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The Proceedings of The Second International Young Scientists Forum on Soil and Water Conservation and ICCE symposium 2018, 27–31 August, 2018, Moscow

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Foreword

The book collects research papers presented during the Second International Young Scientists Forum on Soil and Water Conservation and ICCE symposium 2018 “Climate Change Impacts on Sediment Dynamics: Measurement, Modelling and Management” held at Moscow from 27 to 31 August 2018. This conference was organized by World Association of Soil and Water Conservation (WASWAC) and Lomonosov Moscow State University in cooperation with the International Commission on Continental Erosion of the International Association of Hydrological Sciences and World Large Rivers Initiative.

Preface

This proceeding volume gathers together communications about theoretical and applied aspects of sediment transport monitoring and modelling with a special focus on the relationships between climate and land use changes and river systems' sediment load and quality.

Papers presented in the book deal with consequences of climate change on erosion and sediment transport in various environments of Russia, China, Italy, Iran, Ukraine and Ethiopia. The important aspect of the book is to close the gap in the field of fluvial geomorphology for the territory of Russia which covers nearly one-sixth the land surface of the Earth. In this book, we tried to rectify this with a special focus on presenting the results of the novel studies done in the field of sediment transport in Russia. There are also studies presenting diverse methods for estimating the amount of sediments, its variability in time and uncertainty of the existed monitoring programmes.

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Contents

Abbreviations

CMIP5	Coupled Model Intercomparison Project Phase 5
CV	Coefficient of Variation
DEM	Digital Elevation Model
DFA	Discriminant Function Analysis
DGPS	Differential Global Positioning System
ECOMAG	Ecological Model for Applied Geophysics
EEE	Extreme Erosion Event
GCM	Global Climate Model
GGP	Grain for Green Project
GIS	Geographic Information System
GPS	Global Positioning System
IAHS	International Association of Hydrological Sciences
ICCE	International Commission on Continental Erosion
IPCC	Intergovernmental Panel on Climate Change
IPDRE	International Platform for Dryland Research and Education
IYFSWC	International Young Scientists Forum on Soil and Water Conservation
LBF	Lower Bound Frequency
MAE	Mean Absolute Error
MFI	Modified Fournier Index
MUSLE	Modified Universal Soil Loss Equation
NDVI	Normalized Difference Vegetation Index
RUSLE	Revised Universal Soil Loss Equation
SE	Standard Error
SSC	Suspended Sediment Concentration
SWAT	Soil Water Assessment Tool
SY	Sediment Yield
UBF	Upper Bound Frequency
WASWAC	The World Association of Soil And Water Conservation
WGMS	World Glacier Monitoring Service

Consistency and Uncertainty Analyses of Sediment Transport Monitoring in the Transboundary River: Case Study of Western Dvina (Russian Federation, Belarus and Latvia)

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Keywords: Sediment monitoring · Transboundary river · Uncertainty · Western dvina · Daugava

1 Introduction

Harmonization of the transboundary water resources monitoring is the focus of research efforts. It aims at improving comparability of the assessment of the ecological status of waters, and thus also to more coherently activate action programs of measures (e.g. Arle et al. 2016). Both with differences in monitoring approaches applied in different countries, monitoring inconsistency is also originated from the methodological uncertainty of river monitoring. In the present study, we focused on suspended sediment monitoring problems which are usually associated with considerable higher sampling uncertainties than soluble concentrations (Rode and Suhr 2007). Uncertainty components associated with the automatic pumping procedure, discharge measurements and turbidity fluctuation at the short time scale are reported to be characterized by the greatest uncertainties (Navratil et al. 2011).

The example of the outdated methods can be seen in the methodology of sediment concentrations still applied at the gauging station located in the Russian part of Western Dvina (Daugava) catchment (Velezh gauging station). In Russia according to (RD 52.08.104-2002), the gravimetric filtration is the main method of suspended sediment concentration (SSC) measurement and is based on the old-style pumps and so-called “white paper” filters (5–10 µm size of pores). Vice versa, the EU monitoring service is based on continuous records of SSC which are obtained by monitoring the turbidity of the river water, provided there is a close relationship between fluctuations in sediment concentration and turbidity, and the physical principles of turbidimetry or nephelometry are respected when calibrating the equipment’s sensor or probe (Belozerova and Chalov 2013). A literature review was carried out both with detailed statistical analyses

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of suspended sediment monitoring consistency between international gauging stations located in transboundary Western Dvina River in Russia, Belarus and Latvia.

2 Methods and Data

We analyzed the sediment concentration dataset obtained from Roshydromet (provided by Smolensk branch of Roshydromet), Western Dvina River, Velezh station (Fig. 1). Observation period is 1992–2004, 2017, 11–12 per annum. Values at the reported period at WD Velezh gauging station (SWD, mg/l) were compared to other sediment concentration value S0 for the similar period or historical observations [e.g. reported at Dedkov and Gusarov (2006)]. The difference-factor coefficient was evaluated:

$$Ki = S0i/SWDi$$

where i – either mean annual (i = 1) or maximal (i = 2) observed sediment concentration.

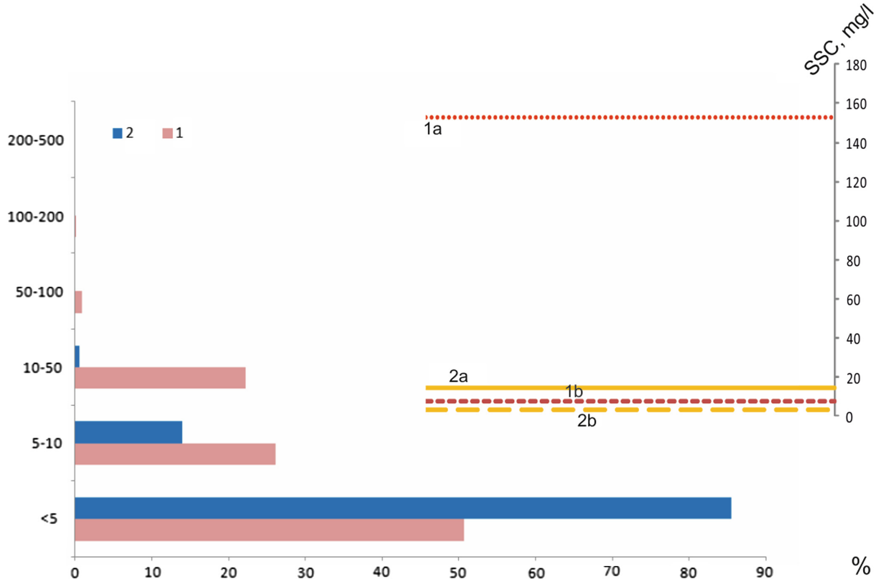

Fig. 1. Frequency curve and average values (a – annual maximal, b- annual mean) for SSC (1- pilot study station, Velesa River, 2017; 2 –Western Dvina River, Velezh station, 1992–2004, 2017).

For comparison, we used SSC observations in 2000–2015 at 10 gauging stations in Belarus (http://old.cricuwr.by/gvk/default.aspx) (annual mean and maximal values) and published data for outlet station in Latvia (Milliman and Farnsworth 2013). The data