CatchX Final Report

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1. Introduction

The CatchX web-platform has been designed by the University of Leeds and Earthwatch Europe to allow universal access to cutting-edge scientific data in any river catchment globally. The most appropriate datasets currently available have been selected and processed into 57,646 catchments. The platform allows users, without needing specialist skills, to interrogate the datasets in their catchment to visualise water balance information, explore trends and compare with other catchments. https://earthwatch.org.uk/get-involved/projects-activities/catchx

The project was funded by the UK Natural Environment Research Council (Grant number NE/P016812/1).

There are five reports in all covering the CatchX project:

(1) The **Final Report** covers all aspects of the project in summary.
(2) The **Methodology Report** describes the methods used to create the platform.
(3) The **Data Selection Report** describes the review and selection procedure of datasets.
(4) The **Workshop Report** describes the workshop held on user needs in South Africa.
(5) The **Data Testing Report** describes testing of CatchX data for South Africa.

This **Final Report** aims to provide the reader with an overview of the project stages in developing the CatchX Platform.

2. Overview of CatchX

The Catchment Hydrology Explorer for Water Stewards (CatchX) platform is a UK NERC (Natural Environment Research Council) Innovations project designed to take the best available global hydrological data, test it and make it available to all in an easy to use, online web map platform that provides important water information anywhere in the world. Potential users of the platform were involved at every stage of its development through a survey and a workshop, ensuring it is directly useful and understandable. The easy to use platform should allow any user to get an independent, local estimate, of the range of the water cycle in their locality and help them understand the implications of the use of water as a resource, whether that is for irrigating crops, water for domestic supply, sustaining the environment or any other use.

The platform has been developed jointly by scientists from the University of Leeds and the experts at Earthwatch Institute, an international environmental charity with a track record of citizen involvement in global water science and the development of online platforms. Local South African scientific expertise in water has been provided by Rhodes University, ensuring local relevance in the testing of the platform. The project has been guided by a number of key partners, WWF, Marks and Spencer, Fathom Global, and Richard Carter and Associates.

2.1 The Key Objectives of CatchX

The three core project objectives achieved were:

- Identify key global hydrologically relevant data and methods that can be utilised in a global hydrology platform.
- Develop a global map-based web platform (CatchX) using global datasets, allowing users to identify and zoom to their catchment of interest.
- Test the platform with users and compare to local hydrology data in South Africa.

2.2 The CatchX Team

- **Dr Mark Trigg**, *Principal Investigator*, School of Civil Engineering, University of Leeds
- **Professor Suraje Dessai**, *Co-Investigator*, School of Earth and Environment, University of Leeds
- **Dr Susana Almeida**, Research Fellow, School of Civil Engineering, University of Leeds
- **Dr Wim Clymans**, *Project Manager*, Earthwatch Institute
- **Luis Felipe Velasquez**, *Web Developer*, Earthwatch Institute
- **Professor Denis Hughes**, *Data Testing*, Institute for Water Research Hydrological and Water Resource Modelling, Rhodes University
- **Dr Jane Tanner**, *Data Testing*, Institute for Water Research Hydrological and Water Resource Modelling, Rhodes University

2.3 Steering Group

The project has been guided by a number of key partners who's experience and support has been invaluable:

Dr Connor Linstead, WWF-UK

Hazel Culley, Marks and Spencer

Christine Colvin, WWF - South Africa

Klaudia Schachtschneider, WWF - South Africa

Dr Andrew Smith, Fathom Global

Dr Christopher Sampson, Fathom Global

Professor Richard Carter, Richard Carter and Associates.

Dr Ian Thornhill, Former Project Manager, Earthwatch Institute. During the project Ian took up a new position at Bath Spa University, where he continued to support the CatchX project as a steering group member.

3. Platform Development Stages

3.1 User Survey

As part of the CatchX project, a survey was distributed to water practitioners to identify the key information needs from potential users of a web hydrological platform that as to be built. The survey was distributed widely (Figure 1), and we received approximately 100 responses from researchers, consultants, water managers, data analysts, and policy makers worldwide. In particular, we received 19 responses from South Africa, where we subsequently tested the pilot version of the web platform. From the survey, a key user need identified was information about water balances at catchment scales (Figure 2). The survey also supported our initial assumptions regarding key parameters to include in the web platform (i.e. precipitation, evapotranspiration, temperature and runoff).

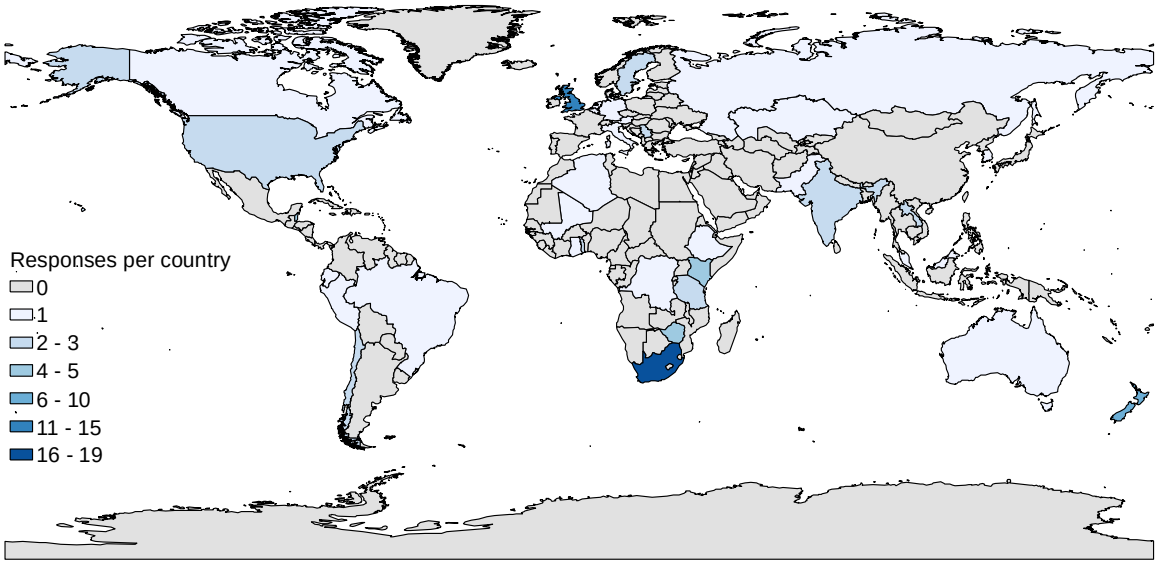

Figure 1 – Number of responses to the survey per country.

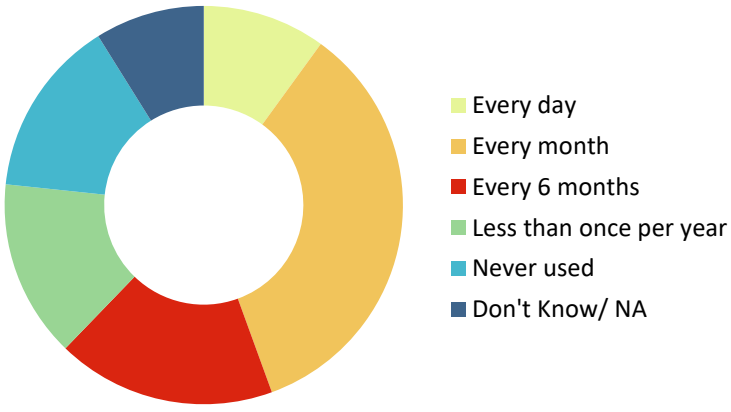

Figure 2 – Catchment water balance (seasonal, monthly) use by the survey participants.

3.2 Data Review Stage

The CatchX platform uses global datasets and a consistent methodology, identified through the review stage, to provide estimates of monthly water balance information (precipitation, evapotranspiration, temperature and runoff) for each catchment, as well as land cover data.

The datasets included in the CatchX platform have been selected to meet the following criteria:

- Geospatial with global coverage;
- Freely available;
- Current;
- Scientifically credible;
- Accepted by water practitioners.

The main datasets selected are:

- Catchment boundaries: HydroBASINS (Lehner & Grill, 2013) provides a consistent global dataset of nested catchments with associated centrelines. Data is available from www.hydrosheds.org
- Precipitation: MSWEP (Beck et al., 2017) - The Multi-Source Weighted Ensemble Precipitation (MSWEP) is a global precipitation dataset that has been specifically designed for hydrological modelling and it includes multiple sources of data (gauge, satellite, reanalysis). Data is available from http://www.gloh2o.org/
- Temperature, actual evapotranspiration and runoff: Earth2Observe tier-2 dataset (Dutra et al., 2017; Schellekens et al., 2017). Earth2Observe dataset is a reanalysis multi-model ensemble that includes land surface and global hydrological models (eight models for tier-2). One of the strengths of this dataset is that it captures (at least partially) the uncertainty that stems from model simplifications and assumptions, by providing outputs from a large number of global hydrological and land surface models. Data is available from http://www.earth2observe.eu/
- Land Cover: CCI LC (Santoro et al., 2017)- The Land Cover Climate Change Initiative (CCI) contains time series of land cover at 300 m spatial resolution on an annual basis from 1992 to 2015 (Santoro et al., 2017). This data set was compiled based on data from five satellite missions providing daily observation of the Earth, including NOAA-AVHRR HRPT, SPOT-Vegetation, ENVISAT-MERIS FR and RR, ENVISAT-ASAR, and PROBA-V for the most recent years. 22 land cover classes defined based on the FAO Land Cover Classification System. Data available from https://www.esa-landcover-cci.org/

More detailed information on the dataset choice is available in the **Data Selection Report**.

3.3 Platform Design

In close collaboration between University of Leeds and Earthwatch, the datasets listed in Section 3.2 have been preprocessed into a geospatial database of 57,646 catchments with timeseries covering 25 years (Temporal coverage: 1979-2014). Numerous platform design meetings were held, including key inputs from the steering committee. These meetings help identify the best processing and visualisation methods and appropriate web-tools for development of the platform. Once an initial

platform design was agreed, a pilot (beta) version of the platform was produced by Earthwatch for all South Africa. This platform was then shared with the workshop attendees and feedback for the final design stage solicited. Once the final agreed design was complete, all the data was preprocessed for all the catchments globally and the final platform tested for stability and usability.

More detailed information on the methodology is available in the **Methodology Report**.

3.4 User Workshop in Cape Town

A workshop with potential platform users was hosted by WWF South Africa on 6 June 2018. The workshop took place at the Hotel Verde, Cape Town, South Africa. The workshop introduced the pilot version (SA only) of the CatchX platform to potential users.. A varied range of users were invited to the workshop and valuable feedback was received to finalise the design of the platform with global coverage. The user feedback documented in the **Workshop Report** covered: i) User stories for the CatchX website; ii) Future platform improvement; iii) Platform testing.

3.5 Finalisation of Platform and Website

Once the final design of the platform was agreed, all the data was preprocessed for all the catchments globally and the final platform tested for stability and usability. This descriptive website for the project and platform were also completed and include links to all the reports described in this document. The final website and platform were shared for public use in February 2019.

https://earthwatch.org.uk/get-involved/projects-activities/catchx

3.6 Platform Future

The CatchX Project partners are actively looking for opportunities to extend and further develop this platform and encourage user feedback and research activities based on the platform. Please use the feedback form at the bottom of the project webpage, if you would like to discuss your own ideas. We would love to hear from you.

https://earthwatch.org.uk/get-involved/projects-activities/catchx

4. Meetings and Events

4.1 Conference Presentations

As well as the user workshop in South Africa, three key conference presentations allowed the team to share the beta platform to scientific users (European Geosciences Union, General Assembly) and geospatial data experts (FOSS4G & Catchment Data & Evidence Forum). There will also be a couple of follow-up papers describing the platform development and use.

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Velasquez, L., Almeida, S., Trigg, M., Clymans, W., Dessai, S., Linstead, C., Sampson, C., Smith, A., Carter, R., Schachtschneider, K., Colvin, C., Culley, H., Tanner, J., Hughes, D., Thornhill, I. (2018). Catchment Hydrology Explorer for Water Stewards (CatchX Platform), FOSS4G 2018, Dar es Salaam, Available from: https://drive.google.com/file/d/1KTnine-oQjSXVJwcCZzagsXy_AxgkahR/view

Catchment Data & Evidence Forum 28/09/18 - Lightning Talks (The CaBA Catchment Data & Evidence Forum brought together around 60 data and evidence professionals from the CaBA community to share knowledge, identify opportunities and discuss future development of the data and evidence sharing landscape, in the light of the government's 25 year plan for the environment.)

4.2 Steering Group Meetings

Three steering group meetings took place via Skype during the project, as well as regular email updates:

- 12 July 2017 – Kick off meeting where the main objectives of the project were discussed, and the initial project stages and key parameters were also discussed.
- 20 April 2018 – A summary of the user survey was presented to the steering committee, feedback obtained at the European Geoscience Union (EGU) conference by the Postdoc has been shared, and feedback from the steering committee on the pilot version of CatchX platform collected.
- 20 September 2018 – Summary of SA workshop, findings from testing, feedback on final platform design documented for inclusion in platform. The meeting also included discussions on long term funding and development of the platform.

5. Acknowledgments

The workshop was supported by the Natural Environment Research Council (Catchment Hydrology Explorer for Water Stewards (CatchX Platform); grant number NE/P016812/1).

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