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Natural Hazards and Earth System Sciences

Book Review of "Debris Flows – Mechanics, Prediction and Countermeasures"

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DEBRIS FLOWS – MECHANICS, PREDICTION AND COUNTERMEASURES, BY: TAMOTSU TAKAHASHI, TAYLOR & FRANCIS, LONDON, UK, 448 PAGES, ISBN 978-0-415-43552-9 (HARDBACK), ISBN 978-0-203-94628-2 (E-BOOK), PRICE: £ 68.00, US$ 119.95, 2007.

Debris flows are a common type of mass movement in mountain areas worldwide. A much diversified and still not fully understood hydraulic and geomorphological phenomenon, debris flows can be highly destructive. Some of the largest landslide catastrophes in the world have been caused by debris flow events. Due to the geological, morphological, and climatic setting, Japan is particularly prone to debris flows. It is therefore no surprise that Japanese scientists and engineers have long investigated debris flows. Professor Tamotsu Takahashi, a prominent scientist and research engineer, devoted his carrier to the investigation of debris flows and to the design of countermeasures to mitigate the risk posed by debris flows and related sediment transport phenomena. Some of his contributions to the field are considered fundamental by debris flow investigators, and are widely cited in the international literature. In this book, Professor Takahashi has not attempted a systematic or comprehensive review of the vast international literature on debris flows. Rather, he has presented the results of his own work and the work of his numerous collaborators, chiefly at the Disaster Prevention Research Institute of Kyoto University, over a period of more than 40 years. With this respect, the book distils the "Japanese approach" to the investigation, prediction and mitigation of debris flows.

The book is organized into seven chapters. Chapter 1 introduces the reader to debris flows and examines taxonomy, explaining the rationale for a mechanical classification of debris flows. Chapter 2 presents theoretical results and experimental data, and discusses models for the mechanics of flows, a complex problem and a fundamental step for the understanding of the – still not fully understood – behaviour of debris flows. In the next three chapters, field data, results of laboratory experiments, empirical equations, and mathematical models are used to explore the three main geomorphological processes that characterize a typical debris flow, namely: (i) the initiation and development of a debris flow (Chapter 3), (ii) the movement and transport of the failed material (Chapter 4), and (iii) the deposition of the debris flow material, most commonly on a fan (Chapter 5). Multiple processes are considered for the possible initiation of debris flows, including gully erosion, landsliding, and the collapse of a natural dam. Mechanical explanations for the shape of a debris flow front, for the ability of a debris flow to carry large boulders and to accumulate coarser material at the front and to the side of the moving flow, are offered. Empirical equations and numerical models are presented to estimate the debris flow arrival distance on a fan, and to describe the formation of a debris flow fan. Chapter 6 presents six examples of field, laboratory and numerical investigations, conducted to study catastrophic debris flow events in Japan, Italy, Colombia and Venezuela, including the December 1999 debris flows along the Caribbean coast of Venezuela that resulted in more than 20 000 fatalities. In the last chapter (Chapter 7) debris flow countermeasures are examined, including "hard" engineering methods and "soft" planning schemes. Given the long tradition and notorious experience of Japanese engineers in building structures to prevent, contain, divert, or stop debris flows (the world-renowned SABO works), the chapter is biased towards the structural measures. The book ends by listing 212 references, 45 percent of which are papers and reports published in Japanese.

As I said before, the book is not intended to be a complete review of the literature on debris flows. Topics only partly covered in the book or not covered at all include: (i) the definition of rainfall thresholds for the possible initiation of debris flows, (ii) methods for regional debris flow susceptibility

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or hazard zonation, (iii) investigation of the recurrence properties of debris flows, and (iv) the design, implementation and management of regional debris flow warning systems. Lack of completeness does not compromise the value of a book that represents an important and welcomed addition.

The book reads well, although in places the text could be further polished. The price is not too high, and the volume represents a good reading opportunity for scientists, engineers and practitioners interested in the multiple aspects of debris flows.