

## 3. ASSESSMENT OF THE CLUSTER CLIMATE, WATER & SOCIETY

### 3.1. Organisation

The following chair groups are involved in the cluster Climate, Water & Society (CWS):

- Aquatic Ecology and Water Quality
- Environmental Systems Analysis
- Hydrology and Quantitative Water Management
- Meteorology and Air Quality
- Water Resources Management
- Water Systems and Global Change

In total, the cluster contains 107 academic staff members (in fte's), of whom 69 are PhD candidates and 18 are postdoctoral researchers.

### 3.2. Aims and strategy

The CWS cluster studies environmental systems, with a focus on addressing challenges related to water and climate. Its mission is to improve our understanding and ability to represent natural and human dimensions of climate and water resources in a changing global environment. The cluster intends to reach this understanding by excellent monodisciplinary research in the atmospheric, hydrological and ecological sciences combined with innovative multidisciplinary, interdisciplinary and transdisciplinary approaches to climate, water and society. The cluster's strength is a team of excellent scientists with complementary expertise. For the future, it aims to improve the inter- and transdisciplinary collaborations within the cluster, to create more synergy. Also, by integrating the work of different groups, the cluster will be even better suited to respond to society's demand for knowledge-based adaptation to meteorological and hydrological extremes.

The committee found that the CWS cluster is a diverse cluster with a broad scientific focus and a mission that is well-aligned with the overall WIMEK mission to address Grand Environmental Challenges. The cluster has a lot to offer, and its expertise is very topical. However, the committee found that the cluster's vision on where it wants to be in – say – six years is not fully articulated yet, beyond consolidation and improvement on weaknesses. The committee recommends CWS to embark on a focused effort to make such a vision more concrete. The cluster could reflect on how the diversity of expertise within the cluster can be used to tap into the many promising opportunities, in particular the scientific and societal need for well-funded information, solutions and services to adapt to a changing climate and water situation. Subsequently, the cluster could determine what combinations of expertise are necessary to perform cutting-edge research with regard to these challenges. When crafting such a vision for the future, the committee encourages the cluster to look broader than just the water topic. It should definitely take into account the great expertise it has on for instance climate, energy storage systems, biodiversity, and pollution.

### 3.3. Research Quality

The committee has established that the research quality of the CWS cluster is of an excellent level. CWS has published over 1900 publications in peer reviewed scientific journals in the past six years, including well-known journals such as *Science*, *Nature* and *PNAS*. Peers within the field often use the results generated by CWS, indicated by a high number of citations of CWS work in peer reviewed journals, exceeding averages in the field. The committee was impressed by the quality of the examples of publications CWS provided in the self-evaluation report. Prestigious personal grants, for instance from the European Research Council, and in particular a high number of early-career grants also bear witness to the appreciation of the research. In addition, the cluster has an outstanding track record in acquiring research grants from a variety of funding sources, such as NWO and KNAW, but also the European Research Council, ministries and charity organisations. All of this underscores the very high quality of research, an excellence that can be found in all chair groups of the CWS cluster. The committee found the case studies presented



in the self-evaluation and during the online site visit convincing. They describe interesting and important topics, to which different chair groups can contribute. As an example, the fine-scale simulation of evaporation which used a large eddy simulation to link the atmospheric hydrological cycle to water and landscape management, as presented during the online site visit, was very inspiring. It could open up new insights in how climate adaptation may work on landscape scales. The committee wholeheartedly considers this kind of projects as top science. In the face of this broad acknowledgement of its qualities, the committee thinks the CWS cluster may act even more boldly, and not shy away from international ambitions. The cluster could for instance make more contributions to international assessments and research projects, and strive to become a knowledge hub for climate solutions.

It struck the committee that many of the most influential publications are about transdisciplinary topics, such as climate and food system emissions, the meteorological mechanisms leading to droughts, and relationships between CO<sub>2</sub> emissions and plant drought resilience. It is therefore not surprising that the cluster strives to increase collaboration between groups, and the committee fully endorses this ambition. The cluster is already very multidisciplinary and there is excellent evidence of working across disciplines within specific topics. This strength should be utilised even more. Also, while there are of course many disciplinary research topics that need further improvement, the high societal and scientific impact is increasingly moving towards inter- and transdisciplinary research. Given the complexity of global change across temporal and spatial scales as well as the interplay between the biophysical and social dimension, integrated research fields are of high importance and increasingly requested by society. For that reason, the committee sees great chances for the multidisciplinary research of CWS. This is particularly the case for climate and ecosystem services and landscape management, using models and observations to assess impact of global challenges on human well-being in the future.

Since CWS is a broad and large cluster, with many chair groups that are already very successful, and all have their own national and international networks, it has a long-standing history of successful but rather parallel activities. Encouraging collaboration in such a structure is a challenge. The CWS cluster has already put some mechanisms in place (or planned) to foster collaborations, such as the CWS strategy day (which was held only once so far but should definitely be repeated in some form or other, according to the committee), and planned PhD days and symposia around cross-cutting themes. Also, several promising themes have been identified for collaboration across the cluster, but also with other clusters. These themes could possibly be implemented as research lines, as is done in the Soil Sciences cluster. At the same time, the excellent monodisciplinary work in for instance atmospheric, hydrological and ecological science should definitely be continued. Also, the cluster understandably does not aim at growing boundlessly, since it is already large. This means that the biggest challenge for the CWS cluster is to set priorities. In order to do this systematically and effectively, the ambitions and strategy at the cluster level should be more clearly specified, as stated above. This means determining what the cluster wants to achieve, and what the criteria are for measuring success and achievements. It may also help, according to the committee, to define stakeholder groups and processes more distinctly, and to develop a strategy for interactions at the science-policy interface. This will lead to trans- or interdisciplinarity in a natural way. In the same spirit, the committee thinks that more exchange and collaboration with the cluster Landscape Architecture and Spatial Planning, for instance on some pioneering demo projects could be useful.

In its discussion with PhD candidates, the committee heard that they still signal a lack of mechanisms to stimulate interdisciplinarity. The committee therefore recommends giving high priority to organizing the planned cross-disciplinary PhD activities. It also applauds the initiative to hire a staff member dedicated to improving funding for interdisciplinary research projects. It encourages joint proposal writing and joint PhD training across chair groups, as suggested in the self-evaluation report.

The committee is under the impression that the body of research and the narrative in the self-evaluation report do not quite live up to the cluster's name in a balanced way. There seems to be a strong focus on water. The societal dimension is prominent in the mission, but weaker in the actual research activities and not entirely integrated. The committee recommends addressing this component more, by integrating social science and even humanities into



the natural and life sciences. This will address the increasing demand for an integrated analysis of physical and socio-economic or societal issues and also improve the holistic perspective on sustainable development.

### **3.4. Societal Relevance**

The committee observed that the CWS cluster makes excellent contributions to society at different levels, from the municipal to the international scale. It provides policy makers with syntheses of the latest science and its implications and uncertainties and gives scientific advice in different forms to governments, grassroots and water user federations, the private sector and NGO's. As a result, the cluster has significant impact and is of great societal relevance. It played a part in the Dutch government's policy to solve the 'nitrogen crisis', for instance, and in a policy advice on the effects of microplastics in nature and society, written on request of the Chief Scientific Advisors of the European Commission. CWS research has also been used by prestigious international actors, including the International Panel on Climate Change (IPCC) and the Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES).

The committee is convinced that if the cluster succeeds in its ambition to create more inter- and transdisciplinarity, this will allow it to have more direct relevance for a variety of stakeholders, and thus increase its impact even further. However, working for and with stakeholders also presents the risks of absorbing much of the capacity, and the risk of not sufficiently innovating. The committee recommends CWS – as part of the strategy exercise mentioned in paragraph 4.1 – to carefully consider which stakeholders it wants to work with and to what extent. It also recommends CWS to ensure that the knowledge that results from working for stakeholders flows back into new research.

The committee notes that virtual and augmented realities offer new ways for knowledge transfer, especially for future scenarios. The work of the CWS cluster could be very well suited to make use of these methods. They could improve the visualization of simulation driven data and enable a wide range of applications for intuitive human-machine interaction. Modern sensor technology would enable the recording of objects and scenarios as well as interaction with them. The committee recommends investigating these possibilities.

#### *Open science*

The CWS cluster is not only strong in knowledge transfer to society, but also in working with participatory methods, or co-creation. Several examples of this were presented to the committee, in particular by the water groups. There is for instance the work on climate-information services, developed with and for farmers in Ethiopia, Bolivia, Ghana and Bangladesh; there is the Wageningen Lowland Runoff Simulator, an open-source hydrological model used by weather boards; and RAINLINK, an open-source app for rainfall mapping through cellular communication networks in regions with scarce data. Clearly, not all research activities are equally suited for co-creation of science, and co-creation also comes with the cost of potentially limiting innovative power. The committee recommends treading carefully along this path and widely sharing experiences on co-creation within CWS and WIMEK. The aim of this benchmarking would be to better understand the conditions under which participatory methods will have added value and lead to larger societal impacts.

The CWS cluster states that it embraces the key elements of open science. Involving stakeholders in research design as described above is one of these. The cluster also mentions the increasing share of open access publications, its efforts to ensure that results of contract research can be disclosed, using open-source model codes and asking all groups and all PhD candidates to craft data management plans. To the committee this seems a good way of stimulating open science.

Media appearances are a way for the CWS cluster to reach out to a wider public. The cluster also engages in citizen science, for example with the project Nature's Calendar. This aims to monitor, analyse, forecast and communicate yearly recurring life cycle events. Through the Calendar, citizen scientists can experience for themselves that due to



the increase in temperature, the length of the growing season has significantly increased. This is a very good and effective way of communicating academic results with the public.

On the whole, the committee is satisfied with the way the CWS cluster performs open science and encourages it to progress further on this road. The ultimate aim should be making *all* publications open access and dealing with *all* research data in a FAIR way.

### **3.5 Viability**

#### *Future outlook*

It is obvious to the committee that the work of the CWS cluster is extremely relevant and will be so for a long time to come, due to the fast-growing impact of global challenges on human well-being. The fact that a large number of the cluster's early career scientists received personal grants underscores the future potential of the cluster. CWS staff has good skills to obtain grants and the chair groups are connected to world-leading organisations. In short: there is plenty of work to do, and the cluster is well-situated to make a meaningful contribution. As stated above, the main challenge for the cluster's future will be to set its own priorities in a well thought out way. The committee strongly recommends CWS to invest in this process. Whilst setting priorities, the cluster should ensure that there will be sufficient to carry the research forward. The challenge then is to find a balance between on the one hand giving excellent PhD's and postdocs the opportunity to continue their research within WIMEK, and on the other hand attracting sufficient 'fresh blood' to support the development of new ideas.

#### *Academic culture*

The cluster aims to further open up its academic culture and strives for a safe and inclusive work environment. It points out that the new tenure track system at Wageningen University has created much better career perspectives for talented individual scientists, but also introduced a large emphasis on personal grants and individual performance, which may occasionally result in opportunistic, individualistic behaviour and stimulate competition and disincentive internal and long-term collaboration.

The committee finds this a good point and compliments the cluster for noting it. It fully endorses the ambition to balance individual and team performance. From the documentation it has not become entirely clear to the committee what institutional mechanisms and practices are in place to support a positive culture for inclusion, safety and equality. The same goes for research integrity. Setting clear goals on this area might help ensure that research integrity is achieved in all domains of research. For inclusion, safety and equality the committee recommends not solely depending on an open culture but having some mechanisms in place that safeguard these aspects.

#### *Talent management*

Human resource management at the CWS cluster is aimed at attracting and keeping the talented staff that is needed to keep up the cluster's high level of research quality. This by no means a foregone conclusion, given the ample career opportunities for environmental specialists.

Parallel to the job market opportunities, the number of students interested in CWS themes has been growing, resulting in a high teaching load for the cluster's staff. The committee found that this is perceived as a threat for research. The cluster will need to address this, and the committee appreciates that it already has some ideas on how to deal with it: lobbying for increased funding, and training tenured staff in grant-writing so that they may rapidly build a small research group. Elsewhere, appointing teaching assistants with specific tasks such as correcting exams has also provided some relief. The cluster may consider this as a complementary option.

#### *Diversity*

The CWS cluster correctly identifies a lack of diversity in the tenured staff as one of its weaknesses. There is a clear lack of diversity both in terms of gender and in terms of cultural background. Further efforts are required to hire and keep female and international full and associate professors. These efforts have to go beyond informal



discussions and encompass clear interventions and targets. The high number of talented female researchers that have managed to acquire personal grants is a promising start, but it will not be self-evident that they rise through the ranks. The cluster will have to create the right conditions for this to happen.

The committee thinks that a little push for the more senior staff to take training on diversity might help. Currently, mostly young researchers take such training, the committee was told during one of the interviews, but the senior staff does not.

### **3.6. PhD supervision and training**

The committee spoke with some of the PhD candidates associated with the WIMEK cluster and got the impression that – together with the postdoctoral researchers – they form a group of engaged and constructive junior scientists working in an open atmosphere. This is a true asset for the CWS cluster.

PhDs candidates within the CWS cluster experience a lot of room for creative input into their own trajectory. However, the flipside of the freedom they have is that they find it sometimes difficult to plan and finish their theses in time. Due to inexperience, an ambitious PhD student cannot always oversee the time investments that are needed for extra activities. It was mentioned by the PhD students that supervisors should intervene when they are overambitious. The committee recommends that this should be part of the supervision training, if it is not already incorporated. Fixed intermediate milestones within a PhD trajectory could also help to keep PhD's on track. For the first year, such strict milestones are already in place (for instance an improved training and supervision plan and Sense A1 course). After the first year, milestones re-appear again only in the last year. It could help to add some milestones in the second and third year, and to safeguard the progress in the annual evaluation meetings.

It was voiced that both postdocs and PhD candidates would benefit from having a personal coach assigned to them, indicating there is still room for improvement in terms of supervision. For PhD students, a postdoc might fulfill this role, for postdocs a coach might be a peer, tenure tracker or someone else provided by the cluster. The committee recommends the cluster to consider this option as an addition to the current supervision arrangements.

Finally, the committee wants to raise awareness concerning the disadvantages of sandwich PhD candidates when they are working from their home country. Being at Wageningen allows PhD's to use advanced facilities such as high-speed internet, computational resources and research labs, and a supporting network of other Ph.D. candidates in an academic environment. These resources are often absent or of lower quality when they are working from the associate research institution abroad. There might for instance be extra frequent monitoring of sandwich PhD's, and early remediation or even stopping if there are serious doubts about the support or supervision the candidate receives at home.

