House of Commons Science and Technology Committee inquiry into the Science in the Met Office.

Response from the National Oceanography Centre, September 2011

1.0 About us:

The National Oceanography Centre www.noc.ac.uk was formed on 1 April 2010 by bringing together into a single institution the Natural Environment Research Council's activity at the National Oceanography Centre, Southampton (NOCS) and the Proudman Oceanographic Laboratory (POL) in Liverpool. The NOC works in close partnership with the wider marine science community to create an integrated research capability. Research priorities include the oceans' role in climate change, sea level change and the future of the Arctic Ocean.

2.0 Declaration of interests

The National Oceanography Centre (NOC) and our parent body, the Natural Environment Research Council (NERC), have a long-standing close scientific collaboration with the Met Office including secondment of staff, research contracts, shared ocean and atmospheric modelling activity and joint location of facilities, for example the Met Office ocean scientific moorings team and specialist facility is based at the National Oceanography Centre in Southampton. This team is responsible for a network of marine observing equipment, including nine moored buoys which provide early warning of severe weather conditions, and technical support for drifting buoys and Argo float deployments. The team have collaborated with NOC scientists participating in the Rapid Climate Change and Porcupine Abyssal Plain observatory programmes. In addition, Professor Julia Slingo is a member of the NOC Advisory Council, and NOC director Professor Ed Hill had a reciprocal role at the Met Office Hadley Centre.

3.0 Responses to questions raised by the Committee:

3.1. How effectively is the Met Office fulfilling its Public Weather Service remit?

3.1.1 The Met Office is certainly able to produce short-range weather forecasts of sufficient accuracy for "the UK public to make informed decisions about day-to-day activities". It is able to warn people and organisations about extreme weather with adequate warning to protect life, property and infrastructure. It is only able to do this through continued access to high quality staff, computing infrastructure, and observations from a wide array of platforms and sensors located in space, the atmosphere, the sea surface and below the sea surface (i.e. the 'Argo' network). Many of these platforms are expensive to buy and operate, but the value of the lives and infrastructure that they protect – a single example would be by providing warning of storm surges for London – vastly exceeds the cost of acquiring data. See for example:
http://www.nerc.ac.uk/using/casestudies/documents/storm-surge-report.pdf

3.1.2 Improved fine-scale modelling and understanding of fundamental processes should lead to enhanced accuracy and robustness of regional forecasts. This should benefit the insurance and re-insurance industries who need probabilities of extreme events for their insured losses on timescales of 1 to 2 years ahead. There is a common public perception, however, that the Met Office does not provide reliable *seasonal* forecasts, largely due to sensationalist media reporting and shortcomings in how 'probability' and 'risk' are understood by non-experts. However in contrast to this public perception, significant spending decisions are made based on seasonal forecasts, ranging from a farmer's choice of crop to major construction projects. Private weather forecasting companies are now often called upon to make these seasonal predictions, suggesting that this is an aspect of the Public Weather Service remit where the Met Office service could be improved. The accuracy of forecasts by these private companies needs to be carefully evaluated on a long-term basis. On individual occasions it is quite likely that a private forecaster may outperform the Met Office. Also, the accuracy of the Met Office forecasts should be compared with other national weather agencies. There is also the problem of communicating the forecast. Most of the public perception is via TV broadcasts but the time available for the information to be presented has been shortened. However, more detailed information is available than used to be the case, so the forecasters and weather presenters have difficult choices to make about what to concentrate on.

3.1.3 The Met Office is demonstrating steady improvement in weather and climate predictions through research. For example the improved understanding of the location and duration of slow-moving heavy precipitation events, or intense rainfall from convective rainstorms such as Boscastle, is a result of improved modelling skill, the use of ensemble short-term predictive systems, and investment in supercomputing infrastructure.

3.1.4 Access to historical weather information is good, with straightforward access via the web portal. The Met Office website also provides a large amount of useful information on daily weather with the ability to select specific regions of the UK. Attempts should be made to widen its use among the general public; it contains much more information than the BBC.

3.2. Is the Met Office's Science Strategy 2010-15 robust and achievable and how will the strategy help to deliver a better service?

3.2.1 The Met Office Science Strategy 2010-2015 is a comprehensive, robust and achievable strategy that is welcomed by the science community at the National Oceanography Centre. The proposed four main priorities of Forecasting Hazardous Weather from Hours to Decades; Water Cycle and Quantitative Precipitation Forecasting; Monthly to Decadal Prediction in a Changing Climate; and Sensitivity of the Earth system to Human Activities provide a wide spectrum of research expertise to meet the challenges faced by the UK and the rest of the world through the 21st Century.

3.2.2 The Strategy recognises that the separation between weather and climate research is no longer required and that there is a need for a seamless approach to modelling and prediction. The proposed new structure for delivering Met Office research and development will encourage joined-up working across all weather/climate scales and should foster a closer research partnership with the very capable UK and international research community that is located outside the Met Office, bringing all-round benefit.

3.2.3 The Strategy is underpinned by the emergent Met Office-NERC strategy on Earth System Modelling which is being delivered through the Joint Weather and Climate Research Programme (JWCRP). This is a strategic partnership which is fostering much closer working relationships between NERC and Met Office scientists in building improved models to focus on climate change predictions on timescales of up to centuries. Similar links exist through the NCOF (National Centre for Ocean Forecasting) partnership (also part of JWCRP) which focuses on improved ocean forecasts on timescales upwards of a few days. By strengthening links with the NERC community in these ways, the robustness and achievability of the Met Office strategy is enhanced, as are the resulting services from their forecasting systems.

3.2.4 Access to core scientific expertise will be necessary across organisational boundaries and the Strategy advocates expanding the successful partnership with NERC on the Joint Weather and Climate Research Programme and sees the Met Office playing a key role within the Living With Environmental Change programme. The proposed three Directorates (Climate Science, Foundation Science and Weather Science) lend themselves well to cross-organisational working and collaboration. It is further noted that even though Climate Science and Weather Science are separate Directorates, they are working towards an integrated approach through their adoption of the seamless modelling strategy, in which a traceable hierarchy of related modelling systems will span all relevant time and space scales.

3.2.5 NOC welcomes the proposals to:

- Bring together a more structured approach to partnerships with Unified Model users.
- Strengthen and extend the Joint Weather and Climate Research Programme with NERC.
- Develop a more effective relationship with the Research Councils and the LWEC programme.

3.2.6 We particularly welcome the establishment of a Met Office Academic Partnership Scheme and the establishment of Met Office Industrial Fellowships.

3.2.7 Under section 6 of the Strategy the proposals to encourage retention and development of scientists by allowing more opportunities for advancement, creativity and innovation are very positive.

3.2.8 The ‘Expert Scientist’ and ‘Research Fellow’ roles will provide excellent opportunities for collaboration with the wider research community, though suitable financial arrangements will need to be set up to allow the interaction to take place. University and Research Council scientists are already heavily committed and assigned to costed research programmes so formal partnerships and collaborations with the Met Office will have to be paid for somehow.

3.2.9 The recommendation to provide more opportunities for Continued Professional Development is important.

3.2.10 We agree with the need to develop a much stronger capability in computational science and software development. The multi-core, massively parallel petascale computers require a very large investment in resources to achieve their full potential. NERC centres are well placed to work with the Met Office to help address this resource requirement.

3.2.11 Supercomputing is a fundamental requirement for understanding ocean and atmospheric processes and will require continued funding, collaboration and ‘joined-up’ working to maximise potential.

3.2.12 Observations are critical for advancing and testing the models and theoretical understanding the ocean-earth-cryosphere-atmosphere system. The marine science community relies upon in-situ observations from above, afloat and below the sea surface, and this requires platforms such as satellites, aircraft, ships, buoys and autonomous floats such as the ‘Argo’ profilers. The Strategy recognises these needs.

3.2.13 Space borne Earth Observation is tremendously important to marine scientists to ‘fill-in the gaps’ in observations of the sea surface and increasingly to enable the full range of air-sea surface interactions to be measured. We look forward to working more closely with the Met Office, including through the Global Monitoring for Environmental Security (GMES) programme, to see investment in new instrumentation and platforms, and to ensuring delivery of an operational product through calibration and validation. NERC and the Met Office worked together in successful advocacy for UK participation in the Jason-2 and -3 altimetric satellite missions.

3.2.14 The Met Office has an important role to play in International leadership, including continued support of the IPCC, WWRP and WCRP. The National Oceanography Centre will welcome a strong lead from the Met Office in the relevant international fora.

3.2.15 Communicating science enables policy makers and the public to act upon the knowledge gained by scientists and address the challenges that face the UK and the world in a century that promises to show the impacts of climate change, reduced fresh water availability, growing human population, changes to land use and many other parameters that require active management, stewardship and adaptation. These are highly political issues. Communicating the underpinning science, with its associate uncertainties, to

policymakers and the general public requires particular approaches and skills that have not historically been part of the scientist's toolkit.
The Met Office Strategy recognises that staff will need training to become better communicators and that there must be openness and transparency on research, methods and data.

3.3. What are the roles of the Met Office's Chief Scientific Adviser and its other senior scientists? How do they provide comprehensive and up-to-date scientific advice?

The main roles of the Met Office Chief Scientist and other senior scientists are to take a strategic overview of, and to coordinate and rationalise, the scientific activity of the Met Office. The Chief Scientist has a deep and extensive knowledge of both the Met Office and external UK research capabilities and systems, and is widely acknowledged as an international expert in her scientific fields. Other senior scientists are similarly highly regarded in their fields, and have an extensive knowledge of Met Office capabilities, and a growing appreciation of the skill base in the external UK community (e.g. through interaction with NERC in the JWCRP programme and in the delivery of NERC's strategy through the development of Thematic Action Plans). They are therefore in a strong position to provide robust and sound advice to HMG, UK and international scientific institutions, and the IPCC assessment process.

3.4. How robust are the models used by the Met Office for weather forecasting, climate predictions, atmospheric dispersion and other activities?

Historically, the Met Office have been viewed as somewhat insular. However, the situation is now much improved through the adoption of common modelling systems and approaches, shared with the external (RC, UK Academic, and European) research community. Specifically, NERC and the Met Office now share a common computational platform, MONSooN, which is greatly aiding collaboration with the external community, and pull through of research from the external community to the Met Office. Furthermore, the Met Office and NERC have adopted a common ocean modelling system, NEMO, and have formed a strategic partnership to develop and utilise this model within the JWCRP framework. A common UK configuration of NEMO has been adopted by NERC and the Met Office, implemented on MONSooN, jointly analysed by the two groups, and now forms the backbone ocean model in use in the Met Office systems today. The work programme is overseen by a joint management committee. In addition, both the Met Office and NERC are partners in the international NEMO consortium for the wider development of the NEMO ocean model. Through such increased and effective collaboration with the external community, the robustness of the Met Office ocean modelling systems is now excellent, with NEMO providing a world-leading system.

3.5. How effectively does the Met Office coordinate its activities with government departments, non-departmental public bodies, the UK research base and its international counterparts?

3.5.1 Within the marine research community the Met Office is represented by a senior scientist on the government's Marine Science Co-ordination Committee and participates in work packages such as science alignment and the co-ordination of long-term marine observations. The Met Office contributes to the work of the Environmental Research Funder's Forum, and the Ocean Processes Evidence Group.

3.5.2 The Met Office is represented by a senior scientist as part of the UK delegation to the Intergovernmental Oceanographic Commission of UNESCO, and has contributed substantial technical expertise to component programmes such as GOOS (the Global Ocean Observing System), JCOMM (the Joint IOC/WMO Commission on Oceanography and Marine Meteorology) and tsunami warning systems. The possibility that a tsunami warning system capability might be incorporated into the Joint Flood Forecasting Centre operated by the Met Office and the Environment Agency is being explored.

3.5.3 The Met Office has a close working relationship with the Natural Environment Research Council through the Joint Weather and Climate Research Programme (as already indicated in 3.4 for ocean modelling) and is increasingly playing a key role in the cross-Government, cross-Research Council programme on 'Living with Environmental Change' (LWEC). In addition the Met Office works closely with the UK marine research community in many other areas, including the National Centre for Ocean Forecasting, national capability in deep water moorings, technology development, the training of PhD students and seminar programmes. However we would welcome a more joined-up collaboration with the Met Office in the area of future sea-level rise research.

3.5.4 There is frequent interaction and exchange of staff between the Met Office and the Research Council and University research sectors, with scientists passing between employers and transferring ideas and skills. Under the proposed Met Office science strategy these links will be strengthened, and Met Office scientists afforded the opportunity to enjoy university-style freedom to undertake curiosity-driven research for up to 20% of their time. This will very much strengthen the science base of the Met Office and make it a much more attractive employer to the brightest Post-doctoral researchers. However, it seems doubtful that this opportunity could be afforded to all Met Office scientists.

3.5.5 In general some parts of the Met Office such as the Hadley Centre work much more closely with the outside world than the core part of the Met Office, which partly explains the international recognition accorded to the Hadley Centre. Under the proposed science strategy the alignment of weather and climate research should enable the Met Office to become more outward-focussed and better able to interact with a wider community.

3.5.6 Since its inception in 2000, the UK contribution to the Argo profiling float programme has been managed by the Met Office with strong support from NOC (Southampton and Liverpool). This function has been carried out successfully against a background of perpetual funding uncertainties. The Met Office has also been active in the international coordination of Argo.

3.5.7 The move of the Met Office into BIS, home of the Research Councils, should also facilitate an enhanced interaction with a wider community.

This submission on behalf of the National Oceanography Centre prepared by Stephen Hall sph@noc.ac.uk with input from : Adrian New, Andrew Willmott, Kevin Horsborough, Jacky Wood and Trevor Guymer