Introduction

The conclusions of the Sixth Assessment Report (AR6) issued by the Intergovernmental Panel on Climate Change (IPCC) warn that reaching net zero greenhouse gas emissions by 2050 is now “too little too late”, meaning that it will not achieve the long-term temperature goals identified in the Paris Agreement to limit global warming to 1.5°C by the end of the century. The main findings are consistent with the Fifth Assessment Report (AR5), but further highlighting the urgency of achieving carbon neutrality while also adapting to the many unavoidable effects of climate change. In New Zealand, the National Climate Change Risk Assessment conducted in 2020 identified priority climate change-related hazards for present day, 2050 and 2100 and highlighted identified 43 priority risk across five domains and 10 most significant risks.

Climate risk is typically considered in two categories: physical risk and transitional risk. Reporting requirements for climate-related financial disclosure were proposed by New Zealand Ministry for the Environment and the Ministry of Business, Innovation and Employment (MfE, 2019)[1]. The Task Force on Climate-Related Financial Disclosures recommends consideration of macroeconomic shocks or financial losses caused by storms, droughts, wildfires and other extreme events, or by changing weather patterns over time. However, currently this is not often seen in organizational climate risk assessments except by the insurance industry. The complexity in determining climate-related physical risk is significant. Identifying consistent and accurate climate risk is necessary to inform disclosure.

While significant advancements have been made, forecasting short range (days-week-months-years) climate-enhanced extreme weather events is still a gap in traditional natural hazard and climate risk assessments. The need for improved weather and climate forecasting to inform multiple hazard risk assessment and subsequently evidence-based decision making has never been stronger. Seamless integration of weather and climate information for risk assessment is critical as the climate’s atmospheric and oceanic motions and the extreme weather they can generate are interconnected[2]. The potential increase in occurrence and intensity of extreme

weather events as a result of climate change and the increasing population in vulnerable areas only reinforces this need.

Forecasting the impacts of short-, medium- and long-term climate variability and their relationship to extreme weather events would provide forward-looking, decision-useful information that can be included in risk planning and management.

Seamless integration of weather and climate information for risk assessment

Over the last 20 years, Tonkin + Taylor conducted impact assessment for weather and climate information and designed early warning systems for multiple hazards. In this work, it became evident that information about future hazard over different time scales (days, weeks, months, years, decades and over 100 years) is key for risk-based decision making. Integrating weather and climate predictions into the risk assessment framework would provide different time scales risk assessment for appropriate actions.

The benefits of seamless hydrometeorological predictions are well tested in many parts of the world and currently under research (Wetterhall et al., 2018; Fakhruddin et al., 2021) (Figure 1). A framework for integrated, system-based climate risk evaluation is needed and may be developed by collaboration of scientists and experts from climate and meteorology fields.

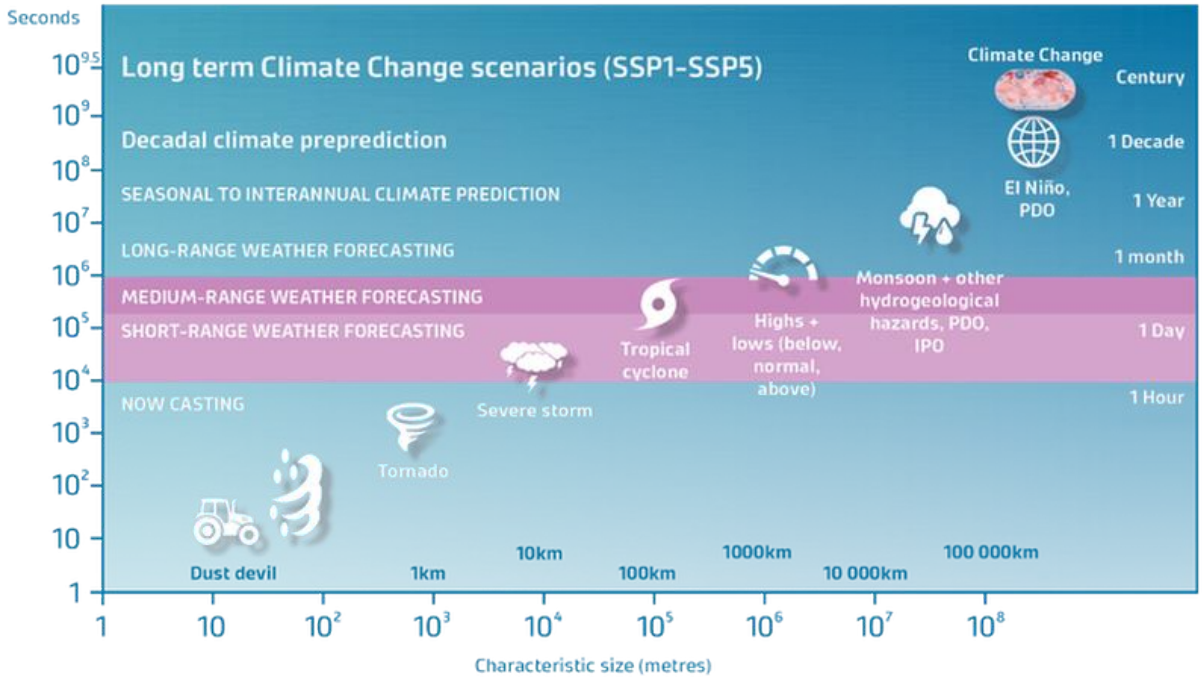

Figure 1: Range and scale of natural hazards due to climate change (Modified from WMO, 2015)

Our future expectations

The world is moving to Fifth Industrial Revolution, a new Renaissance Age (WEF, 2019). Our technology is moving rapidly to ensure creativity and common purpose to use for open access and FAIR (i.e., findable, accessible, inter-operable and re-usable) principles. New Zealand communities have long been waiting to see an inter-operable, open access, transparent, intuitive, flexible, collaborative, reliable, expert supported, secure, open sourced, fast and user-friendly visual platform for risk assessment. RiskScape 2.0 is such a risk modelling tool under development and could support impacts from natural hazards and climate change (GNS, 2020).

A collaborative platform to understand climate change and weather impacts is essential for climate intelligence. This kind of platform could draw from multiple data-driven computational models for different timescales (hours, days, weeks, months, years, decades and century). These computational models are based on local, regional and global climate and weather prediction model data, linked to exposure and vulnerability. A seamless integration of weather and climate products – short-range, medium-range and long-range forecasting - can better support the decision-making process for users by helping them understand the short-, medium- and long-range risks and uncertainties. This platform could target climate related hazard forecasting and scenario-based analytics for wider climate drivers. Additionally, the platform would be developed with consideration for future integration of broader risk and financial and assets modelling, for the purpose of climate-related financial disclosure reporting. Figure 2 shows the conceptual framework for seamless integration of climate and weather information to generate foreseeable future risk information for client decision making.

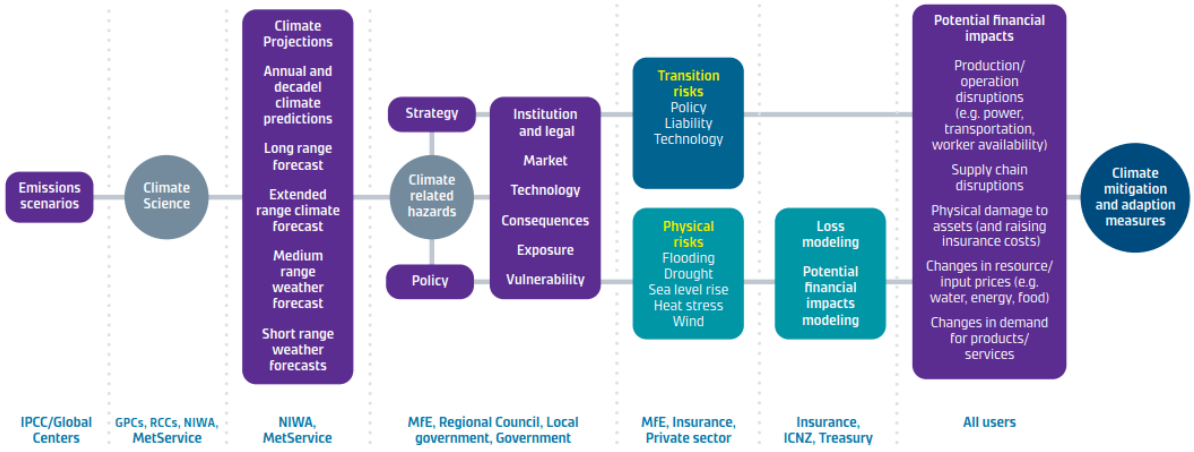

Figure 2: Climate science and risk evaluation for a foreseeable future (T+T, 2020, adopted based on UNEP FI, 2020)

As climate risk evaluation contains inherent uncertainty, reviewing data on varying timescales provides refinement of decision making. The system could be called a “system of a systems”, where end-user feedback is critical as are mechanisms to incorporate feedback into the system to continuously improve the need-based information for specific users.

Conclusions

The importance of accurate and timely weather and climate data for decision making increases. At the same time, different climate change impacts do not occur in isolation. Therefore, disaster and climate action plans must be organised to manage concurrent disaster risk and their compounding and cascading impacts. An integrated weather and climate platform could provide seamless climate induced hazards and risk scenarios based on various temporal scales and their associated uncertainty in the information. This climate change intelligence, combined with hazards assessment, would provide scenario-based risk assessment options for decision making for various climate risks including extreme weather events. Improved understanding of physical risks relating to climate change could provide greater detail for climate change risk assessments and support an impact assessment of the core elements of a recommended climate-related financial disclosure (governance, strategy, risk management, and metrics and targets). This platform is the first step towards achieving a collaborative platform for a financial and physical impact assessment that could provide high-quality, scenario-based consistent reporting in New Zealand.

The national and regional climate risk assessment in New Zealand and the IPCC AR6 have given us a fair warning of what is to come. It is now up to us to boldly embark on a visionary re-think and re-design of our future. We have a once-in-a-lifetime opportunity to re-imagine and build a climate-ready and resilient world. Squandering this has unthinkable consequences.

Footnotes

[1] Disclosure could likely apply to listed issuers, banks, general insurers, asset owners, all local government organisations, lifeline utility providers and asset managers.

[2] The interaction of climate and weather is demonstrated by an atmospheric-oceanic phenomenon that affects weather worldwide, the El Niño Southern Oscillation (ENSO). The atmospheric motions are also interconnected and nearly continuous: a small-scale atmospheric motion can band together to create larger-scale systems (e.g., convective storms could cause floods, droughts, storms and wildfires).

References

Fakhruddin Bapon, Peter Gluckman, Anne Bardsley, Georgina Griffiths, Andrew McElroy (2021). Creating resilient communities with medium-range hazard warning systems. Progress in Disaster Science, 2021

GNS (2020). User requirements of RiskScape2.0 software and opportunities for disaster risk research in Aotearoa- New Zealand

MfE (2019). Ministry for the Environment & Ministry of Business, Innovation & Employment. 2019. Climate-related financial disclosures – Understanding your business risks and opportunities related to climate change: Discussion document. Wellington: Ministry for the Environment.

NCCRA (2000). First national climate change risk assessment for New Zealand. https://www.mfe.govt.nz/climate-change/assessing-climate-change-risk

NCCRF (2019). Arotakenga Huringa Āhuarangi: A Framework for The National Climate Change Risk Assessment for Aotearoa New Zealand. https://www.beehive.govt.nz/sites/default/files/2019-09/National%20Climate%20Change%20Risk%20Assessment%20Framework%20.pdf

Wetterhall, F. and Di Giuseppe, F. (2018). The benefit of seamless forecasts for hydrological predictions over Europe, Hydrol. Earth Syst. Sci., 22, 3409–3420, https://doi.org/10.5194/hess-22-3409-2018.