

Editors: Michio AOYAMA and Yutaka OOCHI

Revisit The Hiroshima A-bomb with a Database Latest Scientific View

on Local Fallout and Black Rain







Hiroshima City 2011

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Research Division, Atomic Bomb Survivors Relief Department Health and Welfare Bureau, The City of Hiroshima

Telephone : 082-504-2191

Editors

Michio Aoyama

Meteorological Research Institute 1-1 Nagamine, Tsukuba, Ibaraki, 305-0052 Japan

Yutaka Oochi

Atomic Bomb Survivors Relief Department Health and Welfare Bureau, The City of Hiroshima 6-34 Kokutaiji-machi 1-chome Naka-Ku, Hiroshima, 730-8586 Japan

This book is dedicated to huge number* victims by the Hiroshima A-bomb in 1945

* The exact number of the death at the instance of explosion of the Hiroshima A-bomb in 1945 has not been cleared. Approximately 140,000 (error of $\pm 10,000$) are estimated to have died by the end of December 1945.

269,446 names are registered in Hiroshima Peace Memorial Park as the A-Bomb victims at of August 6, 2010.

Preface

Nearly sixty-six years have passed since that fateful summer when Hiroshima was completely destroyed by the first atomic bombing in history. Today more than ever, we need to keep working to convey the devastating reality of the bombing to people around the world and pass on our legacy to future generations – this is Hiroshima's mission.

Although many studies have been done on Hiroshima's radioactive fallout and the black rain that fell after the bombing, we have yet to fully understand its impact. As such, in 2010 we established the Hiroshima Study Group on Re-construction of Local Fallout from A-bomb in 1945 (HiSoF) to bring together experts in geochemistry, radiation biophysics, nuclear engineering, and other fields to further evaluate the extent and effects of Hiroshima's black rain and other radioactive fallout.

We created this book, which includes HiSoF's latest findings and data on the conditions right after the bombing, to facilitate collaborative research with experts in Japan and abroad. We sincerely hope it will become the basis for future studies on Hiroshima's radioactive fallout and damage, and that in turn, many more people will come to realize the A-bomb's disastrous effects and feel compelled to work for a peaceful world without nuclear weapons.

In closing, I would like to thank all the members of HiSoF and everyone whose contributions made this book possible, and I ask for your continued cooperation and support for our city's initiatives for peace.

July 2011 MATSUI Kazumi Mayor The City of Hiroshima

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広島が人類史上初めての原子爆弾による未曾有の大惨禍を被ってから、66年目の夏を 迎えようとしています。

被爆から長い年月が経過した今日、原爆被害の実相を広く世界に発信し、次世代に継承していくことが、被爆地広島の使命となっています。

こうした中、原子爆弾投下直後に降った黒い雨などの放射性降下物については、これまでも様々な研究が行われてきましたが、未だにその実態は、十分に解明されていません。

このため、本市では、平成22年(2010年)から、広島の原爆による放射性降下物 などの実態を解明することを目的として、地球化学、放射線物理学、原子力工学などの 様々な分野の専門家で構成された「広島原爆による放射性降下物等実態検証に係る関係者 協議会(Hiroshima Study Group on Re-construction of Local Fallout from A-bomb in 1945 (HiSoF))」を設置し、黒い雨を始めとする放射性降下物などについての研究や最新の知 見の収集に取り組んできました。

この取組の成果として、これまでの研究結果や収集した知見を、今後の国際的な研究の 基礎となる初期条件や検証データとしてまとめたものが本書です。

本書を読まれた国内外の研究者の方々の手により広島の原爆による放射性降下物などの 実態解明が進み、原爆被害の実相について、多くの人々の理解が深まることにより、核兵 器廃絶や世界恒久平和の実現につながることを心から期待します。

最後に、HiSoFのメンバーの皆様を始め、本書の製作に携わられた方々の御協力に改めて 深く感謝の意を表しますとともに、本市の平和行政に対する一層の御協力をお願いいたし ます。

平成23年(2011年)7月

広島市長 松井 一實

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Introduction

Hiroshima City has been carrying out a series of surveys in an effort to draw a complete and more realistic picture of the A-bombing and its impact on the people there at the time of the explosion. As a part of its efforts, the City set up the Hiroshima Study Group on Re-construction of Local Fallout from A-bomb in 1945, HiSoF, to facilitate further studies and discussion on this issue.

HiSoF is a group of researchers including meteorologists, radiobiologists, nuclear engineers, as well as experts in statistics, computer graphics and other related fields. Hiroshima City also invited researchers who were essential to perform studies on the effects of radioactive fallout and 'black rain' resulting from the explosion of the Hiroshima atomic bomb, and to compile data into this book.

Incorporating the latest data and modelling, Hiroshima City is planning to conduct the inter-laboratory comparison experiment of model simulations of local fallout and black rain, if some modellers agree to do this.

The main objectives of this book are to provide results of the latest studies and a comprehensive database on the local fallout and black rain from the A-bomb explosion at Hiroshima on 6 August 1945.

This book contains 11 articles based on studies by members of HiSoF and 3 articles by contributors. It consists of three parts: Initial Conditions, Validation Data and Databases.

Part I begins with a review of current knowledge about the process of atomic bomb cloud formation and radioactivity distribution. The case of the Hiroshima atomic bomb is discussed here (1.1). In order to show the development of the fire field, mapping of induced fires near the hypocenter is created (1.2). Also a digital mapping of the whole urban area of the city just before and after the atomic bombing is produced in an attempt to illustrate accurate damage distribution (1.3). For re-construction of the atomic cloud and rainfalls in Hiroshima, the amount of flammable materials in traditional Japanese houses in the region is estimated (1.4). Then based on those data, heat, water and carbon fluxes are estimated (1.5). Also the height and width of the mushroom cloud is estimated using geometric camera calibration methods (1.6).

In Part II, the results of radiation survey activities during the early stages are overviewed (2.1). Also the previous studies regarding the measurement of ¹³⁷Cs deposition (2.2) and 'black rain' (2.5) are reviewed. In addition, the book carries a geospatial analysis of ¹³⁷Cs in soil core collected in Hiroshima (2.4) and a preliminary report on measurement of ¹³⁷Cs in soil core collected from under floors of houses (2.3). Also re-construction of the

spatial-time distribution of rainfall is produced based on statistical analysis of the witnesses among the survivors of the Hiroshima A-bomb (2.6). Those can be used as validation data for model simulation when conducted. The feasibility of using ²³⁶U to re-construct close-in fallout deposition is included (2.7).

In Part III, sources and a structure of a database are outlined for numerical model simulation of the radioactive fallout and 'black rain'.

For reference, the book carries a synopsis of a preceding study by Mititaka Uda in 1947, and lists a history of 'rainfall areas' in the appendix.

We believe that all articles in this book as well as the database attached would be beneficial to all researchers and modellers in this field, and of use for further development of the study toward elucidation of the effects due to local radioactive fallout by the atomic bombing in Hiroshima.

AOYAMA, Michio Meteorological Research Institute, Tsukuba BABA, Masashi Graduate School of Information Sciences, Hiroshima City University CHIBA, Masaru Meteorological Research Institute, Tsukuba ENDO, Satoru Graduate School of Engineering, Hiroshima University HOSHI, Masaharu Research Institute of Radiation Biology and Medicine, Hiroshima University IMANAKA, Tetsuji Research Reactor Institute, Kyoto University KAWANO, Noriyuki Institute for Peace Science, Hiroshima University KOIZUMI, Toshio Architecture and Civil Engineering, Chiba Institute of Technology KUDO, Yozo Tokuyama College of Technology OHTAKI, Megu Research Institute for Radiation Biology and Medicine, Hiroshima University SAKAGUCHI, Aya Graduate School of Science, Hiroshima University SUZUKI, Manami Coordinator of HiSoF