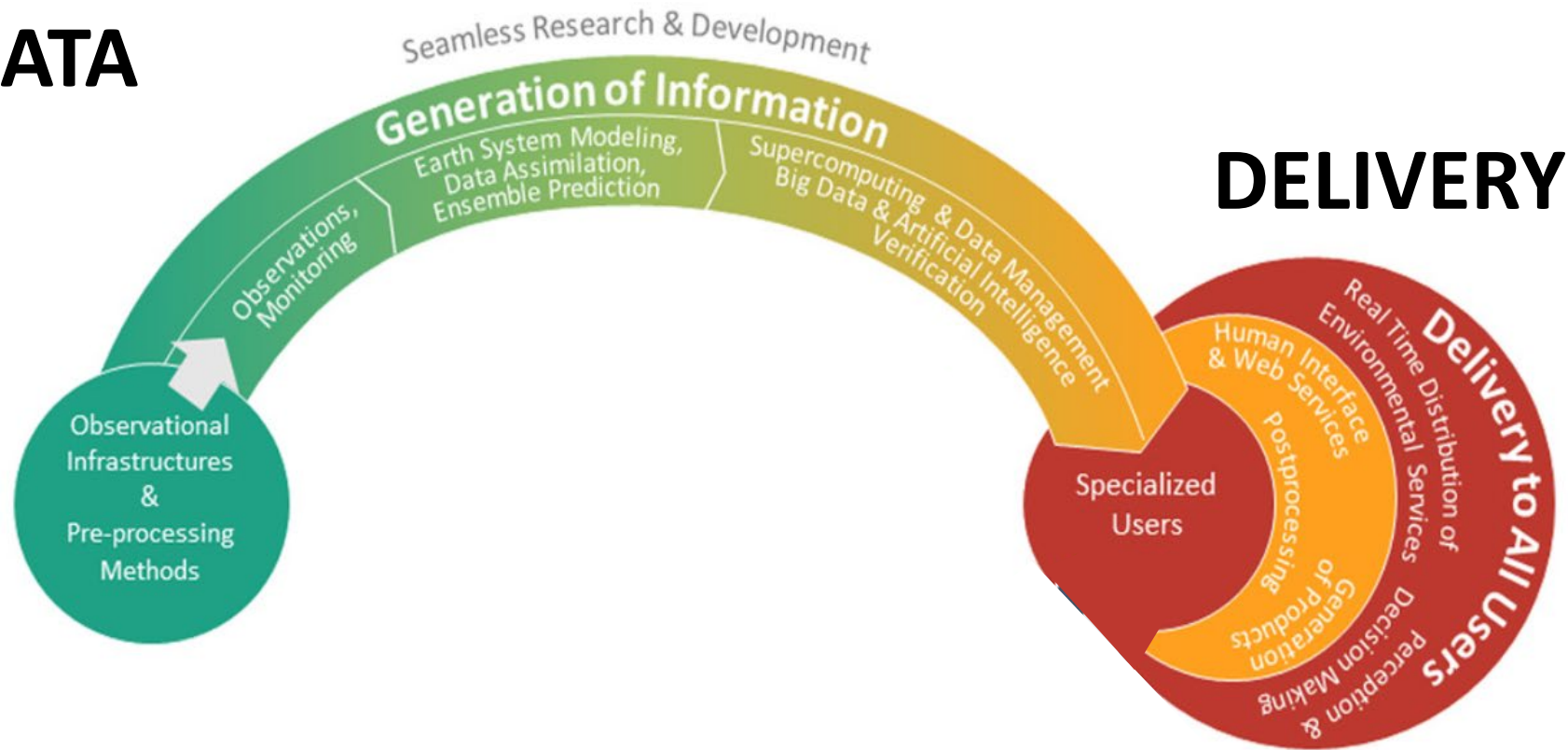
Checking Eq. (12) with Eq. (11) and Eq. (10) in the text.



DATA

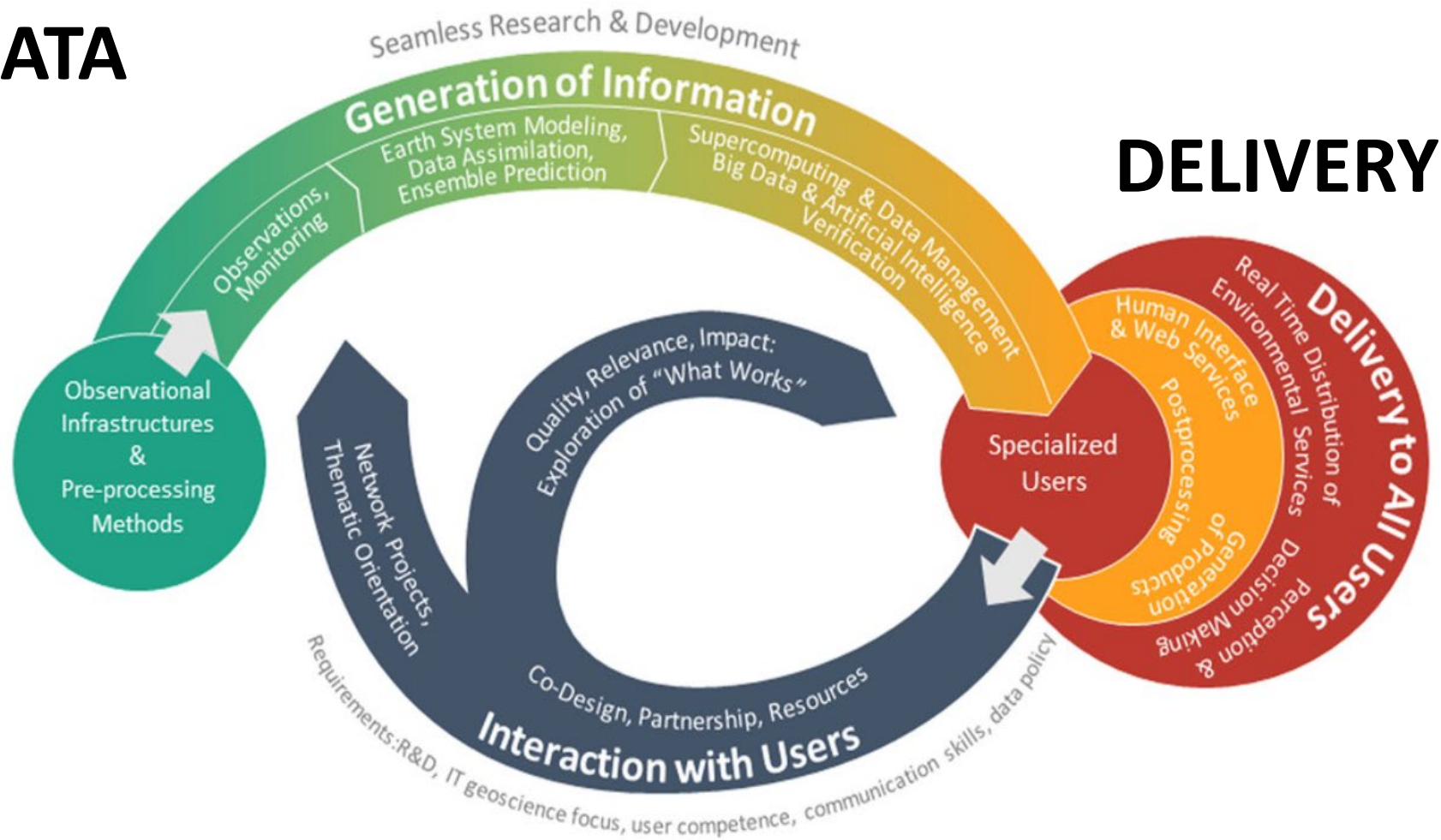


DATA



DELIVERY

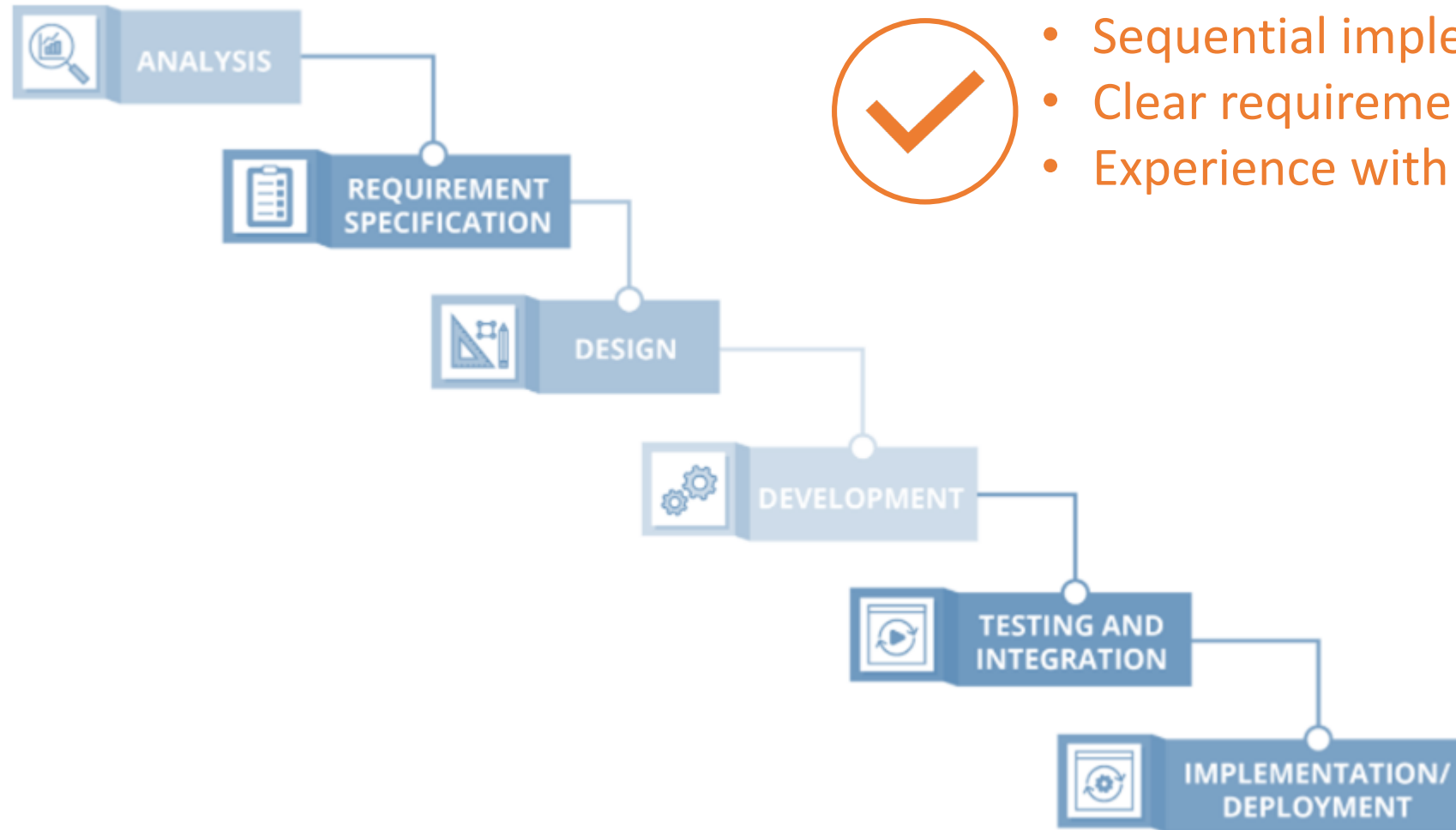
DATA



DELIVERY

FEEDBACK

Waterfall model



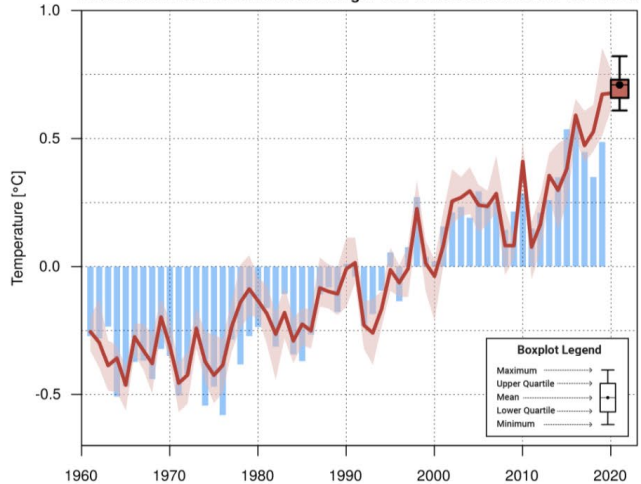
- Sequential implementation
- Clear requirements
- Experience with similar projects



Start year: 2020
 Forecast range: Year 1
 Forecast type: Indices
 Forecast product: Global mean surface temperature
APPLY

Global Mean Surface Air Temperature

Initialisation Year: 2020. Forecast Range: Year 1. Reference Period: 1981-2010.



Anomaly Correlation Coefficient = 0.96

— HadCRUT4.6
— EC-Earth3.3 Decadal Predictions



[Read more about the methodology](#)

Disclaimer and usage

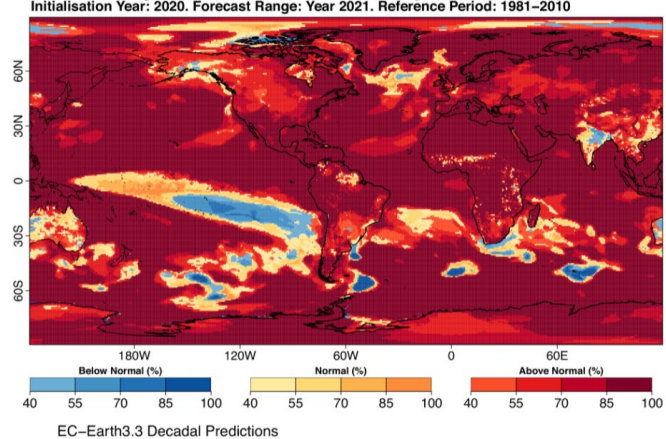
This website presents the annual and multi-annual forecasts of a certain number of climate variables based on the projected state of the atmosphere/ocean system as provided by the EC-Earth decadal forecast system. These forecasts are still in the experimental phase and while they show skill against various baseline measures, they should not be used as a basis for decisions.

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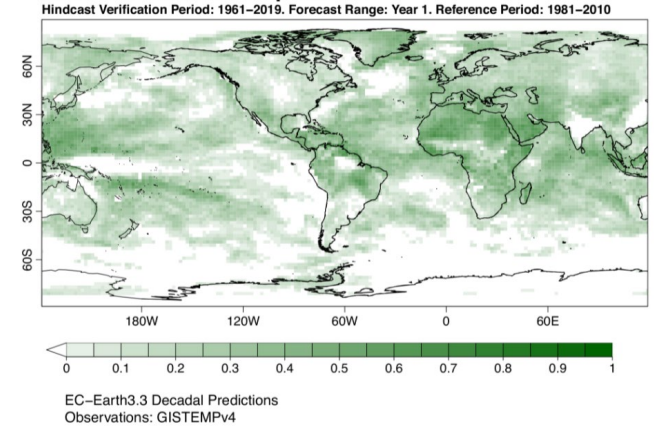
Most Likely Tercile for Surface Temperature

Initialisation Year: 2020. Forecast Range: Year 2021. Reference Period: 1981-2010



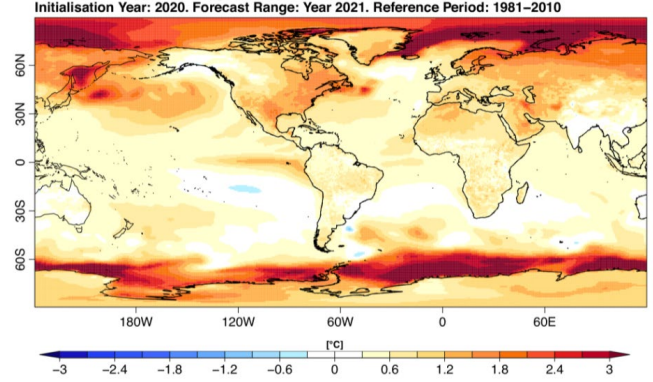
RPSS for Surface Temperature

Hindcast Verification Period: 1961-2019. Forecast Range: Year 1. Reference Period: 1981-2010

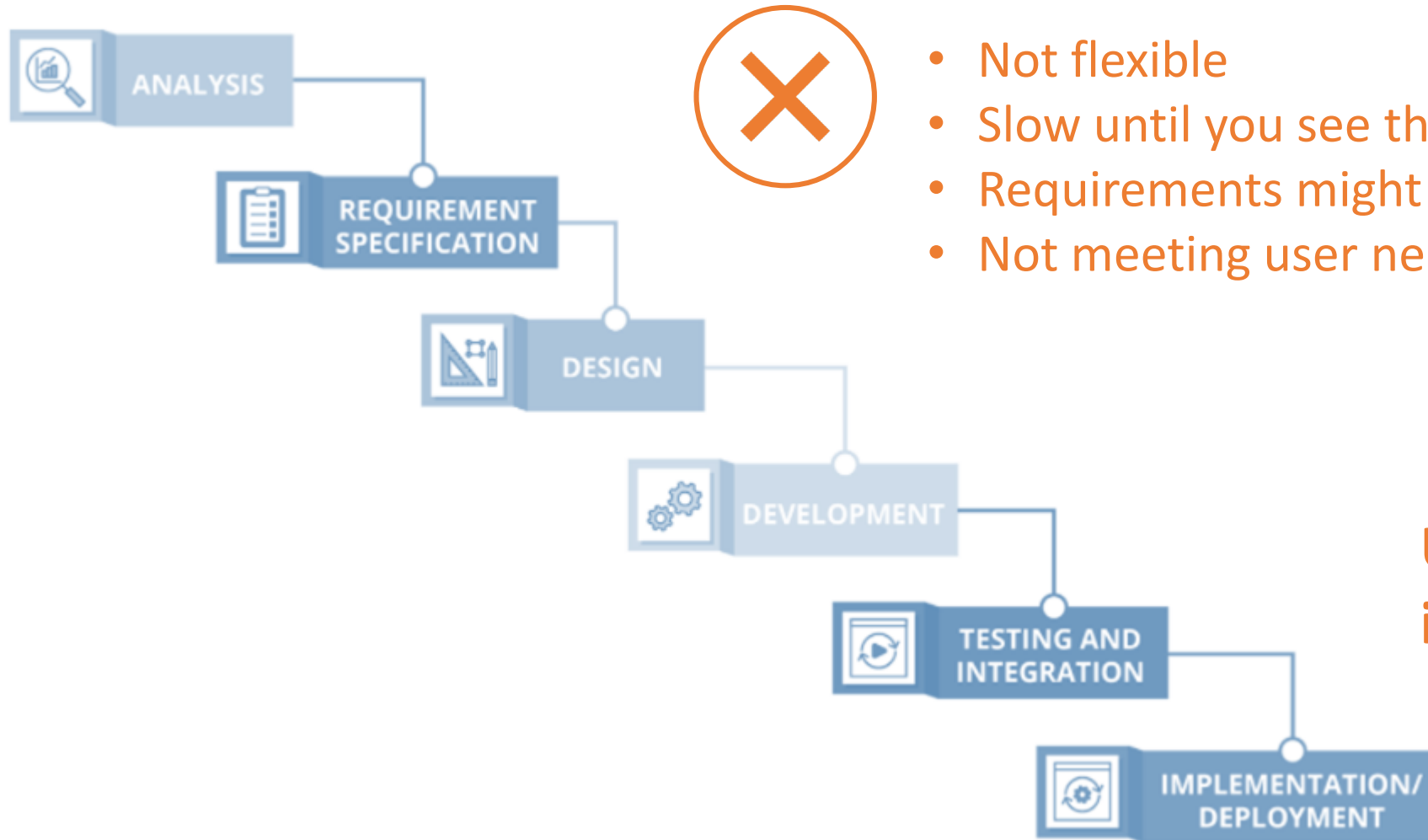


Forecast Anomaly for Surface Air Temperature

Initialisation Year: 2020. Forecast Range: Year 2021. Reference Period: 1981-2010



Waterfall model



- Not flexible
- Slow until you see the final product
- Requirements might be misunderstood
- Not meeting user needs

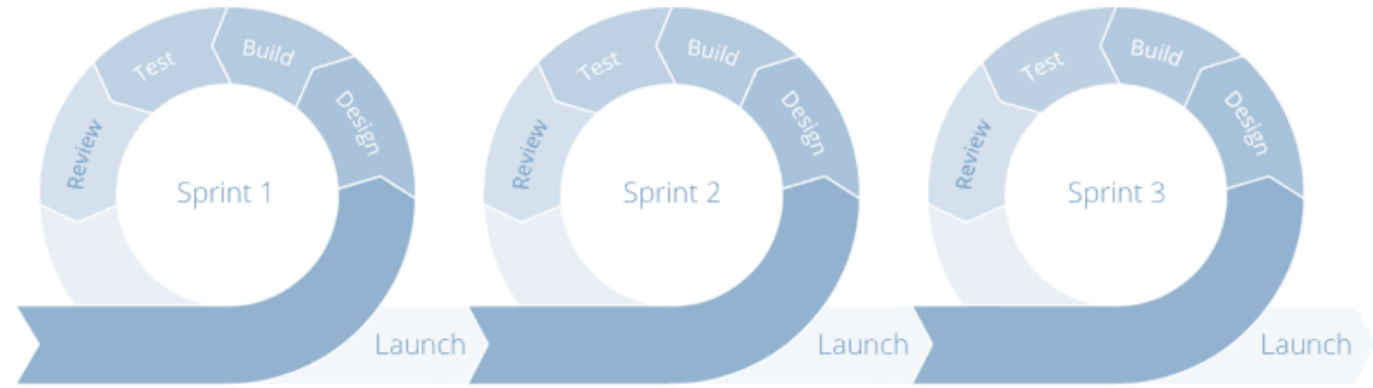
User/stakeholder inputs at the end



“What if we found ourselves building something that nobody wanted?”

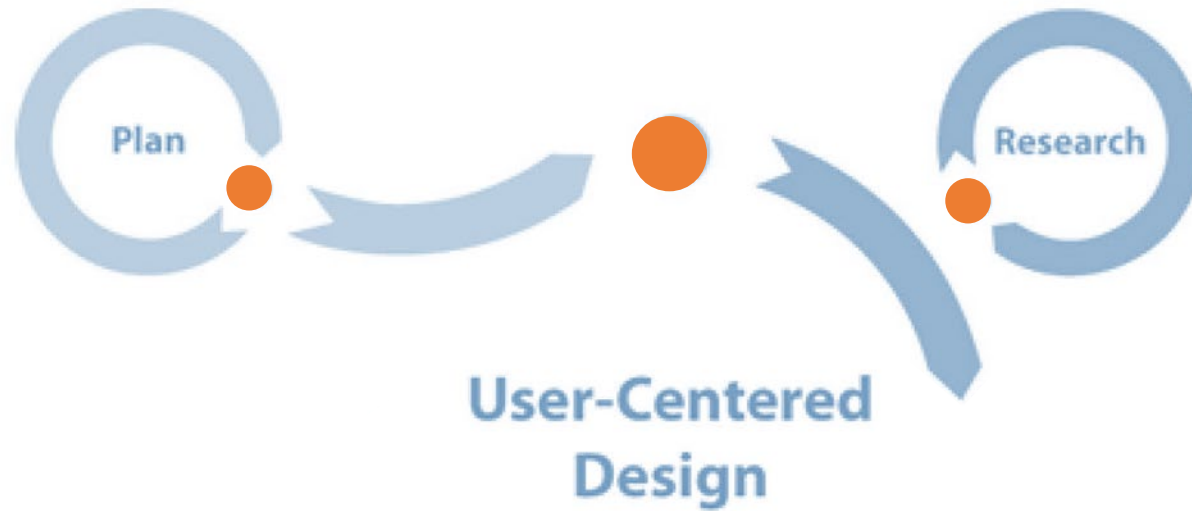
In that case, what did it matter if we did it on time and on budget?”—Eric Ries

User Centered Design + Agile development for climate services



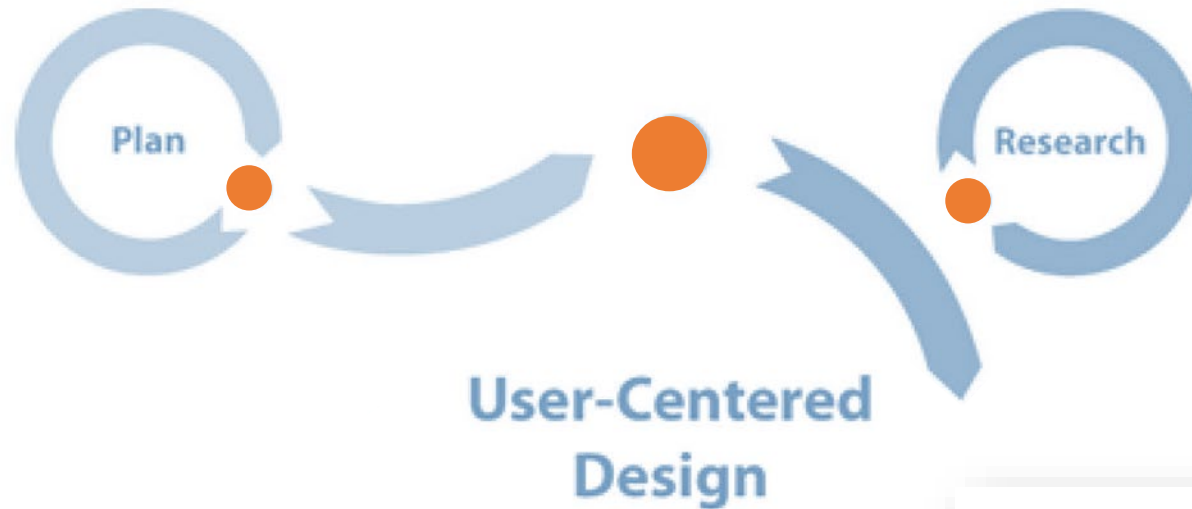
- Increased flexibility
- Quicker and efficient
- Improved collaboration across experts of different fields and stakeholders
- Greater knowledge building
- Meet user needs, focus on User Experience

- Identify key target group
- Competitor analysis

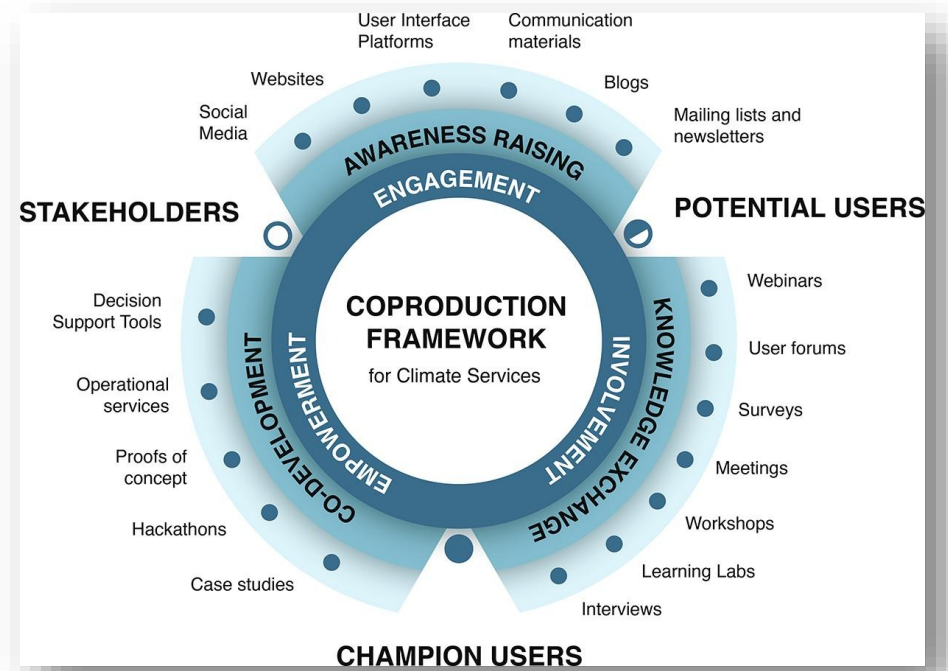


- Engage with users to understand their reported needs and observed behaviour
- Determine use of existing tools

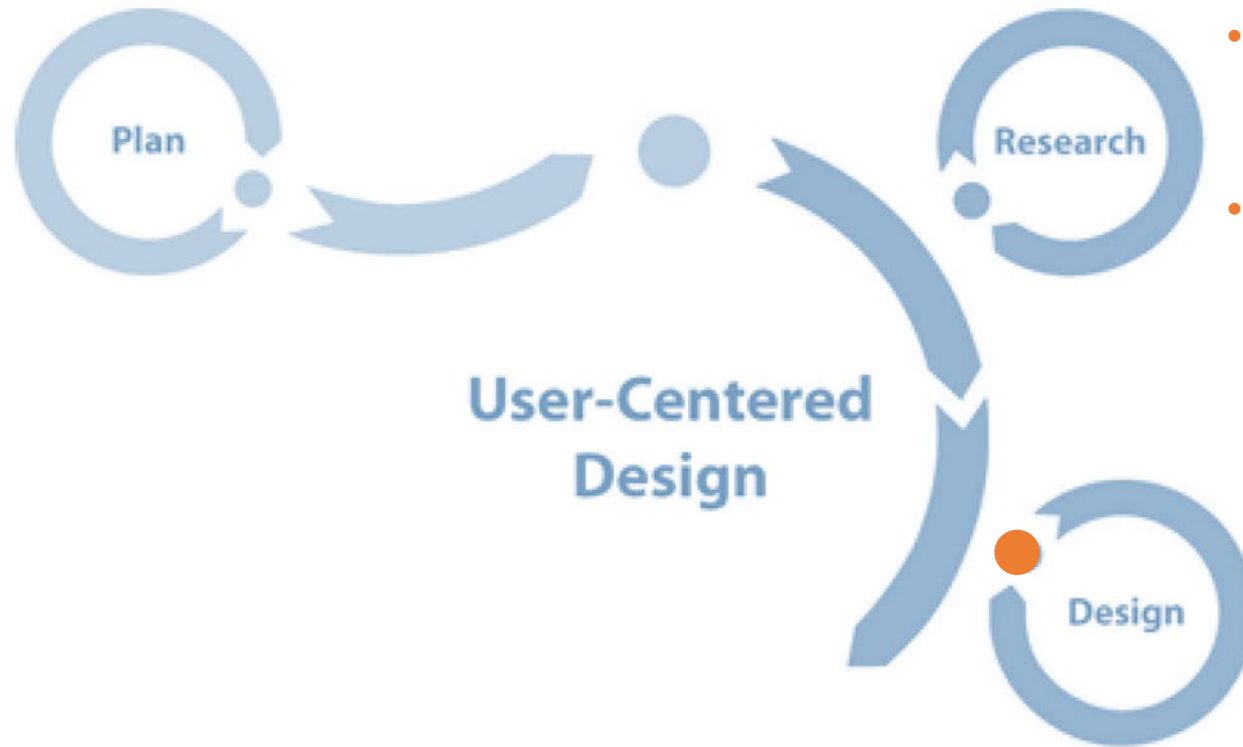
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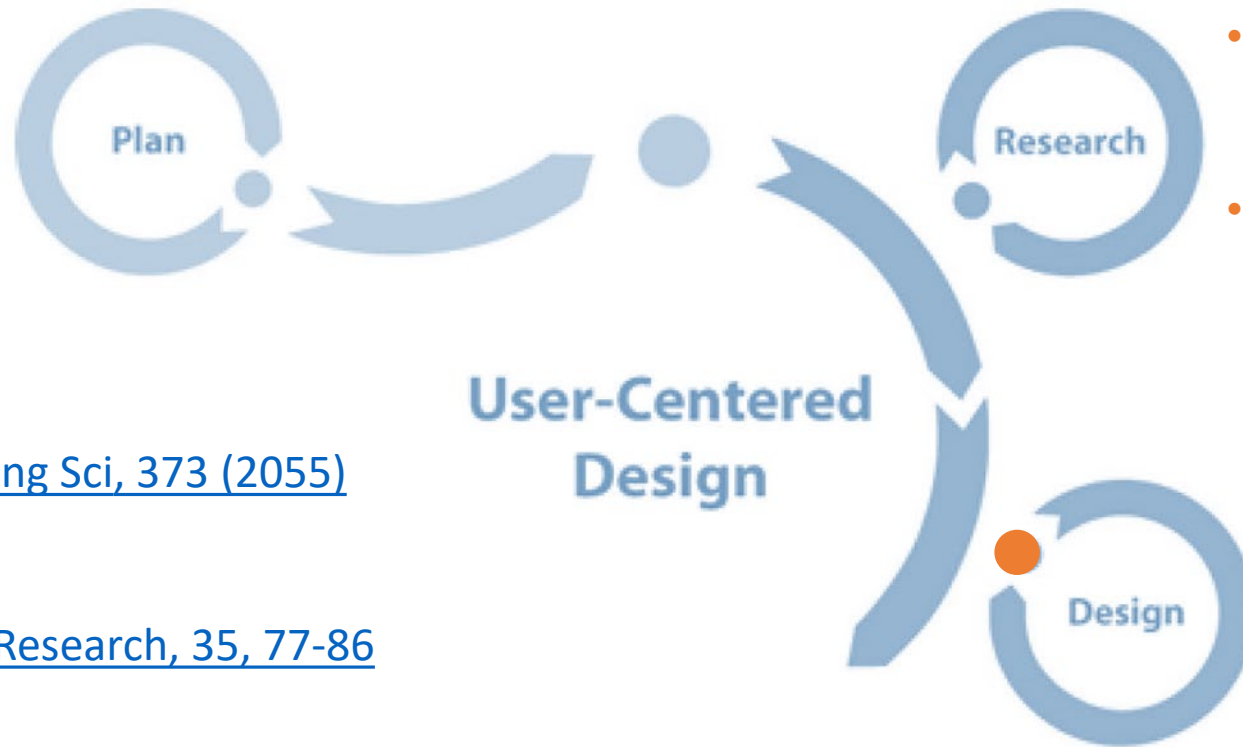
- Identify key target group
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- Engage with users to understand their reported needs and observed behaviour
- Determine use of existing tools

- Data tailoring
- Data visualisation
- Prototyping
- Interaction design

- Identify key target group
- Competitor analysis



- Engage with users to understand their reported needs and observed behaviour
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Uncertainty communication

[Taylor et al. \(2015\)](#)

[Philos Trans A Math Phys Eng Sci, 373 \(2055\)](#)

[Taylor et al. \(2021\)](#)

[Journal of Meteorological Research, 35, 77-86](#)

Service design

[Christel et al. \(2018\) Climate Services, 9, 111-121](#)

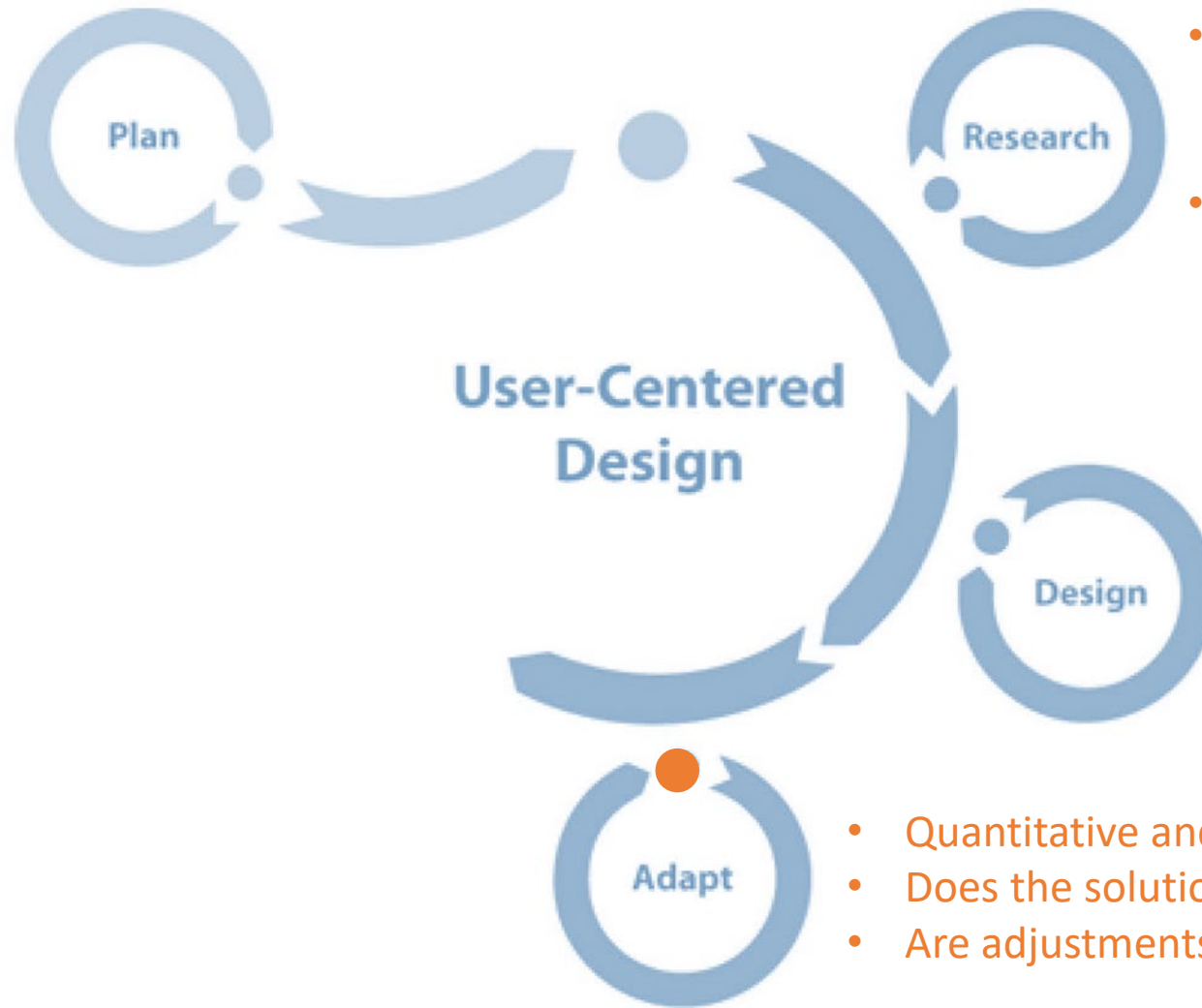
Data visualisation

[inDUST Webinar on Data visualisation tips](#)

<https://youtu.be/yXhRsv0wL4w>



- Identify key target group
- Competitor analysis

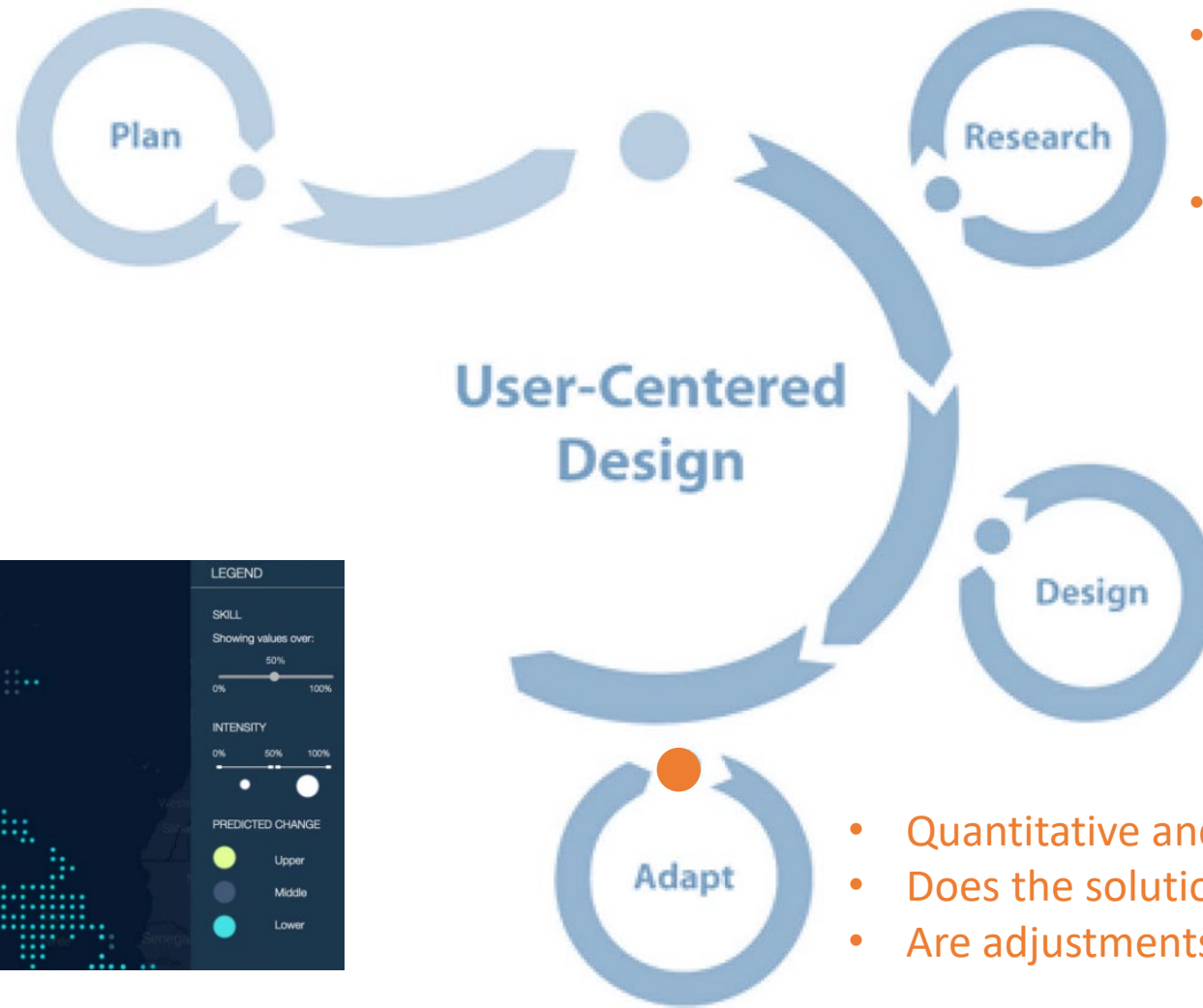


- Engage with users to understand their reported needs and observed behaviour
- Determine use of existing tools

- Data tailoring
- Data visualisation
- Prototyping
- Interaction design

- Quantitative and qualitative prototype testing
- Does the solution solve the user need?
- Are adjustments needed before development?

- Identify key target group
- Competitor analysis



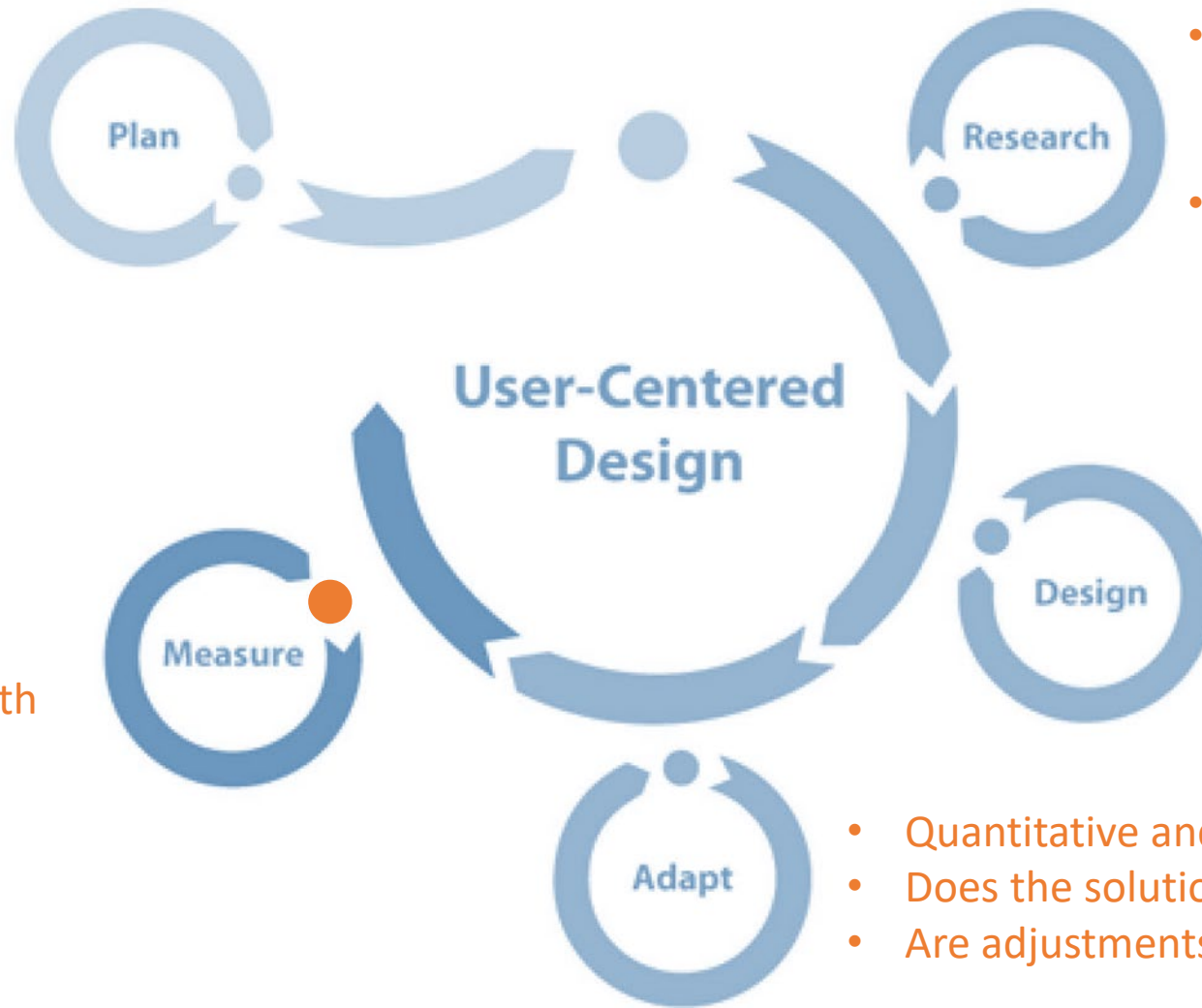
- Engage with users to understand their reported needs and observed behaviour
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- Identify key target group
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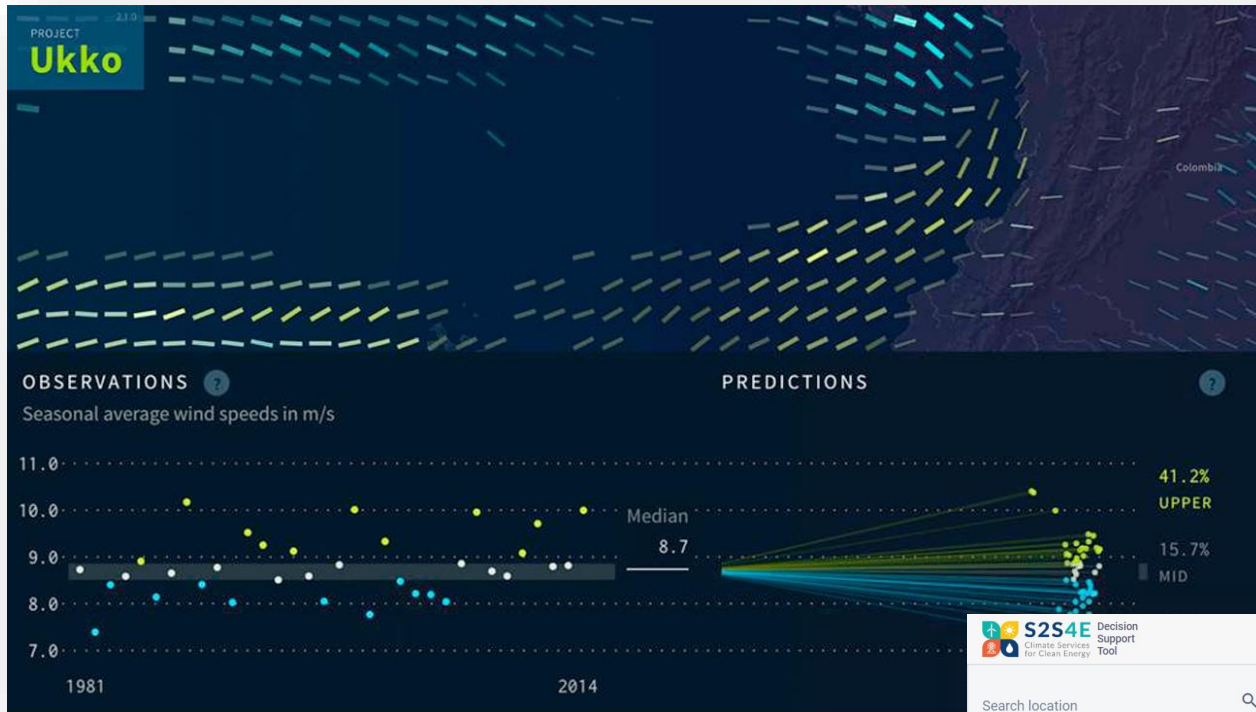


- Engage with users to understand their reported needs and observed behaviour
- Determine use of existing tools

- Evaluate the product experience
- Ensure solution aligns with user requirements

- Data tailoring
- Data visualisation
- Prototyping
- Interaction design

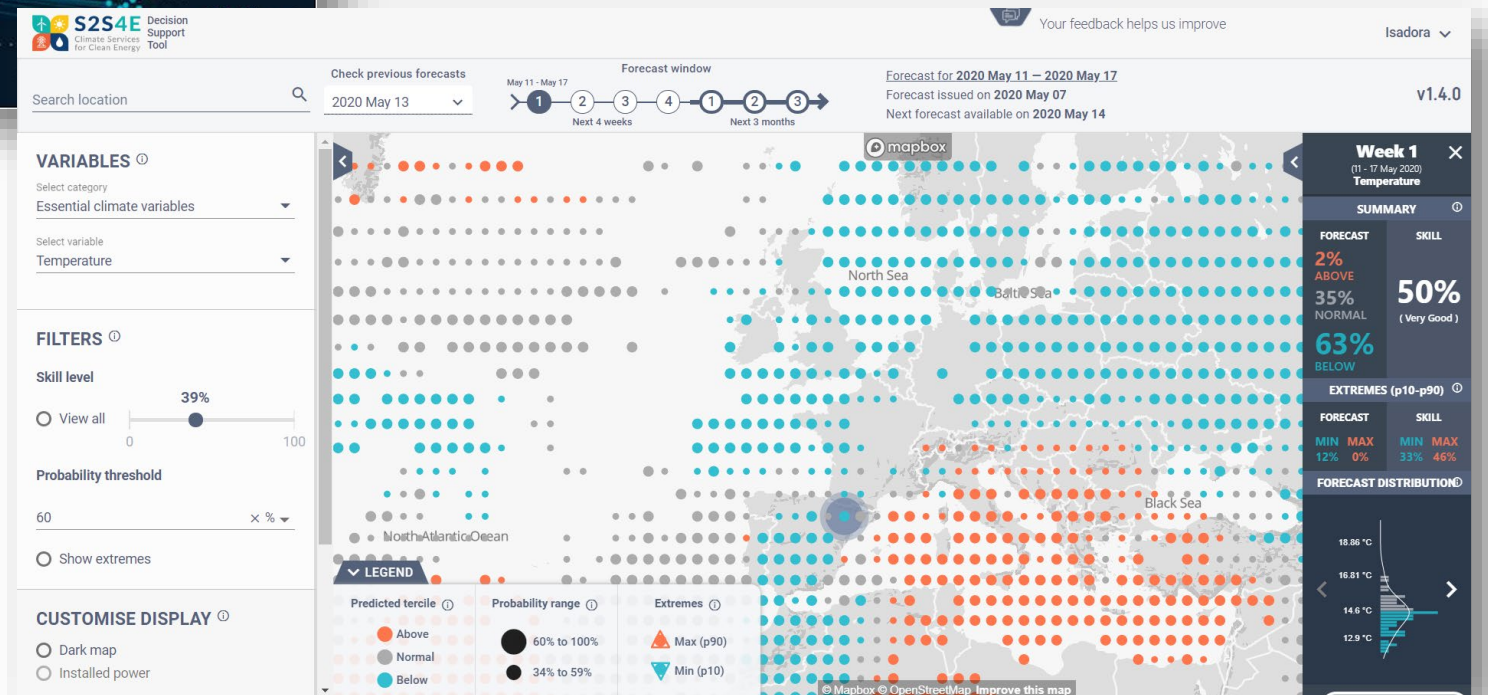
- Quantitative and qualitative prototype testing
- Does the solution solve the user need?
- Are adjustments needed before development?



<https://s2s4e.eu/dst>

<https://project-ukko.net>

EUPORIAS



What happens to the data after they are produced?

Climate services still have a long process ahead

- is time consuming
- needs user engagement all over the process
- requires a transdisciplinary approach



THANK YOU



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