

Enhancing a Real-Time Flash Flood Predictive Accuracy Approach for the Development of Early Warning Systems: Hydrological Ensemble Hindcasts and Parameterizations

Joško Trošelj ^{1,2,*}, Han Soo Lee ^{1,3} and Lena Hobohm ⁴

Citation: Trošelj, J.; Lee, H.S.; Hobohm, L. Enhancing a Real-Time Flash Flood Predictive Accuracy Approach for the Development of Early Warning Systems: Hydrological Ensemble Hindcasts and Parameterizations. *Sustainability* **2023**, *15*, x.
<https://doi.org/10.3390/xxxxx>

Academic Editor: Khalil Ur Rahman, Amro Mohamed Elfeki, Jarbou A. Bahrawi, Muhammad Shahid and Shuai Chen

Received: 21 July 2023

Revised: 5 September 2023

Accepted: 11 September 2023

Published: 14 September 2023



Copyright: © 2023 by the authors. Submitted for possible open access publication under the terms and conditions of the Creative Commons Attribution (CC BY) license (<https://creativecommons.org/licenses/by/4.0/>).

¹ Transdisciplinary Science and Engineering Program, Graduate School of Advance Science and Engineering, Hiroshima University, 1-5-1 Kagamiyama, Higashi-Hiroshima 738-8529, Japan; leehs@hiroshima-u.ac.jp

² Center for Climate Change Adaptation, National Institute for Environmental Studies (NIES), 16-2 Onogawa, Tsukuba 305-8506, Japan

³ Center for the Planetary Health and Innovation Science (PHIS), The IDEC Institute, Hiroshima University, Hiroshima 739-8529, Japan

⁴ Institute for Environmental Systems Sciences, University of Graz, Universitätsplatz 3, 8010 Graz, Austria; lena.hobohm@gmail.com

* Correspondence: troselj.josko.27z@kyoto-u.jp or josko.troselj@gmail.com

Supplementary Table S1

Supplementary Table S1. Initial set of parameters and minimal and maximal searching ranges for the SCE-UA parameter

Optimized parameter/Condition	Initial	Minimum	Maximum
Soil roughness coefficient N_{slo} [$m^{-1/3}s$]	0.6	0.1	1
River roughness coefficient N_{riv} [$m^{-1/3}s$]	0.03	0.01	0.1
Effective porosity of non-capillary subsurface layer θ_a [/]	0.4	0.1	0.7
Saturated hydraulic conductivity k_a [ms^{-1}]	0.05	0.005	0.5
Canopy interception and evaporation factor $F1$ [/]	1	0.6	1
Effective porosity of capillary subsurface layer θ_m [/]	0.4	0.1	0.7
Degree of reduction of permeability due to the volumetric water rate decrease β [/]	4	2	10

calibrations. The first five parameters are used in 5-CPM.