

IUKWC Progress Report

Year 2

September 2018



**INDIA-UK
Water Centre**
भारत-यूके
जल केन्द्र

IUKWC Progress Report

Year 2

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Indian Coordination Office
Indian Institute of Tropical Meteorology
Dr. Homi Bhabha Road
Pune-411008,
Maharashtra, India

UK Coordination Office
Centre for Ecology & Hydrology
Benson Lane
Crowmarsh Gifford, Wallingford
OX10 8BB, UK

CITATION

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The India-UK Water Centre promotes cooperation and collaboration between the complementary priorities of NERC-MoES water security research.

Front cover image: India, Pixabay

Contents

Contents	2
Foreword	3
1. Introduction.....	6
2. Centre Operations	6
2.1. Secretariat	6
2.2. Year 2 Delivery Timetable	7
3. Engaging the Community	8
3.1. Open Network of India-UK Water Scientists	8
4. Facilitating Partnerships.....	10
4.1. Science Workshops	10
4.2. Researcher Exchanges	15
5. Knowledge Exchange.....	17
5.1. User Engagement Initiatives	17
5.2. Grassroots Field Exposure Sessions	19
6. Supporting Future Collaboration	19
6.1. Pump Priming Projects	19
7. Centre Profile and Communication.....	21
7.1. Website	21
7.2. Social Media	22
7.3. Email Communication	23
7.4. Outreach and Events	24
8. Monitoring Outcomes.....	25

Foreword

The second year of the virtual India-UK Water Centre (IUKWC) has seen improved stability at the operational front and growth with respect to engagement of scientific and stakeholder communities in both the countries. We are happy to report that sustained growth in membership of the Centre's Open Network of India-UK Water Scientists shows that the IUKWC has, through its various activities and online tools, almost doubled its engagement with individual scientists since the end of year one. The members include representatives from key scientific institutions from both the countries along with stakeholders from NGOs, State & local government water managers. The increased reach achieved over year two is helping the Centre to establish a widespread network of collaborations between India and the UK, which will hopefully ensure long-term sustainable links in water security research.

The Centre has been functioning smoothly on its co-delivery model with a joint Secretariat based in the UK at the Centre for Ecology & Hydrology and in India, at the Indian Institute of Tropical Meteorology. The Secretariat continues to comprise a team of experienced project managers, stakeholder engagement experts, administrators and web developers. While year two has seen changes in a few team members, the transition has been managed to ensure the planning and execution of Centre activities remains unaffected.

IUKWC has successfully hosted one science workshop, a User Engagement Initiative (UEI), a Pump Priming Project and 3 Research Exchanges over year two, in addition to concluding a number of activities commenced in the first year. The technical focus of these events included: Integrating precipitation forecasts and climate predictions with basin-scale hydrological modelling; Linking and predicting heat waves with droughts; Monitoring range of antibiotics in rivers; and Integrating remotely sensed observations of surface water storage with climate forecast. Centre activities continued to receive highly positive feedback with respect to issues addressed, technologies presented, discussions held, engagement mechanisms and of course execution.

The Centre's inaugural UEI was held in January 2018 in Kochi and focused on Improving freshwater monitoring frameworks and data for research and management. The event, which aimed to disseminate the outputs of recent joint India-UK water science, witnessed active participation from stakeholders as well as scientists. The stakeholders included state level water managers in the pollution, biodiversity, supply and irrigation sectors from five states: Kerala, Karnataka, Maharashtra, Andhra Pradesh and Tamil Nadu. The event outcomes highlighted the specific scientific barriers, the current priority needs of stakeholders and the expertise/technology available within India and UK science community. The event saw extensive coverage by the local media.

Implementation of the Centre's new Grassroots Field Exposure Sessions (GRFS) initiative experienced delays due to the availability of participants but, the first two events are to be implemented before the end of 2018 in West Bengal, focusing on managing & monitoring agriculture water demand and water quality. The GFES initiative was launched after discussions at the previous IUKWC Steering Group meeting and is planned to take the form of multi-day events designed to expose scientists to issues faced by water stakeholders at the ground level so as to encourage co-design of future research projects.

The Centre and its activities continue to be facilitated by an online web platform, which also hosts the Open Network of India - UK Scientists. The website has now been fully translated to Hindi in order to reach a wider audience in India and the Centre's publications are also translated to Hindi to assist the above goal. A new website service to disseminate the latest opportunities and news from the India-UK water community has been introduced in order to make the website a water hub for its members. Efforts are also being made to encourage the use of the online discussion portal and webinar tools by Centre members. The Centre continues to use social media platforms like Facebook, Twitter and LinkedIn to spread news regarding its activities and to increase engagement amongst the scientific community.

The years' one and two have been two very engaging and successful founding years for IUKWC and we would like to thank the Ministry of Earth Sciences and the Natural Environment Research Council for their continued support to the Centre. We would also like to acknowledge the support of the hundreds of water scientists and stakeholders from across India and the UK who have responded enthusiastically to our activities and engaged in the IUKWC over the last 24 months. The positive feedback received from our members is overwhelming. We hope to continue to engage existing members and increase the reach of our activities to new audiences from across the India-UK water security science sector. In doing so we will ensure the Centre continues to facilitate an increased impact and sustainable legacy for bilateral water science between the two countries.



AK Sahai

IUKWC Coordinator



Harry Dixon

IUKWC Coordinator

1. Introduction

The India-UK Water Centre (IUKWC) was established in 2016 with an aim to promote cooperation and collaboration between National Environment Research Council, UK and Ministry of Earth Sciences, India (NERC-MoES) water security research in order to establish a platform for, and legacy of, long-term partnerships and dialogue between Indian and UK water researchers, water policy-makers and water businesses.

Following a successful first year, the Centre's funding was extended to 2019. This report documents the progress the IUKWC has made in its second year of operation (July 2017 to June 2018), covering key milestones, challenges, and metrics accordingly, against the five overarching goals outlined for the centre:

- To engage the community;
- To facilitate partnerships and build capacity;
- To enhance knowledge exchange;
- To support future India-UK collaboration; and
- To develop effective communication platforms.

2. Centre Operations

2.1. Secretariat

The daily operations of the IUKWC continues to be conducted through a joint-management team, based in the UK through the Centre for Ecology and Hydrology (CEH) and in India through the Indian Institute for Tropical Meteorology (IITM). Hence, the day-to-day planning and delivery of activities continues to draw upon local knowledge, contacts and information about current research and water issues.

The Centre's Management Board, supported by the wider Secretariat team, leads the operations of the Centre (Figure 1). The board is co-chaired by the Centre Coordinators, Dr Harry Dixon (CEH) and Dr Atul Kumar Sahai (IITM), and supported by a UK-based Project Manager (0.3FTE; Anita Jobson, CEH), and an India-based Stakeholder Engagement Manager (Priya Joshi, IITM). A new Project Manager (Dr Sunita Sarkar) joined CEH in June 2018 to take over management of the IUKWC with a phased transition due to complete in September 2018. As in the first year, the Board's time over 2017-18 has been partially funded by the IUKWC and partially through in-kind support from the coordinating institutions.

The wider secretariat team is also split across the two organizations, and comprises the Project Administrator (0.3FTE) – a role that was being undertaken by Dr Carol Diffenthal (CEH) and Chris Bell (CEH) but has been handed over to a Project Officer (Emma Bennett), newly recruited by CEH in April 2018. Chris Bell continues to provide a small amount of in-kind support in the form of guidance on the website and communications platforms when required. Anil Kumar Pandey (IITM) continues to support the Centre's website, as well as the Hindi language translations of all Centre publications.

Following from the successful interaction within and between the India and UK elements of the Secretariat in the first year, the mode and frequency of communications have remained the same. Formal management meetings are held approximately every 6-weeks and undertaken by Video-

Conference (VC). These meetings enable the entire team to not only discuss the strategic and activity related issues, but to also bond as colleagues. Between the formal meetings, all the events and activities are discussed, planned, and implemented through frequent communication via email, skype, and VC, as required. Face-to-face meetings are held to coincide with Centre activities to further promote the implementation of the Centre’s activities and its strategic direction.

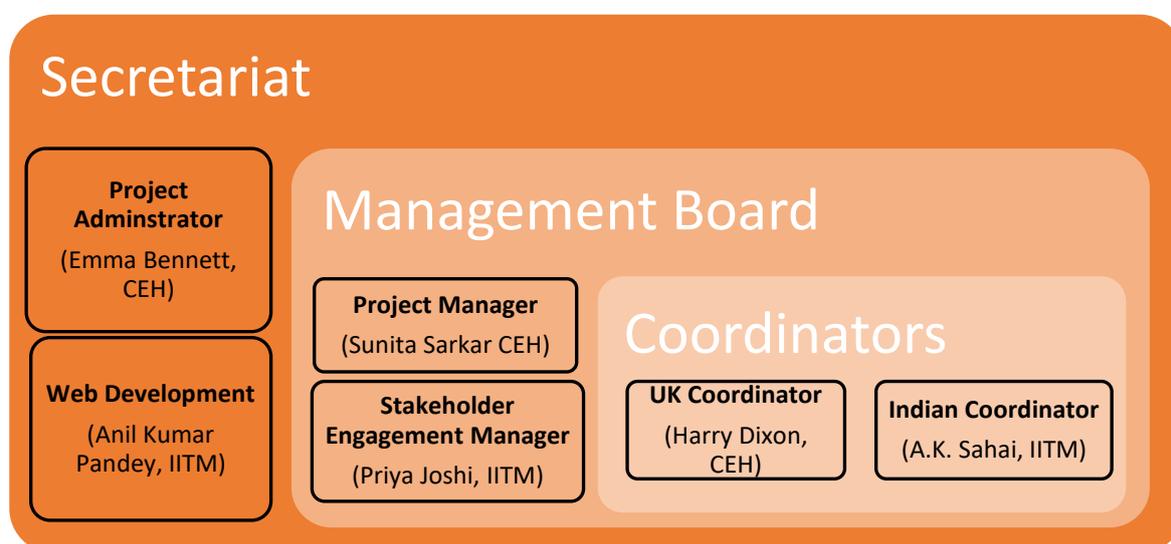


Figure 1 Management structure of the India-UK Water Centre (at time of publication)

2.2. Year 2 Delivery Timetable

In its second year of operation, the IUKWC completed the remaining Year 1 activities that had been delayed for a variety of reasons, as explained in IUKWC progress report for year 1¹, as well as promote its Year 2 activities as proposed in the ‘Proposal for Continuation of the India-UK Water Centre’ put forward in 2017. Table 1, below, summarises the planned delivery of Year 2 activities versus achievement, and includes all year 1 activities that were completed between July 2017 and June 2018.

Table 1 Delivery of activities in Year 2 (July 2017 to June 2018)

Activity	Planned	Actual
1. Facilitating Partnerships		
Open Calls for Workshops and Exchanges	June - September 2017 and January - March 2018	1 st September, 2017 To improve efficiency, both sets of calls were combined into one call for each activity
Second Science Workshop UK (Year 1)	June 2017	19 th -21 st June, 2017, Stirling
Third Science Workshop India	October 2017 – March 2018	2 nd – 4 th May, 2018, Dehradun The delay resulted from this being the earliest date available for the Activity Leads
Fourth Science Workshop UK	April - June 2018	18 th – 20 th , 2018, Lancaster Delay in holding the Third Science Workshop meant postponement of this Workshop
Year 2 Research Exchanges	October 2017 – June 2018	December 2017 – September 2018; Delay in an Indian exchange to UK due to unavailability of date with the host and delay in getting subsequent

¹ IUKWC (2017). IUKWC Progress Report: Year 1. Wallingford, UK and Pune, India. 28 pp

		approval from the candidate's institution in India. However, all the exchanges are now complete.
2. Enhancing Knowledge Exchange		
First User Engagement Initiative (Year 1)	Summer 2017	23 rd – 25 th January, 2018, Kochi; This event was moved into January to accommodate schedules of executive stakeholders who were invited to the event.
Second User Engagement Initiative	October 2017 – June 2018	February 2019, Bhopal; Delay in implementation of science workshops lead to delay in identifying a lead and defining a focus area for the UEI. The current lead for UEI 2 was identified through the discussions at the Science Workshop in Dehradun. However, a UK lead has now been secured and the planning for the event is progressing swiftly.
3. Supporting Future Collaborations		
Pump Priming Projects 1 and 2 (Year 1)	January – September 2017	March - October 2017
Pump Priming Project 3	October 2017 – June 2018	October 2017-October 2018; The delay in completion was caused by unforeseeable, personal circumstances affecting one of the research partners.

3. Engaging the Community

3.1. Open Network of India-UK Water Scientists

The IUKWC has continued to expand the membership of the Open Network since its establishment in September 2016, as shown in Figure 2. The Open Network had 659 members as of the end of June 2018; a 54% increase from the number of members at the same time last year.

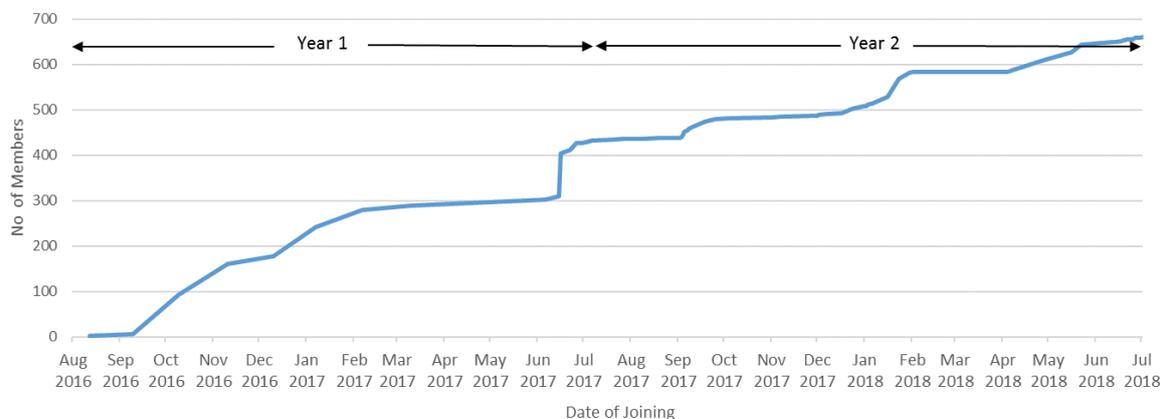


Figure 2. Membership of the Open Network by joining date

The network is now a fully operational, searchable database, with future enhancements to the search functionality planned in Year 3. When logged in, a member can search for other scientists that have similar interests to theirs. The information that a search reveals however, does not provide any

personal contact information except for institutional address. This ensures that the Open Network complies with the new European GDPR regulations that came into effect in May 2018. Going forward, whenever IUKWC publishes a call for an activity, explicit consent is sought for the applicant's data to be made available to IUKWC Secretariat and Activity Leads for the management of applications and events. Applications are not accepted unless the person is registered on the Open Network.

The split in membership numbers by country is shown in Figure 3. The Indian membership grew at a slightly faster rate in Year 2, however the increases in membership coincide loosely with calls for IUKWC events. In order to attract more UK based scientists, leads of activities such as the UEI and Workshops are allowed to invite a few participants who then learn more about IUKWC and its activities. In addition, the IUKWC is taking advantage of various modes of communication (see section 7, below) to get the message out to the UK-based target audience.

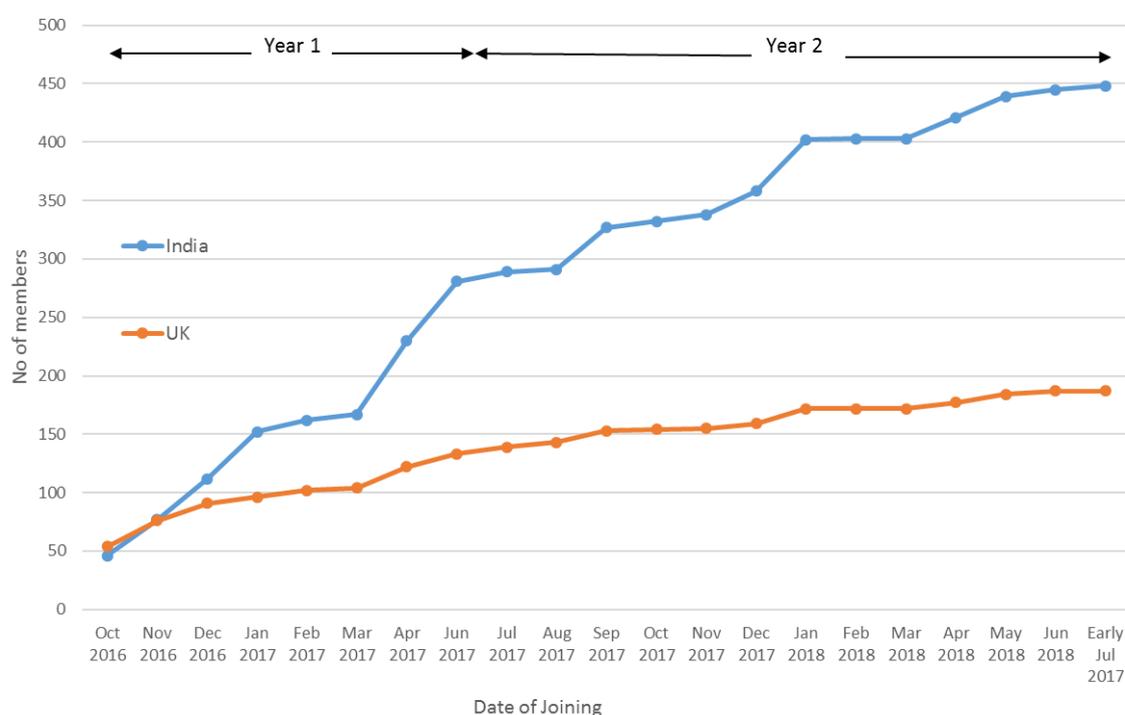


Figure 3. Membership of the Open Network by country

The total number of institutions that are now represented in the Network is 272, from 166 cities in the UK and India; the way in which this diversity is split between the countries is shown in Figure 4.

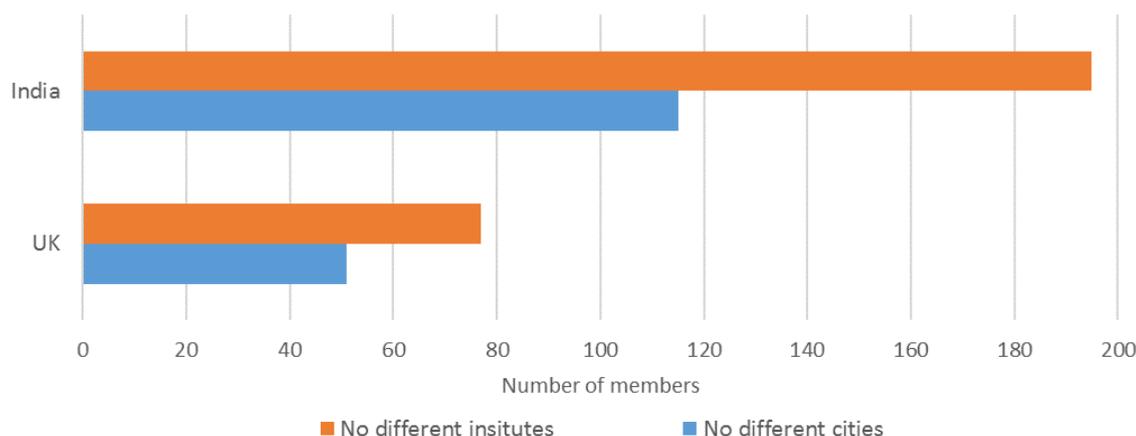


Figure 4. Diversity of Open Network member's organisations and cities

Overall, representation from the scientific community along with stakeholders such as NGOs, and state & local government water managers has been good. However, the private sector is not as well represented amongst the network members and IUKWC will actively dedicate at least one of its activities specifically to engage with these stakeholders in Year 3. As a step forward, the IUKWC board is considering a collaboration with Smart Water Networks Forum to engage with more private sector stakeholders.

4. Facilitating Partnerships

4.1. Science Workshops

The IUKWC has now hosted three Science Workshops to date that have brought together UK and Indian Scientists to discuss the current state of knowledge in the thematic area; to identify the future requirements or new ideas for joint research; and to share knowledge and skills in water security science. In Year 1, the first, focussed-call Workshop was held in Pune, India. Following that, Open Calls for the Second, Third and Fourth Workshops were published and Workshops held, details of which follow.

4.1.1 Second Science Workshop

Held between 19th and 21st June, 2017 at the University of Stirling, UK, the Second Workshop entitled '**Enhancing Freshwater Monitoring through Earth Observation**' was convened jointly by Prof Andrew Tyler of the University of Stirling, UK, and Prof Mihir Kumar Dash of IIT Kharagpur, India, and the IUKWC co-managing institutes, IITM and CEH.

The aim of the Workshop was to bring together scientists to explore the latest generation of Earth Observation (EO) capabilities in the Indian and UK water sectors. Topics discussed during the meeting included current and near future EO data products available for freshwater monitoring; practical applications to enhance water security; and synergies and opportunities to develop and exploit EO capability for effective early warning for freshwaters. The full Activity Report has been published on the IUKWC website at <http://www.iukwc.org/activity-reports>, with full access available to Open Network members only.

A call for attendees, advertised via the IUKWC website in April 2017, resulted in a total of 75 applications (5 UK, 70 India). Ten of the Indian applications were accepted, with 6 invited speakers. For the UK participants, 3 applications were accepted and 2 were declined. Relevant individuals in the UK science community were identified by the Activity Leads and also via a search of NERC Grants on the Web, and invitations were sent to them. With additional invited speakers and the organizing committee, a total of 44 delegates (21 UK and 16 India) attended the Workshop. Although, as planned, Workshop 2 was smaller than the First Workshop, the diversity of cities and organizations was comparable to Workshop 1. The distribution between the UK and India was more equitable, as seen in Figure 5 below, as a result of the way in which the selection process was managed.

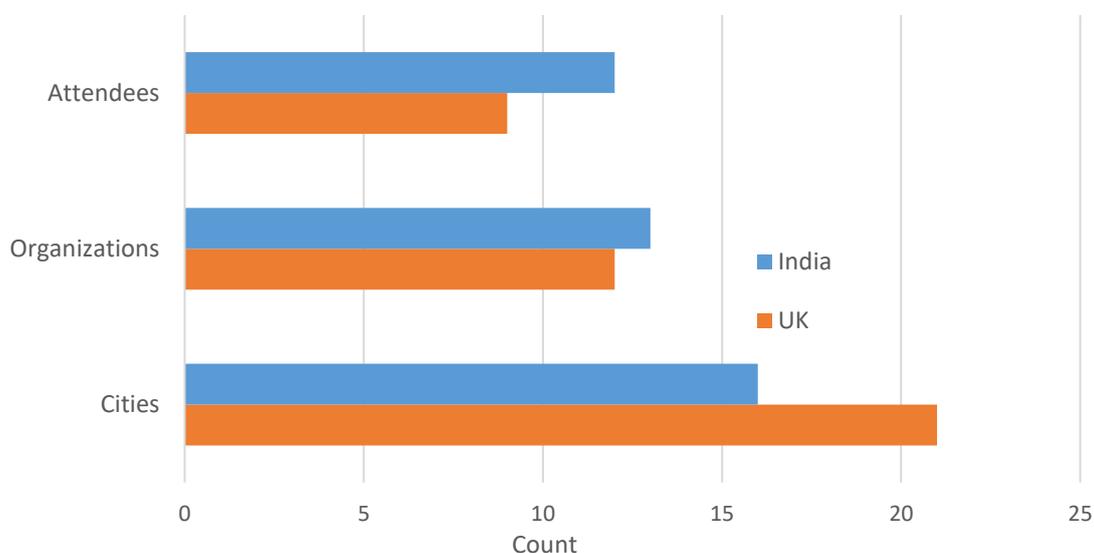


Figure 5 Geographical and institutional diversity of attendees at the Second IUKWC Workshop in Stirling, UK

The Workshop was structured into five sessions, with the first three focusing on oral and poster presentations to highlight the challenges and opportunities around using EO in freshwater monitoring, and the final two sessions being discussion sessions centered on the outputs of the first three sessions. A field trip to Loch Leven was conducted on the final day to give the delegates demonstrations on the work that is being conducted there using EO tools and techniques.

Overall, the delegates came up with a list of recommendations and future opportunities for EO in freshwater monitoring. The ones that have potential to be promoted by IUKWC included:

1. Promoting the two-way exchange of skills and knowledge on EO, including making data available and promoting development of validation sites;
2. Linking EO-derived water quality information with conventional parameters of water quality such as nutrients and pathogens;
3. Promoting knowledge exchange platforms through PhD programmes; and
4. Promoting interaction between universities, research institutions, business and industry, governance and society.



Photos from the second IUKWC workshop held in Stirling, UK. Clockwise from top left: Oral presentation, poster session, and a field trip on Loch Leven.

As with the First Workshop, all delegates were asked to provide feedback on the Workshop content, meeting venue and organization, and networking opportunities. A total of 21 respondents provided feedback (Figure 6), with 95% of them having found the Workshop useful to developing future collaborations and new networking opportunities; about 50% finding future funding opportunities; and about 81% greatly appreciating the knowledge exchange aspect of the Workshop, with the recommendation that these events continue to be hosted.

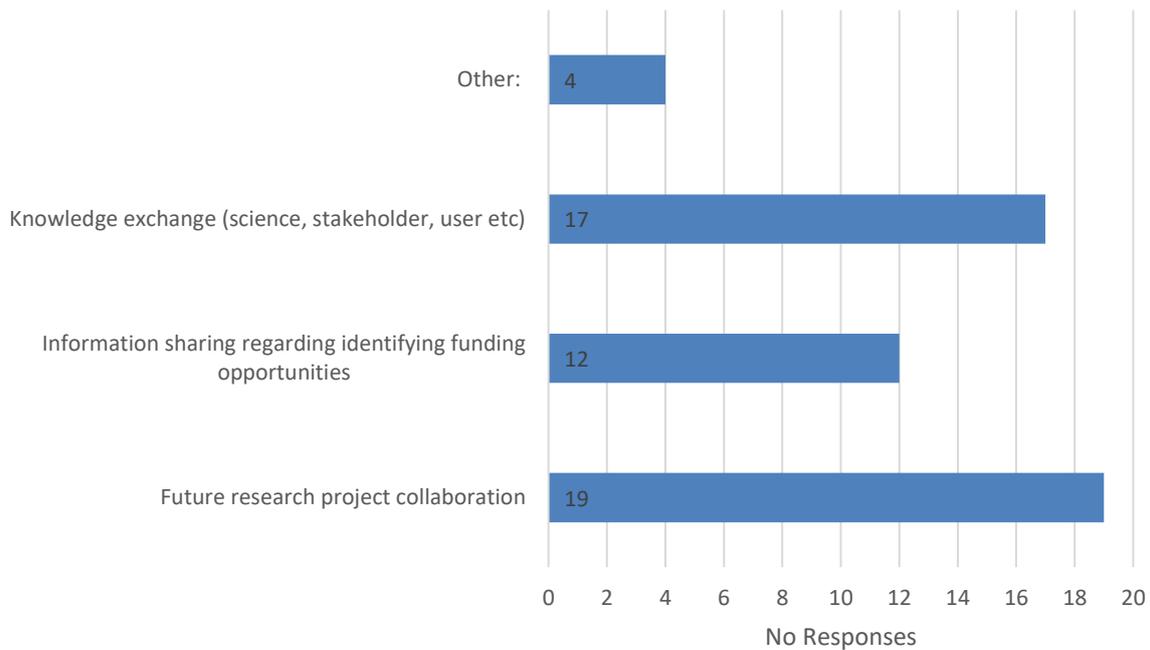


Figure 6 Delegate Feedback on potential outcomes from new contacts made during the Second IUKWC Workshop in Stirling, UK

Several delegates highlighted the need to develop PhD exchanges and funding opportunities going forward, but overall the delegates greatly enjoyed the Workshop and gave it a mean score of 9.3/10.

“Nice mix of activities, with good opportunities for discussion.”

4.1.1 Open Call for Year 2 Workshops

A combined Open Call for both UK and India Workshop topics for Year 2 was published on the IUKWC website on 1st September, 2017. The calls were combined to improve efficiency with regards to communication and planning. By the closing date of 25th September, 2017, 10 applications were received in total, with 9 for the first-half year Workshop to be held in India, and one for the second-half year Workshop to be held in the UK. The Secretariat undertook the now standardized process based on established criteria to evaluate the applications and select the Year 2 Workshops. Four applications did not meet the required threshold or basic requirements for the application. The remaining five India applications were ranked, as shown in Table 2.

The successful Workshop, which scored the highest across all the criteria, was proposed by Dr Shresth Tayal (The Energy and Resources Institute (TERI), India) and Dr Martin Widmann (University of Birmingham, UK). The IUKWC board discussed the possibility of changing the location of the Workshop to one more in line with the topic; the location was therefore changed from New Delhi to Dehradun. See the next section for more details.

Table 2 Proposed workshop topics from Open Call applications September 2017

	Proposed Workshop Topic	Location
1	Integrating precipitation forecasts and climate predictions with basin-scale hydrological modelling in the Himalayas	New Delhi, India
2	Advancing Drought Monitoring, Prediction, and Management Capabilities	Hyderabad, India
3	Advancements in pollution monitoring and management of brackish and fresh water bodies in India	Cochin, India
4	Catchment management to reanimate functioning and socio-ecological security: the Banas River, Rajasthan (India)	Jaipur, India
5	Water crisis in urban India and solutions	Coimbatore, India

The Second Workshop topic chosen was originally submitted to be held in India (Advancing Drought Monitoring, Prediction and Management Capabilities; Table 2). However, after discussion with the Activity Leads, Dr. Chakravarthi Vishnubhotla (University of Hyderabad, India) and Dr. Peter Atkinson (Lancaster University, UK), it was agreed to relocate the Workshop to Lancaster, UK. See below for further details.

4.1.1 Third Science Workshop

The Workshop was on **‘Integrating precipitation forecasts and climate predictions with basin-scale hydrological modelling in the Himalayas’**, and was held between 2nd and 5th May, 2018 at the Wildlife Institute of India (WII), Dehradun, Uttarakhand, India. It was co-lead by Dr Shresth Tayal (The Energy and Resources Institute (TERI), India) and Dr Martin Widmann (University of Birmingham, UK), with co-conveners WII.

The aim of the Workshop was to foster the development of short-, medium-, and long-term hydrological predictions for Himalayan basins by specifying how integrated meteo-hydrological prediction systems for the region can be improved. Experts from both countries presented the latest research findings and discussed ways of improving the future of water security within the Indian Himalaya. The Workshop built upon the outputs of the Year 1 IUKWC Pump Priming project led by

Dr Widmann (see section 6.1 below). Results of the project were presented and the scientific questions which remain around the large-scale drivers of regional climate variability in the region, their relevance on different timescales, their interaction, and their representation in global weather forecasting and climate models were discussed. The Workshop comprised of oral and poster presentations over five technical sessions, culminating in a number of break-away discussions on topics ranging from funding, to India-UK collaboration, as well as capacity building and the main challenges around hydrological predictions for the basin. A short tour of the WII campus and forest was also conducted.

The call for delegates, published in January 2018, returned 87 applications (18 UK, 69 India). Twenty one of the India applicants and 12 of the UK applicants were accepted. With the addition of invited speakers, including from WII and the IUKWC secretariat, the total number of attendees was 53. See Figure 7 below for the distribution of attendees between countries, cities and organizations.

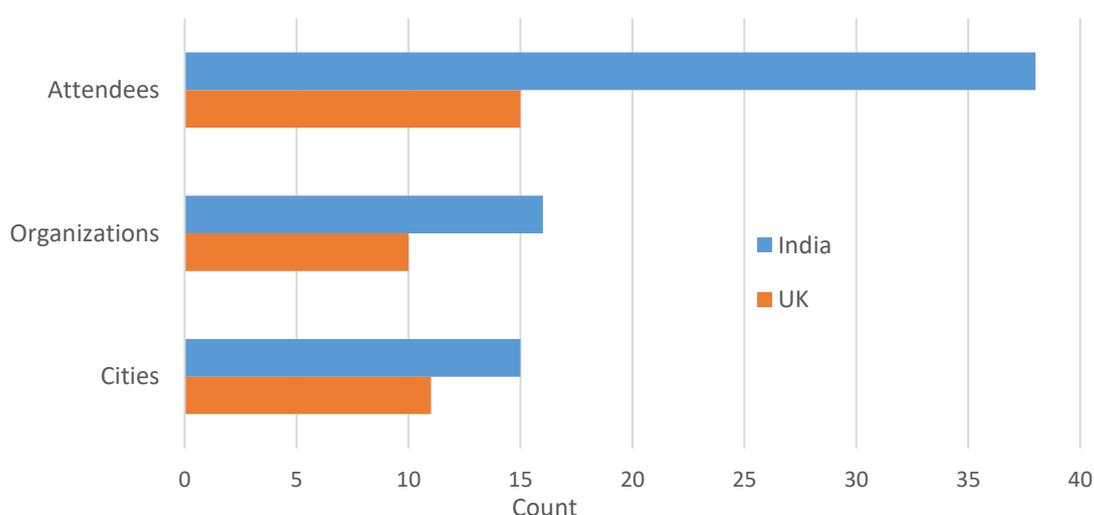


Figure 7 Geographical and institutional diversity of attendees at the Third IUKWC Workshop in Dehradun, India

There was a good mix of organizations from both countries, despite the higher number of Indian participants. This enhanced the exchange of information, meeting a key objective of this activity for IUKWC.

The Workshop was rated 8/10 by the respondents who participated in the feedback survey. The theme, content of talks and structure of the Workshop – with time dedicated to breakout sessions and networking, were highly appreciated, as was the venue and the logistical support the received. All the respondents indicated that they had made new contacts through the Workshop, through which they will continue information sharing, knowledge exchange and collaboration. The respondents recommended that the following events could include a field visit, or handling of equipment to gain practical knowledge, pre-workshop preparation to further discussions, as well as more time to the poster sessions.

Full details on the Workshop will be contained in the Activity Report, which when completed, will be published on the IUKWC website.

4.1.1 Fourth Science Workshop

This final Workshop for Year 2, entitled '**Advancing Drought Monitoring, Prediction, and Management Capabilities**', will be held between 18th and 20th September, 2018, at Lancaster University. As mentioned above, Drs. Vishnubhotla (University of Hyderabad) and Atkinson

(Lancaster University) are the co-leads, with CEH and IITM.

The aim of the Workshop is to bring together, in one platform, key actors engaged independently in the three domains of drought monitoring, prediction and management to leverage cutting-edge drought science to inform new approaches to meet society's needs for drought planning and management. This will be accomplished through oral presentations from a mix of UK and India researchers, as well as two poster sessions. Breakout groups and discussions will be held on the last day, with a social visit to the Lancaster Castle, followed by a networking dinner, arranged for the afternoon of Wednesday, 19th September.

The call for delegates was published in May 2018 and upon closing at the start of June, 76 India-based and 18 UK-based applications were received. Following the standard evaluation process, IUKWC management selected 13 Indian participants, and 15 UK participants. At the time of preparing this report, delegates were confirmed, logistics were in place, and the agenda was being finalized.

4.2. Researcher Exchanges

4.2.1 Outcomes from Year One Exchanges

In Year 1, five Researcher Exchanges, two to India and three to the UK, were supported. There was a total of three Junior and two Senior Researcher Exchanges. The Exchanges were all completed between the end of April and June 2017, and four of the five Activity Reports can be found on the IUKWC website at <http://www.iukwc.org/activity-reports>. The pending Report is currently being designed for publication.

The Exchanges were diverse in their make-up and objectives with each resulting in a specific outcome – such as improving the understanding between NGOs working on catchment management and hydro-climatic researchers, piloting a case study in India on urban resilience to extreme precipitation events, collecting information from experts and desk review on the water-food-energy nexus to help enhance India's adaptation to climate change, and developing a proposal and scientific paper on applications of ecosystems services assessment tools in India, to name a few. Overall, however, the common theme was the sharing of knowledge between research groups/practitioners in the two countries and building of capacity of scientists, both Junior and Senior, with the potential to develop further collaborative works.

4.2.2 Year Two Exchanges

The second Open Call for Researcher Exchanges was published in September 2017. At its close, a total of 11 applications, with two from the UK (including one Senior Researcher) and the rest from Indian applicants (including two Senior Researchers). For details on their topics, see Table 3.

Table 3 Applications for Researcher Exchanges in Year 2

	Applicant	Host	Junior/ Senior	Title	Funded?
Applications for exchange to India					
1	R. Tiwari; University of Leeds	S. Joseph; IITM	Junior	Are heatwaves exacerbating drought situation in India? Trends in occurrence and intensity of drought and heatwaves	YES
2		University of Jaipur	Senior	Progressing existing scientific research on the Banas system, Rajasthan, into application with key stakeholders to inform integrated catchment management solutions	NO
Applications for exchange to UK					
3	Ms. Akanksha Singh Kachhawaha; CSIR-NEERI	Dr Alistair Boxall; University of York	Junior	A small-scale monitoring study for a range of antibiotics in the River Foss catchment and comparison of antibiotic exposure in the UK and India.	YES
4	Dr Vimal Mishra; IIT, Gandhinagar	Dr Harjinder Sembhi; University of Leicester	Junior	Integrating remotely sensed observations of surface water storage with climate forecast for freshwater management	YES
5		CEH	Junior	Non-stationarity in regional frequency analysis for design flood estimation	NO
6		CEH	Senior	Developing low-cost sensors for water quality management of urban lakes in large cities	NO
7		PML	Junior	Understanding aquatic environments strong fingerprint in cholera outbreaks in Indian Subcontinent.	NO
8		University of Sterling	Junior	Monitoring Freshwater Quality and Quantity through Earth Observation	NO
9		BGS	Senior	Using new scientific knowledge to help stakeholders set objectives for freshwater management	NO
10		University of Portsmouth	Junior	Explore new techniques on improving freshwater monitoring and its dissemination for better aquifer based management	NO
11		University of Birmingham	Senior	Understanding the extremes in hydrological parameters	NO

In Year 2, funding was available to cover three Exchanges, and based on the average scores for each application, two from India and one from the UK were funded. At the time of preparing this report, the three selected Exchanges were completed and the Activity Reports were being compiled by the leads. These will be published on the Centre website in the following months.

5. Knowledge Exchange

5.1. User Engagement Initiatives

The aim of hosting User Engagement Initiatives (UEIs) was to support the translation and communication of India-UK water security science to users, and collection of input on stakeholder needs for future research and innovation, by bringing together scientists, policy makers and stakeholders such as regulators, commercial companies, grassroots communities and so on. In the second year of operation, IUKWC held one successful UEI and planning was in progress for the second UEI, which will take place in the beginning of 2019; details can be found in the following sub-sections.

5.1.1 First User Engagement Initiative

The first UEI on the topic of **'Improving Freshwater Monitoring Frameworks for Data and Research Management'** was held in Kochi, Kerala between 23rd and 25th January, 2018. It was convened by the IUKWC Secretariat, in collaboration with the Plymouth Marine Laboratory, UK and Nansen Environmental Research Centre, Kochi, India.

The UEI covered four themes, namely:

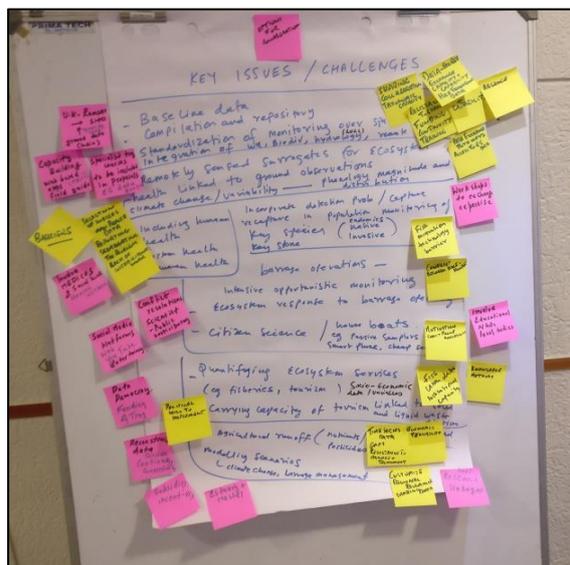
- ◆ Water Quality - Monitoring Pollution & Treatment;
- ◆ Monitoring Aquatic Ecosystems & Biodiversity;
- ◆ Irrigation - Monitoring Availability and Consumption;
- ◆ Water Provision - Monitoring Supply & Consumption.

This mix of themes was well received by the delegates, as they felt it promoted cross-sectoral dialogue; the segregation of irrigation and water supply sector, however, was much appreciated as delegates indicated that irrigation tends to overshadow discussions on water supply management. The event was co-designed with the wider community. The selection of focus areas was based on the results of the survey of members of the Open Network, which was conducted in 2017². This survey underlined a need for scientists to raise awareness regarding the potential applicability of new scientific technologies and frameworks for improving freshwater monitoring through engagement with regional-level stakeholders in India. Hence, the UEI was designed to bring together regional-level policy makers, implementers (including NGOs) and regulators, who are responsible for identification and interpretation of available scientific knowledge, with scientists from the UK and India, in order to share the potential of evolving scientific knowledge, as well as, discussing the inherent risks and limitations of applying this knowledge. A total of 47 participants, including the organizing committee members from IITM and CEH, attended the event; twenty four stakeholders from 16 different Indian government and research institutions, 16 scientists (8 UK and 8 India), representing 14 research institutes and universities from around the UK and India (invited from the Open Network), participated in the initiative.

The location and key themes of the UEI were informed by the presentation given by Dr Shubha Satyendranath (Plymouth Marine Laboratory, UK) at the Second IUKWC Workshop held in Stirling University, UK in June 2017, which highlighted issues related to the monitoring and subsequent management of freshwater systems in the Southern India region.

² For further details on the survey please visit: <http://www.iukwc.org/marking-target-iukwc-survey-results-developing-first-user-engagement-initiative>

Over the three days, stakeholders were informed on the latest developments in joint India–UK water security science by the scientists; in turn the stakeholders shared their feedback on the current use of demonstrated scientific outputs, and key issues perceived in water resource management at state level. The delegates then had a chance to visit Lake Vembanad, to visualise the discussed concepts and see demonstrations of new technologies. The last day was set aside for sector specific discussions, aided by preparatory toolkits outlining expectations and background of the initiative that were provided to both stakeholders and scientists before the Workshop.



Photos from the first IUKWC User Engagement Initiative in Kochi, Kerala. *Clockwise from top left:* Presentation session at WWI campus, output of discussions between scientists and stakeholders, and field presentation at Lake Vembanad

The recurring theme from the UEI was the need to identify and engage stakeholders acting at different levels of a particular sector in action-oriented research. However, this was challenged by a lack of mechanisms to take forward ideas, even when collaborations were identified. In their feedback, delegates requested that events like this UEI and the other activities promoted by IUKWC be continued as they promote such engagement and linkage.

Overall, the activity was scored 9/10 by the delegates who filled in the survey. The Activity Report is being finalized for publication and will be shared on the IUKWC website shortly.

5.1.2 Second User Engagement Initiative

The second UEI will be held in February 2019. This initiative was planned differently, in that the third Grassroots Field Exposure Session (GFES) will be held immediately before the UEI; a decision made by the IUKWC Board to improve efficiency. The theme of the event will be the water supply sector in the central Indian region, a topic that was brought to our attention by Dr Pankaj Kumar (Indian Institute of Science Education and Research Bhopal) whose expertise in the sector and in the region enabled the IUKWC secretariat to award him the Indian Lead position for the event. An Open Call was conducted in July 2018 for the UK Lead and Dr Sumit Sinha of the School of Earth and Environment (SEE), University of Leeds, UK was shortlisted. A second UK scientist, Dr Alexandre Gagnon from University of the West of Scotland, has also been recruited to assist with the planning of this UEI-GFES given that it comprises two consecutive events.

Thus far, the plan is to call for delegates to attend either both or one of the two events. The GFES will take place first, allowing scientists to interact with ground level managers and actors in the water supply sector of the central Indian states of Madhya Pradesh, Uttar Pradesh and Gujarat in order to identify the scope for actual utility and collaboration with end users in their research. Following this, a 3-day UEI, which is to be held at IISER Bhopal, will allow scientists to communicate an integrated outlook of their research outputs to stakeholders working at state and regional levels of water management, who in turn will discuss their challenges and requirements.

5.2. Grassroots Field Exposure Sessions

At the June 2017 Steering Group meeting, a proposal for a new Grassroots Field Exposure Sessions (GFES) initiative was tabled and NERC approved funding for one year (2017/2018) in October 2017, with second year of funding dependent on a successful review of the first year and submission of a programme of work for Year Two. Funding from MoES in India was approved for two years (2017/18 and 2018/19).

Details on the progress of GFES implementation and plans for 2018/19 has been developed and accompanies this report³.

6. Supporting Future Collaboration

6.1. Pump Priming Projects

Pump Priming Projects are designed to take forward ideas and recommendations for future India-UK collaborations that result from Science Workshops, UEI and GFES activities, by bringing together India and UK water scientists to either take forward an idea or provide preparatory groundwork for future Centre activities.

6.1.1 Outcomes of Projects One and Two

In the first year of the Centre, as reported in the Year 1 progress report, the UK Coordination team received additional funding via the NERC Innovation Fund, which was used towards two Pump Priming Projects based on ideas that were developed out of the First IUKWC Science Workshop. The Activity Reports for both these projects were submitted to IUKWC, and one of the Water Briefs (#04; M. Widmann, University of Birmingham) has been published on the IUKWC website, with the second one being finalized for publication to the website by the end of September.

The aim of Dr Widmann's project was to identify opportunities and challenges in developing hydro-climatic services in the Himalayas, particularly within the Indian states, through a comprehensive review of the relevant scientific literature of current modelling capabilities and availability of these models. The work took place between March and August 2017 and acted as preparatory groundwork for the Third IUKWC Science Workshop.

Dr Widmann and his colleagues⁴ acknowledged the role of the IUKWC in facilitating advances in hydro-climatic services, although more remains to be done. Some of the key recommendations that

³ IUKWC (2018). IUKWC Grassroots Field Exposure Sessions: Update. Wallingford, UK and Pune India.

⁴ Widmann, M., R. Blake, K. P. Sooraj, A. Orr, J. Sanjay, A. Karumuri, A., Mitra, E.N Rajagopal, A.F. Van Loon, D.M. Hannah, N. Barrand, R. Singh, V. Mishra, F. Sudgen, and D.S. Arya, 2018: Current Opportunities and Challenges in Developing Hydro-Climatic Services in the Himalayas. IUKWC report; and relating water brief 04

IUKWC could influence in future to further this area of work included:

- Furthering interdisciplinary cooperation;
- Capacity building with respect to observations, computing resources, and educating scientists who have a sufficient understanding outside their main discipline;
- Close dialogue with the potential users of hydro-climatic information and co-design of the ways information is presented and of the lines of communication;
- Coordinating existing scientific, observational, computing and hydrological management resources between different Indian and UK institutions.

The second Pump Priming Project undertaken by Dr Zareen Pervez Bharucha (Anglia Ruskin University⁵) aimed to develop an understanding of current practice of stakeholder engagement in the development of hydro-climatic services in India, with a specific focus on tools such as forecasts and agro-meteorological advisories, designed to aid decision making in dryland agricultural environments. It comprised of an assessment of general practice via desk-review, research interviews, an introductory webinar (hosted on the IUKWC website using the new webinar functionality installed through NERC Innovation Funding) to launch the project, build a network, and generate multidisciplinary dialogue, as well as a participatory stakeholder workshop held in Pune. The key overall recommendation was the need for more inclusive, co-production of tools. Hence, IUKWC could in future support activities that promote the co-development of tools, promote participatory action research, and capacity building on participatory processes.

6.1.2 Project Three Status

The third Pump Priming Project funded by the IUKWC was designed to take forward ideas from the discussions and recommendations of the Second IUKWC Science Workshop. Drs Emma Tebbs (King's College London) and Manika Gupta (University of Delhi) were selected to undertake a project entitled '*Synergistic utilisation of EO-based soil moisture observations: Applications in the UK and India*'. The aim of the project was to investigate barriers and user requirements in more detail and to investigate where EO products can be applied to improve monitoring and forecasting. The project commenced in October 2017, with a completion date of June 2018; however, due to unforeseeable, personal circumstances the work has been extended to October 2018.

The structure of the project included desk review, model development, forecasting and validation, as well as user survey, field testing and information dissemination through webinar, Activity Report and Water Brief. The final activities to be completed are the field testing and information dissemination. The final two Pump Priming Projects will be undertaken in Year 3, with the intention of funding projects which take forward ideas from the Lancaster Workshop, Research Exchanges, UEs or the upcoming GFES.

⁵ Bharucha, Z.P, Chattopadhyay, R, Bhawe, A, Green, M, Krishnaswamy, J. 2018: Stakeholder Engagement in Hydro-climatic Services in India: Report of Pump Priming Project. IUKWC Report

7. Centre Profile and Communication

In order to establish a platform for water scientists and stakeholders interested in water security that would foster long-term partnerships and dialogue, the IUKWC has continued to publicise the Open Network and communicate its activities as widely as possible to its target audience.

The target audience for IUKWC communications are still research scientists, policy-makers, and water businesses in both the UK and India, as well as, the global public. The following sub-sections outline the progress we have made on the use of different communication channels to reach these audience.

7.1. Website

Since its launch in September 2016, the IUKWC website has continued to grow, with an actively updated front page and access to various publications, events, and news items on current water security issues. Some of this content is open to the public, whereas content such as Briefs, Reports, Workshop presentations, and application forms for activities are only available to Open Network members. Registration to become a member is simple and now contains the required disclaimer in line with GDPR requirements.

The website now hosts a Community News section, which allows members, including the IUKWC Secretariat, to promote news, events, and opportunities from the wider Indian and UK Water Science communities, which may be relevant to IUKWC members.

As planned, the members of the Open Network are able to use the online discussion forum when required. The webinar functionality has also been made available and was used by Dr Barucha for her Pump Priming Project. The BOS online survey was used by Drs Tebbs and Gupta for the Year 2 Pump Priming Project that is ongoing. These applications will be promoted again in the upcoming events so that new members are also made aware of their availability.

The website is now fully translated into Hindi, thus increasing its reach within India and Hindi-speaking stakeholders. The searchable library has also been developed and continues to be populated with Centre publications, documents and event materials.

Figure 8 outlines the user access and statistics for the website for the period June 2017 to June 2018.

Audience Overview



Figure 8 Google Analytics for the www.iukwc.org website for the period June 2017 to June 2018.

7.2. Social Media

The IUKWC Twitter account continues to prove to be a valuable medium for disseminating notifications and communications to a wide community interested in water security and related issues. On average, the Centre sends out 5 tweets a month. Although obscured by the tweet impressions in Figure 9, the timing of the tweets correspond to spikes in Twitter impressions, visits to the profile page, number of retweets and number of new followers. The metrics as of June 2018 show that the account has 344 followers, of which 69% are male and 31% female. Twitter is slightly more used in the UK (40%) than in India (36%), with 14% of the followers coming from the rest of the world.

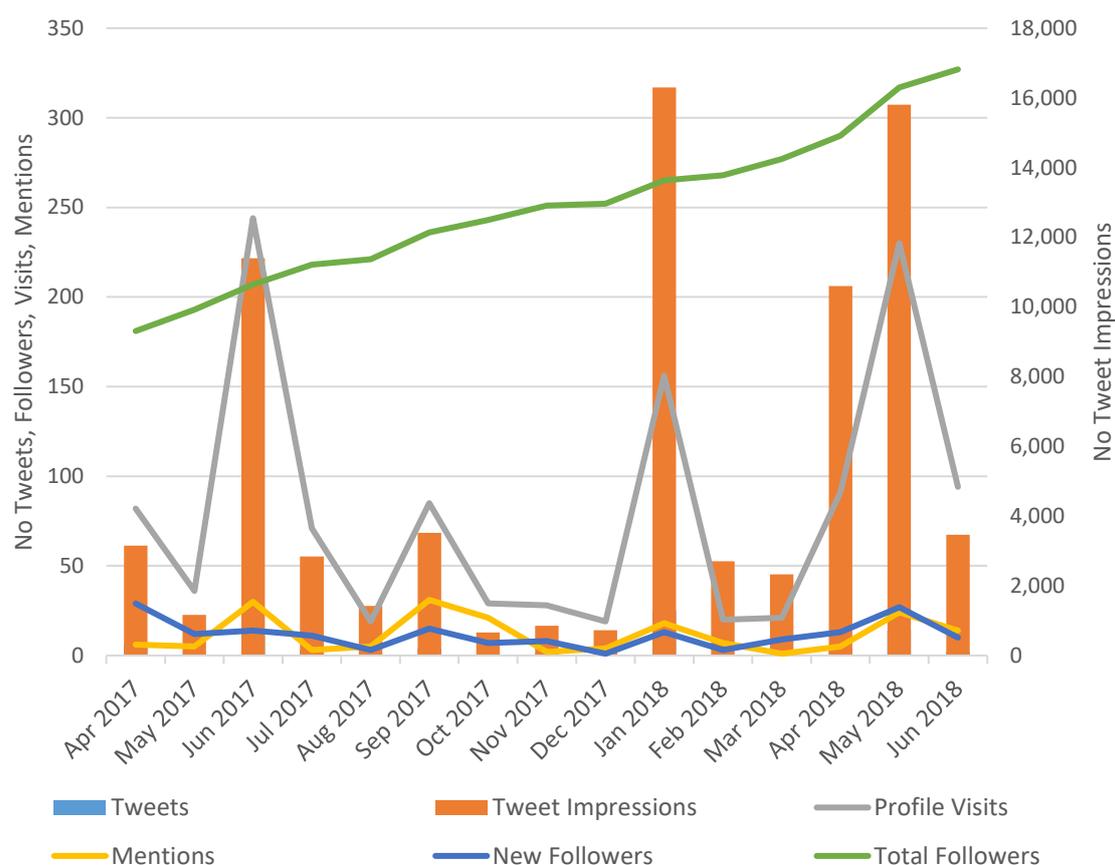


Figure 9. Twitter Analytics for the period April 2017 to June 2018; Tweet impressions: number of times our tweets are seen; Tweets: number of posts by us; Profile visits: number of visits to the @IndiaUKWater Twitter profile; Mentions: Number of times @IndiaUKWater is mention directly within another tweet; New Followers: new followers of the @IndiaUkWater account. NB. The axis on the right indicates the number of tweet impressions. Legend:

The IUKWC Facebook page is available at <https://www.facebook.com/IUKWC/>. The page has proved to be a very useful communication and interaction tool to publicise IUKWC events, calls, activities, and outputs. Apart from IUKWC news, the page also contains posts on latest news in the India – UK Water security sector. The centre currently has 135 dedicated followers while the reach of posts associated with IUKWC news range from a minimum of 5 to a maximum of 693 Facebook users (Figure 10).

7.3. Email Communication

Targeted email campaigns continue to be used by the Centre to inform and remind members of upcoming Centre events and external activities that are relevant to the Centre's theme. All applications for activities are received through the Centre email, info@iukwc.org, and any mass communications with delegates are conducted through this account. This system is working well and will remain a key way to communicate with members, in addition to social media and the website.

Total Page Followers as of Today: 135



Post Reach

The number of people who had any posts from your Page enter their screen.



Figure 10 Facebook Analytics for the IUKWC Facebook page, showing the number of followers and the reach of posts, between August 2017 and July 2018.

7.4. Outreach and Events

The IUKWC Secretariat has continued to leverage on other events to promote the mission of the Centre. Ms. Joshi attended the 5th India Water Week held in October 2017, in New Delhi. The theme of the event was 'Water and Energy for Inclusive Growth' and attracted stakeholders and scientists from India and worldwide, working in various sectors, including amongst others, agriculture, irrigation, hydropower, rural development, water resource management and supply. The event presented a unique opportunity to network with, and spread the message of IUKWC, to the variety of stakeholders present and to encourage them to enrol in the Open Network and engage in IUKWC activities. Many of the science and social science stakeholders were well aware of IUKWC and its activities, however, the private sector had little knowledge of the Centre. Hence, the decision to explore collaborations with other organizations such as the Smart Water Networks Forum to engage more with private sector stakeholders.

The secretariat has also begun to engage the media in activities that have wide appeal, such as the first UEI, where the Indian media were invited for the event conclusion. The media found the issues addressed at the Workshop relevant 'hot-topics' and were impressed with the unique structure of the initiative; reporting as such in nine articles written in both English and the local vernacular, Malayalam; hence, further promoting awareness, not only of the work of the Centre, but of issues and advances around water security.

8. Monitoring Outcomes

The proposed key output for the IUKWC was to increase engagement between (and within) the water research communities of India and the UK, and an enhanced awareness of the benefits Indo-UK water science can provide amongst stakeholders; which was to be measured using proxy measures such as the number of members in the Open Network over time; reach of online communication; and so on.

As we enter into the third year of the programme, we are now able to compare change over time and determine if we are making progress, as shown in Table 4 below.

Table 4 Comparison of Measures of Success between Year 1 and Year 2 of the IUKWC

Measure of Success	Year 1	Year 2	Comment
Number of members in the Open Network	352	659	54% increase, see Error! Reference source not found.
India: UK balance	2:1	3:1	Not surprising seeing that the focus of IUKWC is to promote water security in India through collaboration with the UK (Figure 3).
Organizational and geographical diversity	India Institutes: 116 India Cities: 78 UK Institutes: 60 UK Cities: 42	India Institutes: 195 India Cities: 115 UK Institutes: 77 UK Cities: 51	Overall increase in all the sub-metrics.
Reach of online communications	Website # users – 3,029 Page views – 26,999 New visitors – 52.2% Twitter # followers - 169 UK:India:World followers – 50:34:16	Website # users – 5,344 Page views – 87,303 New visitors – 79.2% Twitter # followers - 344 UK:India:World followers – 40:36:14 Facebook page – 135 followers	Overall improvement in key statistics, plus the addition of the IUKWC Facebook page
Evidence of collaboration	Feedback from event surveys indicating that networks were formed for furthering collaboration	Similarly in Year 2, respondents all made meaningful contacts	No further survey has been done to assess actual outputs beyond activities; a survey of the members may be developed in Year 3, time permitting. More importantly, outputs from past events have informed future ones, e.g. the UEI resulting from the Stirling Workshop, thereby enabling even more development in key areas of concern.

In addition to the above metrics, the IUKWC strives to cover the various core scientific themes that were set out in the proposal, through its work. The Centre continues to grow by taking on feedback from its events, such as including field visits into Workshops, as well as promoting the use of a variety of engagement methods for e.g. the toolkit used for the UEI, online polls and webinars, to further collaboration and knowledge sharing.

In Year 3, the IUKWC will continue to promote its mission through well planned and executed activities, as well as more publicity within the UK water security sector.



**INDIA-UK
Water Centre**

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