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# Visualisation and communication of probabilistic climate forecasts to renewable-energy policy makers

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Despite the strong dependence on weather and climate variability of the renewable-energy industry, and the existence of several initiatives towards demonstrating the added benefits of integrating probabilistic forecasts into energy decision-making processes, weather and climate forecasts are still under-utilised within the sector. Improved communication is fundamental to stimulate the use of climate forecast information within decision-making processes, in order to adapt to a highly climate dependent renewable-energy industry. This work focuses on improving the visualisation of climate forecast information, paying special attention to seasonal time scales. This activity is central to enhance climate services for renewable energy and to optimise the usefulness and usability of inherently complex climate information. In the realm of the Global Framework for Climate Services (GFCS) initiative, and subsequent European projects: Seasonal-to-Decadal Climate Prediction for the Improvement of European Climate Service (SPECS) and the European Provision of Regional Impacts Assessment in Seasonal and Decadal Timescales (EUPORIAS), this paper investigates the visualisation and communication of seasonal forecasts with regards to their usefulness and usability, to enable the development of a European climate service. The target end user is the group of renewable-energy policy makers, who are central to enhance climate services for the energy industry. The overall objective is to promote the wide-range dissemination and exchange of actionable climate information based on seasonal forecasts from Global Producing Centres (GPCs). It examines the existing main barriers and deficits. Examples of probabilistic climate forecasts from different GPC's are used to make a catalogue of current approaches, to assess their advantages and limitations and, finally, to recommend better alternatives. Interviews have been conducted with renewable-energy stakeholders to receive feedback for the improvement of existing visualisation techniques of forecasts. The overall aim is to establish a communication protocol for the visualisation of probabilistic climate forecasts, which does not currently exist. GPCs show their own probabilistic forecasts with limited consistency in their communication across different centres, which complicates the understanding for the end user. The recommended communication protocol for both the visualisation and description of climate forecasts can help to introduce a standard format and message to end users from several climate-sensitive sectors, such as energy, tourism, agriculture and health.