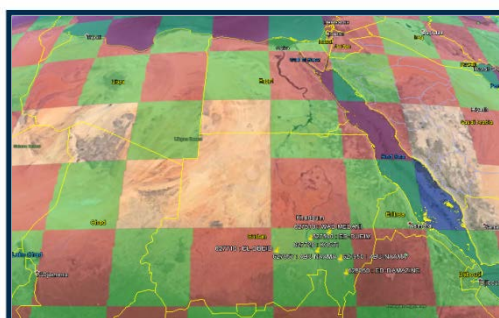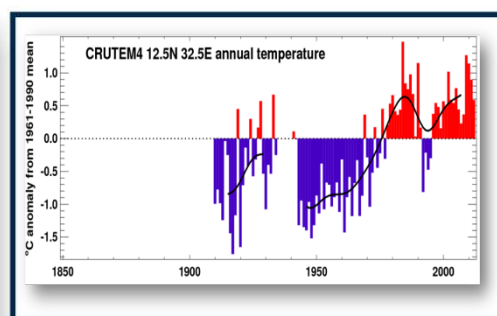# CSIR Contribution to Defining Adaptive Capacity in the Context of Environmental Change

2nd Interim Report

Approved for public release; distribution unlimited

Report Documentation Page

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13. SUPPLEMENTARY NOTES

14. ABSTRACT
The Defining Adaptive Capacity in the Context of Environmental Change (DACE) project set out to understand the relationship between environmental factors and human security for developing regions. In this reporting period (month 2-3) the team collected and organised data related to the above objective. The project workshop held in Washington DC in February 2014 served to further develop the analytic framework and discuss data overlay as part of the data fusion process. The next steps are to further define and confirm correlative relationships between the datasets.

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CSIR Contribution to Defining Adaptive Capacity in the Context of Environmental Change

2nd Interim Report

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CONTENTS

1.   ABSTRACT

The Defining Adaptive Capacity in the Context of Environmental Change (DACE) project set out to understand the relationship between environmental factors and human security for developing regions. In this reporting period (month 2-3) the team collected and organised data related to the above objective. The project workshop held in Washington DC in February 2014 served to further develop the analytic framework and discuss data overlay as part of the data fusion process. The next steps are to further define and confirm correlative relationships between the datasets.

2.   INTRODUCTION

The CSIR and ERDC are jointly doing research on Defining Adaptive Capacity in the Context of Environmental Change (DACE) under grant W911NF-14-1-0113. The research is based on the premise that human security and environmental security is inextricably linked and that a better understanding the relationship between human and environmental security will assist in reducing vulnerabilities and improving stability. The grant supports CSIR and ERDC research in adaptation to water-related impacts of climate change. The research is based on a comparison of historic human responses to environmental change in the Mississippi River and the Nile River, as measured by human security indicator datasets and environmental variability data. The overall goal is to measure regional adaptive capacity and thus understand how to facilitate regional stability that can withstand threats imposed by environmental impacts (Figure 1). Based on the outcome of this analysis, a set of metrics will be developed that will assist in measuring the adaptive capacity of a region based on past behaviour and capabilities to cope with physical or environmental changes.
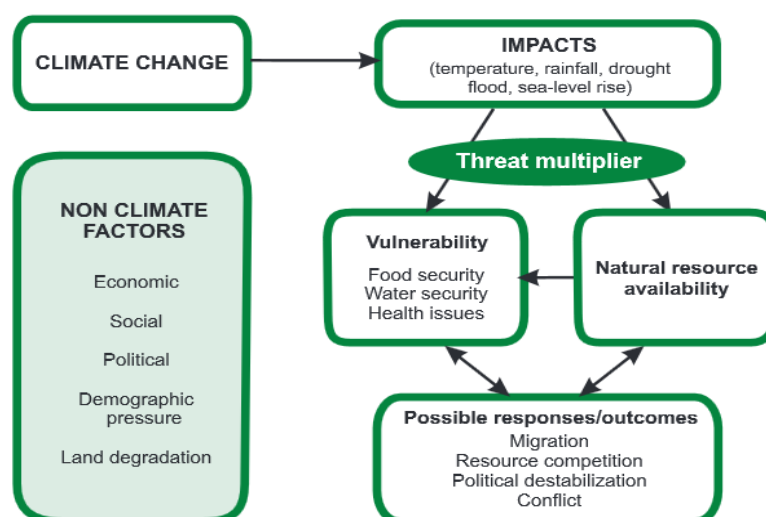

Figure 1. Conceptual Framework (UNEP, 2011)

This second interim report presents progress on the data overlay component of the data fusion phase. The data overlay phase supports the understanding and identification of vulnerabilities in developing regions that inherently have fewer institutional capabilities to handle large-scale changes. The data overlay supports the qualitative and quantitative analysis of adaptive capacity compares areas in the Mississippi and Nile Basin, with the Mississippi case area serving as a more controlled case study with the Nile Basin representing a context with more limited historical data. Environmental change and human behaviour over the hundred year time scale (1910-2010) are being used for the analysis. The comparison of environmental change (eg. precipitation and temperature trends) and the corresponding human behavioural responses (eg food access and migration patterns) will provide an input to metric creation, contingent on evidence that changes in local stability are related to environmental change. These metrics will be used to measure areas of vulnerability within both study regions.

3.   PROJECT TASKS AND PROGRESS

3.1 Tasks

No.	Task	Description	Target date
1	Datasets	1.1 Inputs to environmental and human security datasets	31 Jan 2014
2	Data fusion	2.1 Data overlay	31 March 2014
2	Data fusion	2.2 Data analysis 2.3 Additional data collection	30 Sept 2014
3	Correlation	3.1 Compare results	30 Sept 2014
4	Metrics	4.1 Develop adaptive capacity metrics	31 March 2015
4	Metrics	4.2 Identify areas of vulnerability	30 June 2015

This report pertains to Task 2.1: Data overlay. The Task has been described as follows in the Project Plan:

Task 2: Data Fusion:

*Task 2.1: Overlay the environmental dataset produced from the reanalysis with the historic human indicator data. This task will be done for both the Mississippi River and the Nile River. **The CSIR will provide technical assistance with this task, which will be achieved through a joint workshop at ERDC.***

3.2 Progress

CSIR project members, Marius Claassen and Karen Nortje journeyed to Washington DC in February 2014 during the week of the 17th to the 21st (Figure 1). During this week the CSIR collaborated in a joint workshop with ERDC team members, Swathi Veeravalli (project leader), Laura Harding and Nicole Wayant. The agenda (Figure 3) included an overview of the objectives and discussions on the data to consider the relationships and linkages over time and space for the two project case areas. Significant time was spent to refine the methodology whereas the team also discussed joint participation in related activities.

Figure 2. South African team members, Karen Nortje and Marius Claassen in Washington DC with the Capitol in the background

TEC-CSIR 6.1 Planning Meeting
Defining Adaptive Capacity in the Context of Environmental Change
Topographic Engineering Center
7701 Telegraph Road, Alexandria VA 22315
February 17 – February 21, 2014

Tuesday, February 18, 2014	0930 - 1030	Arrive at TEC/Security in processing	Marius/Karen
	1030 - 1130	Administration	Marius/Karen
	1230 – 1330	PMP review	All
	1330 - 1430	Lunch	All
	1430 - 1530	Environmental Data Review	Nikki Lead
	1530 - 1630	Task Identification	All
Wednesday, February 19, 2014	0930 - 1030	Methodology	All
	1030 - 1130	Correlation Analysis	All
	1230 – 1330	What do we mean by Metrics?	CR-4 All
	1330 - 1430	Lunch	
	1430 - 1530	Climate/Weather/Human Security Briefing	CR-4 (Swathi/Laura lead)All
	1530 - 1630	Review	
Thursday, February 20, 2014	0930 - 1030	Conceptual Framework	CR-2 All
	1030 - 1130		
	1230 – 1330	Lunch	
	1330 - 1430	Next Steps	
	1430 - 1530		
	1530 - 1630		
Friday, February 21, 2014	0930 - 1030	SA workshop planning	Swathi/Marius/Karen
	1030 - 1130		
	1230 – 1330	Lunch	
	1330 - 1630		

Figure 3. Agenda for the joint CSIR and ERDC workshop in Washington DC.

Defining Adaptive Capacity in the Context of Environmental Change

Further progress was made with regards access to the following datasets for both qualitative and quantitative, and environmental and human security factors:

1910-2010 Quantitative	Hyde; GIMMS; MODIS/NDVI; HURDAT; Radiosonde; NCAR, Flow, ENSO
1910-2010 Qualitative	Human dynamics in the MS (Primary and secondary) Human dynamics in the Sudan (Secondary)

An example of climate data presentation in presented in Figure 4. The map shows the climate variation for the 100-year study period, whereas the graph shows the annual deviation from the long term mean. Figure 5 shows a representation of river runoff time series data, with the different gauging stations being shown on the map and the time series data for the Malakal gauging station (GRDC-no.: 1673600) on the White Nile being shown in the graph.
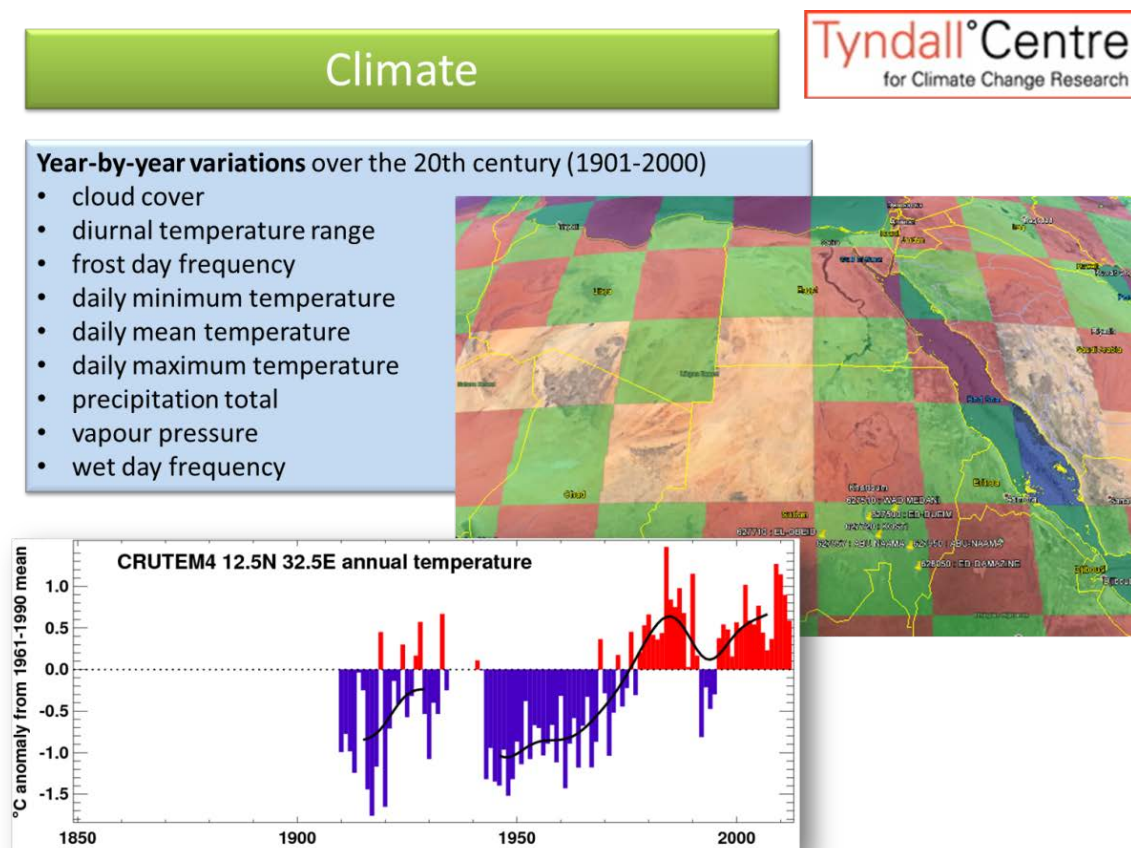

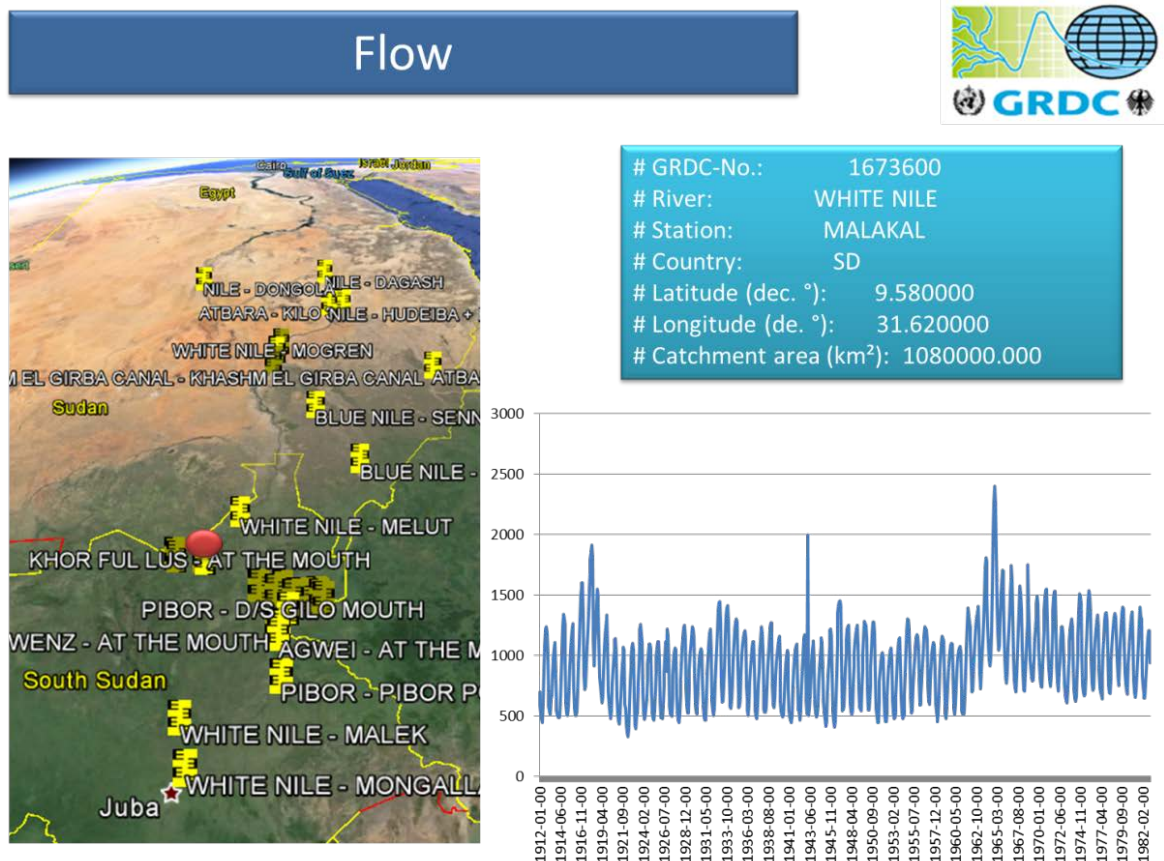Figure 4. Climate data presentation (Tyndall Centre, 2014)

Figure 5. Hydrology data presentation (Global Runoff Data Centre, 2014)

During this joint workshop the team tested the composite human security indicator dataset developed during Task 1. This dataset took into consideration the contextual nuances of the two case study areas, the Mississippi River and the Nile River. This new dataset comprised of a number of main categories, namely: economic, health, personal, community, political, food, environmental, cultural/spiritual, physical infrastructure and livelihoods. Each of these categories also had sub-categories which were specifically linked to human adaptive capacity within the context of environmental change.

In order to test the new dataset, an excel spreadsheet was created where the team then input data both spatially namely, national, regional and local, and temporally according to decade. For example:

year	space		economic	health
			status of financial system	Health trends
			Level of income	Access to safe water
			Sufficiency of incomes	Access to housing: shelter from natural elements
			types of employment	Accessibility to healthcare systems (physical and economic)
			employment rates	Accessibility to safe and affordable family planning
			land tenure system	Medical care
			division of labour	Type health system
				infant mortality
				fertility rates
1991	National		GNI: 440 GDP: 11,379,222,223 Unemployment (% of total labour force): 15.4	Infant mortality rate per 1000 live births: 80 Fertility rate (total children per woman): 6.1
	Regional			
	Local			
1992	National		GNI: 340 GDP: 7,031,933,410 Unemployment (% of total labour force): 15.2	Infant mortality rate per 1000 live births: 79 Fertility rate (total children per woman): 6
	Regional			
	Local			
1993	National		GNI: 300 GDP: 8,881,009,956 Unemployment (% of total labour force): 15.3	Infant mortality rate per 1000 live births: 78 Fertility rate (total children per woman): 6
	Regional			
	Local			
1994	National		GNI: 310 GDP: 12,793,798,349 Unemployment (% of total labour force): 15.1	Infant mortality rate per 1000 live births: 77 Fertility rate (total children per woman): 5.9
	Regional			
	Local			
1995	National		GNI: 390 GDP: 13,830,369,880 Unemployment (% of total labour force): 15.1	Infant mortality rate per 1000 live births: 75 Fertility rate (total children per woman): 5.8
	Regional			
	Local			

Figure 6. An example of the excel spreadsheet created for the Sudan. This snapshot is of the categories 'economic' and 'health' during the years 1991-1995.

The teams are currently in the process of populating the spreadsheet to see whether or not this type of data capturing is appropriate for the purposes of this project.

Lastly, the team have started looking at possible ways of conceptualising the data that is being generated. The following diagram is a draft conceptual model developed in the workshop as a starting point for the analysis that is to follow further along in the project.
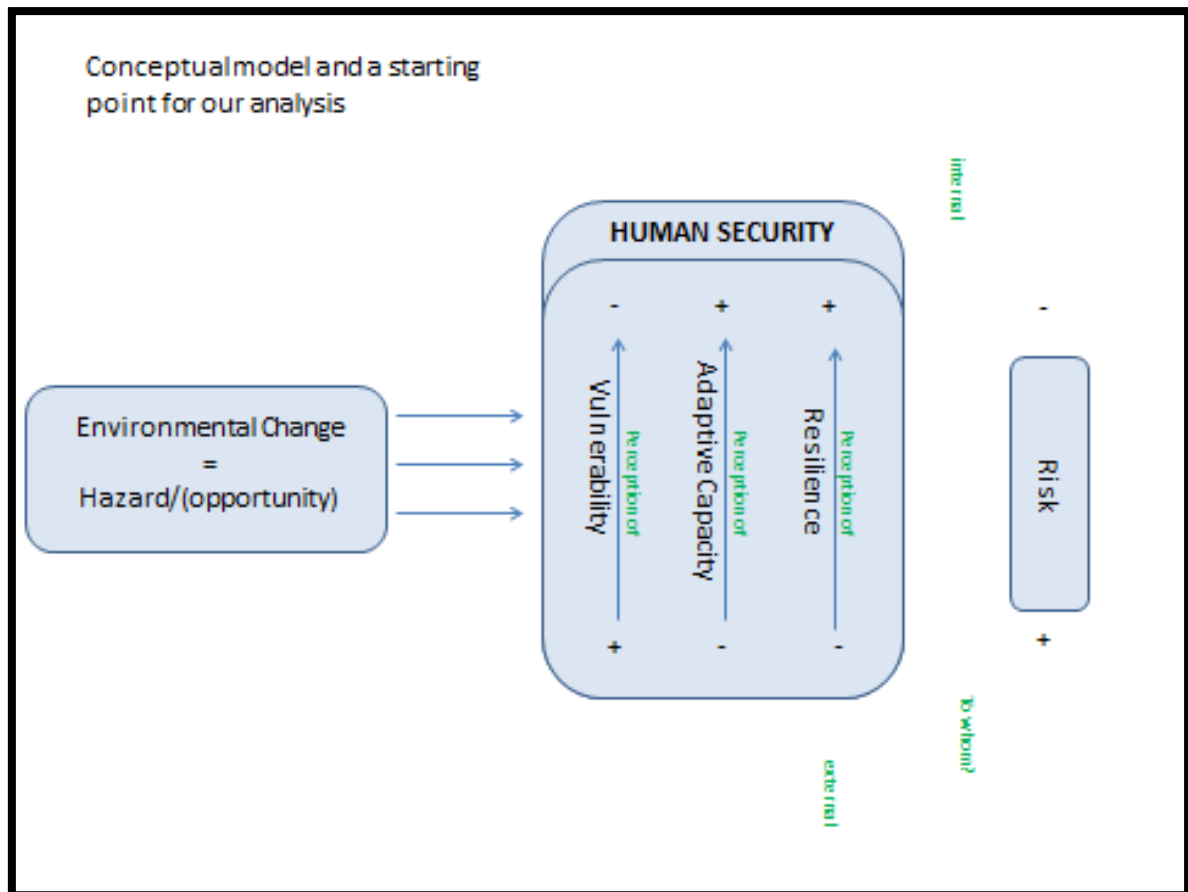
Figure 7. Draft conceptual model developed during the joint workshop in Washington DC in February. It will be used as a starting point for further data analysis.

3.3 Red Flags

There are a small number of important issues that needs to be flagged. These are however not show-stoppers and the fact that they have occurred will also be an input into the methodological reflection captured for the project and the overall process.

1) Flow data for the Nile: Quantitative flow data for the Nile is readily available up to 1982. From here on data is difficult to come by. Negotiations on the Cooperative Framework Agreement (CFA) for the use, development, protection, conservation and management of the Nile River Basin and its resources has been ongoing for the past two decades, Both Sudan and Egypt are opposed to the agreement, whereas seven of the upstream countries have already signed it.

2) Qualitative data for the Nile, specifically for the themes the project is looking at is difficult to find, not all encompassing, and not housed in one place. As a result the team has to delve through both academic and grey literature to find the information needed, also data is not complete and may leave gaps in the narrative.

3.4 What's next?

Following on from Task 2.1, the team will now take the data fusion tasks further by focussing on the data fusion processes of data collection and analysis.

Task 2: Data fusion

> *Task 2.2: Determine if significant changes in environmental variability data correspond to changes in human behavior using both visual (GIS) and statistical methods for each river. Use both the human security indicators and relevant historical case studies to find and affirm a correlation to tangible changes in environmental data. Due to the future transition of this research, past military involvement with populations residing within the watershed will also be researched and the impact will be considered.* **This task will be facilitated through the joint workshop in which the CSIR will participate.**

> *Task 2.3: To further define and confirm correlative relationships between the two datasets, additional background research will be conducted to consider the following potential historical factors: man-made infrastructure alterations to each river, topographic modifications within each watershed due to urbanization, industrialization, and technological advancements, and changes in environmental policy relating to use of and disposal in the rivers.* **The CSIR will assist with this research particularly regarding the Nile Basin and selected study area.**

4. COST AND PAYMENT SCHEDULE

4.1 Cost and Price

	Tasks	Cost items	Units	Rate	Amount (US$)	Due date
	Datasets	Karen Nortje Marius Claassen Stationary & communication	40 hrs 29 hrs	69 146	2 760 4 220 20	31 Jan 2014
		Task total			7 000	
→	Data fusion (Data overlay)	Karen Nortje Marius Claassen Travel cost (visit to ERDC)	48 hrs 44 hrs	69 146	3 312 6 402 3 286	31 March 2014
		Task total			13 000	
	Data fusion (Analysis and data collection)	Karen Nortje Marius Claassen Local travel & communication	48 hrs 40 hrs	74 156	3 544 6 227 229	30 Sept 2014
		Task total			10 000	
	Correlation (Compare results)	Karen Nortje Marius Claassen Travel cost (visit to case study area)	56 hrs 48 hrs	74 156	4 134 7 473 3 393	30 Sept 2014
		Task total			15 000	
Subtotal for year 1					45 000	
	Metrics (Adaptive capacity metrics)	Karen Nortje Marius Claassen Local travel & communication	48 hrs 40 hrs	74 156	3 544 6 227 229	31 March 2015
		Task total			10 000	
	Metrics (Areas of vulnerability)	Karen Nortje Marius Claassen Local travel & communication	24 hrs 20 hrs	74 156	1 772 3 114 114	30 June 2015
		Task total			5 000	
Subtotal for year 2					15 000	
		Total amount requested from ERDC			60 000	

4.2 Payment schedule

Invoices will be generated as per the deliverable dates based on approval of deliverables and transfers should be within 30 days of invoice receipt

4.3 References

UNEP (2011) Livelihood Security: Climate Change, Migration and Conflict in the Sahel. United Nations Environment Programme. ISBN: 978-92-807-3198-9

Tyndall Centre (2013) Climate grids and derived data-sets. http://www.cru.uea.ac.uk/~timm/data/index-table.html

Global Runoff Data Centre (2014) River Discharge Time Series. http://www.bafg.de/GRDC/EN/Home/homepage_node.html