Offre de stage/ Intership proposal Master 2 (feb.-july 2024)

Weather forecast for sports and outdoor activities: improving our understanding of forecast processes, communication and decision-making

Prévisions météorologiques du temps pour les activités sportives et de plein-air : améliorer notre compréhension des processus de prévision, de communication et de prise de décision

Forecasting the **weather for sport activities and large sport events** (e.g., Olympic Games, Formula One, Tennis tournaments, boat races) poses several challenges for both the weather forecasters and the event organizers. Many sporting events are held outdoors and can be affected by the weather in varied ways, with consequences for athletes, organizers and the public (e.g., change of schedule, cancellation, effect on player's performance and health). Severe weather, in particular, including lightning, high winds, heavy rain and urban flooding, or extreme heat, threatens the safety of athletes and spectators. It is very challenging to predict severe weather precisely in space and time (where and when it will happen) as well as in magnitude (how severe it will be) and in terms of its potential socio-economic consequences (how impactful it might be on people, infrastructure and event organisers).

Weather forecasting is a **complex and challenging task**. It involves processing vast amounts of observational data and outputs from numerical weather prediction (NWP) models and/or artificial intelligence algorithms to predict the evolution of weather in the future. It also requires skills to communicate weather information and inform decision-makers. The weather forecaster, a person who forecasts and interprets the weather, is a meteorologist, who is trained to analyse, contextualise and offer guidance to decision-makers. In the case of sports events, weather forecasters have to deal with the needs for precise information in space for specific sports areas, timely information for a quick assessment of weather conditions, and complete and updated information for the evaluation of weather risk and changing conditions.

During the process of forecasting the weather, **different types of biases and mental shortcuts** may affect the quality of the forecasts delivered, and differences between actual outcomes and previously generated forecasts may occur. Statistical biases occur due to the fact that data and models are not perfect and present errors. They can be adjusted through statistical post-processing (Vannitsem et al., 2021). All humans, including weather forecasters, rely on mental shortcuts (heuristics) when processing and interpreting information, which affect judgments and decisions (Doswell et al., 2004). In addition, forecasters understand that models are imperfect, and they make mental adjustments accordingly based on their extensive experience (Novak et al. 2008; Demuth et al. 2020; Henderson et al. 2022). Understanding what mental shortcuts that forecasters employ, including what potential errors may emerge, can contribute to guiding the improvement of weather forecasts by humans.

Study aim and approach

This internship aims to investigate two aspects related to how weather forecasters deal with high-stakes, spatially localized, large-event venue sports events:

- • Space-time mapping the forecast processes (e.g., tools, organization and planning);
- • Investigating mental shortcuts, including cognitive biases, on forecast communication and decision-support processes.

Research questions:

- What key weather and other "non-weather" factors influence the forecasting and its communication processes in weather forecasting for sports activities (e.g., time pressures, stress

management, asymmetric penalties, recent successes/problems, cognitive and affective heuristics/biases)?
- How predictability limitations and corresponding uncertainty play a role in these processes?

The study will focus on interviews with weather forecasters who have experienced and faced challenges in analysing forecasts and communicating them in a decision process involving sports events (either in France – Météo-France weather forecasters – or abroad, mainly in National Meteorological Services in Europe). Interviews will mainly be online, with face-to-face interviews whenever possible.

More specifically, the candidate will be responsible for the following tasks:

- Literature review on related topics such as: links between weather and sports/outside large-venue events; specificities of weather forecasting for sports/large-venue events; weather forecaster's biases and perceptions; forecasters working under stress and their interaction with users/customers; decision-making processes of games organizers (e.g. how weather forecasts play a role in their decision-making, what other factors play a role).
- Design an interview protocol, and conduct about 20 semi-structured interviews with
  o weather forecasters specialized on forecasting for sports and /or large-venue outdoor activities
  o decision-makers and organizers of sports and /or large-venue outdoor events
- Transcribe and analyse of the interviews
- Report on the findings

Requested qualifications and competences
- 2nd year of Master degree in Social sciences (geography, environmental psychology, decision sciences, etc.), or in Environmental/Atmospheric sciences with experience in qualitative social sciences methods/interview analysis.
- Background or experience on interdisciplinary studies will be particularly appreciated.
- Capable of effectively communicating in spoken and written English and French.
- Autonomy in dealing with external research partners.

References:

Demuth, J. L., et al. (2020). Recommendations for developing useful and usable convection-allowing model ensemble information for NWS forecasters. *Weather and Forecasting*, 35, 1381–1406, https://doi.org/10.1175/WAF-D-19-0108.1

Doswell, C. A. (2004). Weather forecasting by humans—Heuristics and decision making. *Weather and Forecasting*, 19(6), 1115-1126. https://doi.org/10.1175/WAF-821.1

Henderson, J., J. Spinney, and J.L. Demuth (2023). Conceptualizing confidence: a multisited qualitative analysis in a severe weather context. *Bulletin of the American Meteorological Society (BAMS),* 104(2), E459–E479.

Novak, D. R., D. R. Bright, and M. J. Brennan, 2008: Operational forecaster uncertainty needs and future roles. *Weather and Forecasting*, 23, 1069–1084, https://doi.org/10.1175/2008WAF2222142.1

Vannitsem, S. et al. (2021). Statistical Postprocessing for Weather Forecasts Review, Challenges, and Avenues in a Big Data World. *BAMS Essay*, 102 (3), E681–E699, https://doi.org/10.1175/BAMS-D-19-0308.1

Research environment

Advisors
- Isabelle Ruin (Social geographer, CNRS, IGE, Grenoble; isabelle.ruin@univ-grenoble-alpes.fr)
- Paul Abeillé (Météo-France Sports, Lyon, paul.abeille@meteo.fr).

The work will directly contribute to the Paris Olympics 2024 Research Demonstration Project (RDP): https://www.umr-cnrm.fr/RDP_Paris2024: the RDP is endorsed by the World Weather Research Program of the World Meteorological Organization (WMO), the special agency of the United Nations for weather,

climate and water. It is also supported by the WMO GURME (Global Atmospheric Watch Urban Research Meteorology and Environment) project.

In addition, the intern will work in close collaboration with French and international partners directly involved in this subject proposal: Julie Demuth (National Center for Atmospheric Research, NCAR, USA; https://staff.ucar.edu/users/jdemuth), Brian Golding (UK MetOffice; https://www.metoffice.gov.uk/research/people/brian-golding) and Maria-Helena Ramos (INRAE, Antony; https://webgr.inrae.fr/en/people/current-staff/).

The retained candidate will be entitled to a monthly allowance according to the French Labour Code (about 600 €/month)

The internship should be carried out within a maximum period of six months, between February 2024 and August 2024.

Location
Institute of Environmental Geosciences (IGE)
Maison Climat Planète, 70 rue de la physique, Domaine universitaire 38 400 St Martin d'Hères

How to apply

Interested candidates should send their **CV and motivation letter, and a reference** and their contact details (e.g. a professor or past internship supervisor) by email to: isabelle.ruin@univ-grenoble-alpes.fr ; paul.abeille@meteo.fr ; maria-helena.ramos@inrae.fr

Deadline for applications: 15/11/2023 (applications will be reviewed on a rolling basis)