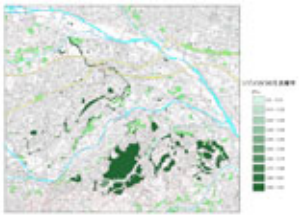
EXPO'04
Models and Computer Software for Hydrological Cycles

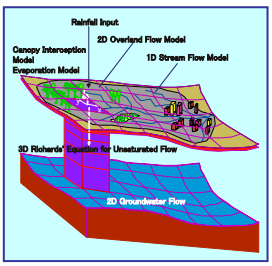
April 23, 2004

Surugadai Memorial Hall, Chuo University, Tokyo, Japan

Water quality problem

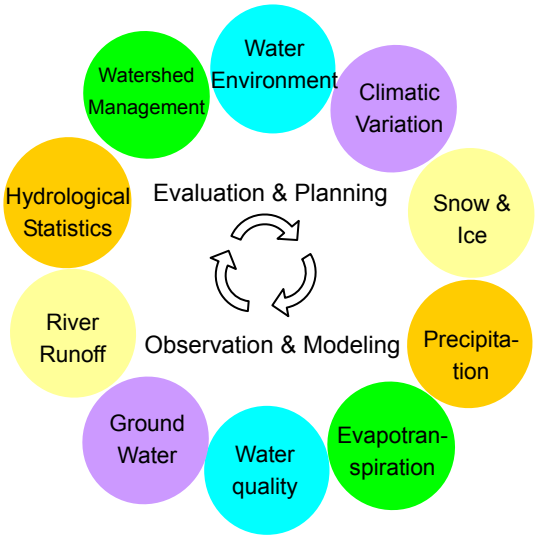


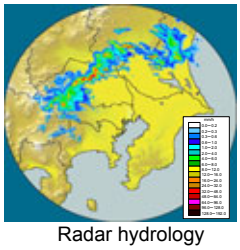
Ecological system



Grid based distributed hydrological model

Watershed management





Radar hydrology

Water resources management

Organized by	The Japan Society of Hydrology and Water Resources
Co-organized by	National Institute for Land and Infrastructure Management
	Ministry of Land, Infrastructure and Transport
Supported by	Science Council of Asia
	Public Works Research Institute
	Japan Society of Civil Engineers
	Japan Society on Water Environment
	Foundation of River & Basin Integrated Communications, Japan
	Japan Civil engineering Consultants Association

EXPO'04

Models and Computer Software for Hydrological Cycles

Program

Date: April 23, Friday, 2004 10:00-18:00

Place: Surugadai Memorial Hall, Chuo University, Tokyo, Japan

Organized by: The Japan Society of Hydrology and Water Resources

Co-organized by: National Institute for Land and Infrastructure Management
Ministry of Land, Infrastructure and Transport

Supported by: Public Works Research Institute, Science Council of Asia, Japan Society of Civil Engineers, Japan Society on Water Environment, Foundation of River & Basin Integrated Communications, Japan Civil engineering Consultants Association

	Contents
10:00	**1. Opening Address** Kaoru TAKARA Professor, Disaster Prevention Research Institute, Kyoto University (on behalf of Tetsuya Kusuda, President of The Japan Society of Hydrology and Water Resources) Seikou FUKUDA Chief Director, Environment Department, National Institute for Land, Infrastructure, Management Ministry of Land, Infrastructure Management and Transport, Japan
10:10	**2. Explanation of Expo'04 Models and Computer Software for Hydrological Cycles** Tadashi YAMADA Chair, Organizing committee, The Japan Society of Hydrology and Water Resources Professor, Faculty of Science and Engineering, Chuo University
10:30	**3. Keynote Speech** "Towards widespread use of water cycle software" Michiharu SHIIBA Co-chair, The Japan Society of Hydrology and Water Resources Professor, Faculty of Engineering, Kyoto University
11:00	**4. Exposition of "The Models and Computer Software for Hydrological Cycles"** ○ Exhibition of the models and computer software at individual booths ○ Introduction of the framework of the works exhibited on main screen
15:00 ～17:00	**5. Discussion** "Future of the computer software for hydrological cycle" Coordinator: Tadashi YAMADA and Michiharu SHIIBA
18:00	**6. Closing**

Objectives of Expo ’04, Models and Computer Software for Hydrological Cycles

In national land development and planning, computer-software for the simulation of hydrological cycle processes and improvement of the level of sophistication of their usage has been keenly expected by parties ranging from hydrological engineers, planers, administrators, and politicians to concerned citizens and NPO’s. Especially, in the investigation and research for city or regional planning, policy assessment, and in the process of obtaining consensuses of a society for policies, the hydrological computer-software have become one of the crucial practical support tools nowadays. On the other hand, it is a fact that many of the models and their computer-software have not been utilized widely and effectively even at present time among those users mainly due to the lack of information on their reliability and applicability. Although, in addition to the development of core-computational engines, the improvement of peripheral software components such as pre and post-processing, production of graphics on model results and data archival has been performed with energetic efforts for over a decade, problems remain due to the lack of coordinated efforts among software developers of various hydrological fields in universities, the research arms of engineering consultant companies and national and private institutions.

In the context of the social and academic background, the Expo ’04, Models and Computer software for Hydrological Cycles (hereafter the Expo) is held with the cooperation of the developers of state of the art computer-software techniques related to hydrological cycles with the following objectives.

1) Ascertain the needs for hydrological computer software by policy makers, planning engineers and researchers,
2) Forming the development incentives to develop models and computer software,
3) Discussing the directions that hydrological models and related computer software development should take in the future.

The coverage of the Expo is the exhibition of products and methodologies addressing aspects ranging from main computational logic to the peripheral supporting technologies and from purely theoretical modeling of hydrological processes to various computer implementations, and techniques like GPS, GIS and remote sensing.

The organizing committee and the secretariat

The Expo is organized and sponsored by the committee of The Japan Society of Hydrology and Water Resources and is co-sponsored by National Institute for Land and Infrastructure Management, Ministry of Land, Infrastructure and Transport for Japanese government. The members of the organizing committee are:

Chair: Tadashi YAMADA, Professor, Faculty of Science and Engineering, Chuo University

Co-Chair: Michiharu SHIIBA, Professor, Faculty of Engineering, Kyoto University

Hirokazu HIRANO, Professor, Faculty of Policy Studies, Chuo University

Yasuto TACHIKAWA, Associate Professor, Disaster Prevention Research Institute, Kyoto University

Koichi FUJITA, Division Director, River Environment Division, Environment Department, National Institute for Land, Infrastructure Management, Ministry of Land, Infrastructure and Transport

Tadashi SUETSUGI, Division Director, River Division, River Department, National Institute for Land, Infrastructure Management, Ministry of Land, Infrastructure and Transport

Jyunichi YOSHITANI, Leader, Secretariat for Establishment of UNESCO-PWRI Centre, Public Works Research Institute

Tadahiko NAKAO, Administration Officer, Foundation of River & Basin Integrated Communications, Japan

Kazuo MURATA, Chairman, River Planning expert commission, Japan Civil Engineering Consultants Association

The secretariat of the Expo are composed by the following members:

Hiroyuki ITO, Senior Researcher, River Environment Division, Environment Department, National Institute for Land, Infrastructure Management, Ministry of Land, Infrastructure and Transport

Takeshi ORO, Researcher, River Environment Division, Environment Department, National Institute for Land, Infrastructure Management, Ministry of Land, Infrastructure and Transport

Shouji OKADA, Research Associate, Faculty of Science and Engineering, Chuo University

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Towards widespread use of water cycle software

1. Importance of software on water cycle processes

Recent years have seen an increased effort on different aspects of watershed management, including community participation, to improve the state of the surface hydrological processes in terms of environmental improvement, disaster reduction and better utilization of water. A clear understanding of the present situation of the water environment and the quantitative idea about the anthropogenic influences are prerequisites for such improvements. Software related to the water cycle can play an important role in this process as a means of gaining a holistic understanding of the water-environment system and to understand artificial influences quantitatively. In this respect, we foresee a wide role for water cycle software in the future.

However, hydrological software is quite complicated in operation. We feel that the amount of studies done on the reliability of model results and the applicability of such results on real-world situations is not adequate at the moment. Popularization of software use among various groups of experts is a means of overcoming these shortcomings.

2. Present problems and their solutions

We classify the problems in today's water related software in to two categories, namely, problems faced by the users and problems related to performance and evaluation.

2-1. User-related problems

1) Dissemination of software information

The first step in successful use of computer software to solve a practical problem is the selection of proper candidate for the problem at hand. Today, the information available to facilitate good decision making at this stage is extremely limited. This makes it hard for the end-user to select the software that is best suited for the nature of their problems.

→ A framework that can support the dissemination of general information on software is required.

→ It is necessary to consider about the information offer system by propriate amount of user who needs information and developer who offers information.

→ At a later stage, a user may need a deeper understanding and evaluation of a particular system. Such issues are addresses in (2)

2) Performance and Evaluation of software

Detailed information on computational accuracy and the fitness of a particular computer program to solve a given problem are needed. However, such information on many water related software is scare at present. This makes it extremely difficult for the general user to evaluate and judge a product. Widespread use of software is adversely affected by this shortcoming.

→ The evaluation of governing principals, theories, mathematical models and numerical implementations is necessary. The most efficient means to achieve this would be by the co-operation of academics and other specialists and to share the results with the community.

→ Sharing information on evaluation of software not only helps the users, but also helps the manufacturers in quality control and establishing development targets.

→ For evaluations to be fair and effective establishing standards for evaluation and intercomparison is a must.

3) River basin data sharing

For the successful use of models for solving water problems, a host of data types including hydrological, hydraulic, water quality, geographical, geological and anthropogenic information, are required. Presently, it is not usual to see systematic archival and management of such information, and the information collection mechanisms remain ad-hoc, at best. These are problems that hinder the development and widespread use of water models. Further, once the data is archived it is important to consider them to be a valuable assert and to take steps that ensure it is maximally utilized by interested parties. Important steps towards this goal are to build effective data-sharing frameworks and present the information as a single unified watershed information system.

→ A system that provides controlled access to different user groups to example is the ‘National Land and Water Information Database’. Co-operation of different groups towards such projects is important.

→ In order to improve the accuracy of data products, effective screening and quality control processes are important.

→ One important ingredient for efficient management of data and automation using computer programs is the promotion of the standardizing of data formats.

→ As a community we should focus on the establishment of ‘data clearinghouses’ that functions as ‘locators’ of data and on the development of rules that encompass not only data but also the means of reading them.

2-2. Development aspect

4) Good user-interfaces to help using software to aid agreement formation.

We are entering an era, which the community participation is land and water management at local and national level is increasing and is encouraged. The stakeholders of the water decision-making process are no longer limited to the water experts. It is important for all these parties to have a good understanding of the behavior of the hydrological systems concerned. In this environment, water related software is expected to facilitate agreement formation between different parties. In order to achieve this, the facilitating the seamless flow of information between the core calculations and the user by means of good user interfacing is also as important as the quality of the results.

→ As additional benefits, good user interfacing can promote the chances of the model to be used in education environments and can help increasing the user base.

5) Sharing technical know-how, improvement by cooperation

To this day, the biggest incentive for development of software by companies and research groups has been the competition to produce better software than the opponents. Due to this, the sharing of know-how between different groups has become limited and numerous models that serve the same purpose has come in to being. In order to excel in functionality and flexibility and to improve the efficiency in development phase, the sharing of technical knowledge, coming up with standardization of software and merging of existing standards by mutual consent are important.

→ To achieve this end, the improvement of various protection systems, such as intellectual property rights law is a requirement.

→ Standardizing the interfacing portions of software that deal with different aspects of water problems helps different groups to specialize such different aspects and improves the scalability of the overall systems.

→ Dialog among developers is important.

3. Strategies to popularize software and to stimulate the future development.

We believe that the following proposals to achieve these objectives.

3-1. Construction of a software library (proposal)

1) Objectives

Software developers in Japan and overseas provide information on different existing water related software, their features and functions. Creation of an institution to receive, process and publicize this information systematically. This aids the users with varied objectives to select candidate software for addressing their problems. On the other hand, it is expected that this exposure of software and their capabilities within a structured framework and the resulting increase of popularity, can act as an incentive for improvement and future development of software.

2) Methodology

2-1) An organization to mange a software information library

The organization which manages the processes of receiving and public disclosing of software information should be setup. Since the objective is to manage information for the benefit of all parties, such organization should be of a neutral standing and of a cooperative nature.

2-2)The process from receiving information to the disclosure to public

→ A developer registers the information concerning their software (consisting of an overview and detailed description) conforming to a pre-decided format. The developer will be charged for this registration. .

→ This registration does not indicate that the managing organization's endorsement of the software or its quality assurance. It is only for the purpose of exposure of information.

→ The overviews shall be made available on the web. The detailed descriptions will be made available for the interested users for a fee.

2-3) The range of the information to be provided

→ An online searchable system should be created. This system includes the name of software product, the developer, functions of the product, the required input data, the price, etc.

→ As detailed information, the theories on which the program is based, numerical implementation, sample applications, results of such applications and their comparisons with observed data. are provided.

→ An English version should be created with the overseas users in mind.

→ Registration information is suitably updated corresponding to the upgrade of software and the actual performance and experiences.

→ Though the revealing of source-code of programs can raise ownership issues, the database should be able to accommodate source-code when the developer permits its opening.

3) Future considerations

→ Maintenance of management organization, funding.

→ As a means of obtaining relevant and useful information, it is desirable to solicit third party groups of experts for evaluations. (discussed in (2))

3-2. Construction of the evaluation system of software (proposal)

1) Purpose

The performance evaluation information on software (a scope, accuracy, reliability) turns into more useful information for a user selects software. The evaluation system by the people of academic standing is built and it provides as the reference information on software selection that scope of software and accuracy of calculation result are evaluated. The development incentive by the side of a developer also increases in order that opportunity of software that received high evaluation for a user to use increase.

2) Method

2-1) Establishment of the evaluation committee of software

→ The evaluation committee which consists of high neutrality person of academic standing who has the knowledge and experience about software is organized

2-2) The evaluation method of software

→ Developer carries software and evaluation committee evaluates

→ Developer pays the work and expense concerning evaluation

→ Not only evaluation but advice about improvement is performed

2-3) Public presentation of an evaluation result

→ Developer judges public presentation of an evaluation result

→ It opens to the public by WEB by request of a developer

3) Task

→ Planning of an efficient and fair valuation standard, evaluation criteria, and the evaluation method。

→ Creation of the database for verification of software

3-3. Preparation of watershed database (proposal)

1) Objective

Watershed database facilitates search and retrieval of data related to a particular problem and selection of software based on the available data, by gathering, and sharing watershed data. This aims at promoting effective use of water-related data in various research fields.

2) Methodology

2-1) A Construction of a watershed data library

A management organization receives all the data acquired by different groups. Processing of these data and systematic opening to different parties in done by this organization.

2-2) A format of watershed data

→ A unified format for space-time data should be created and all the data in the library should adhere to this format. Future development of water-related software should consider supporting this format.

→ Immediate attention should be paid on the creation of rules that collectively cover data and data processing.

2-3) Data collection and disclosure mechanism

→ The party owning the data applies for registration with the data management organization

→ The management organization performs registration and opening to public what it considers to be suitable after careful screening of data.

→ Users are provided with data for a fee.

3) Further considerations

→ Developing of a watershed data format (production of rules for data and data processing)

→ Planning of the efficient screening and quality control methods

→ Managing and maintenance of the data registration and publishing mechanisms.

Organization List (1/2)

	Organization	Product Name
1	Geosphere Environmental Technology Corp.	GETFLOWS General-purpose Terrestrial fluid-FLOW Simulator
2	Wallingford Software Ltd. (UK)	InfoWorks RS 5.0, Flood Works 3.0
3	WACOS Japan Co., Ltd.	Flood Runoff Forecasting System
4	ECOH CORPORATTION, Ltd	NSPECT Wave, Storm Surge and Tsunami Models
5	CTI Engineering Co. Ltd.	CTI- MIKE11 - AN INTEGRATED MODELLING SOFTWARE FOR BASIN MANAGEMENT-
6	Japan Water Agency	Mass model (Analysis of water quality in dam reservoirs)
7	Disaster Prevention Research Institute, Kyoto University	Grid-Cell based rainfall-runoff simulation system
8	DHI Water & Environment (Danish Hydraulic Institute)	MIKE FLOOD – MIKE URBAN FLOOD
9	Chuden Engineering Consultants Co. LTD	Software for Support of Disaster Management
10	Nippon Koei Co., Ltd.	NK-GHM (Nippon Koei Grid-based Hydrological Model)
11		NK-GIAS (Nippon Koei Geographic Information Analysis System)
12	Disaster Prevention Research Institute Kyoto University	Integrated Hydro-BEAM
13	Chuo Kaihatsu Corporation	River Environmental Information Support System using GIS
14	Japan Space Imaging Corporation	I-Browser, Skyline
15		
16	Chuo University	Integrated tools for the water cycle simulation based on hydro-meteorology (CHUO UNIVERSITY)
17	HITACHI, LTD. Industrial Systems Public& Municipal Systems Division	TRANSITION ANALYSIS PROGRAM OF WATERCOURSE SYSTEM IN PUMP STATION
18		Watershed Pollutant Load Estimation Simulator
19	Consulting Engineers INA Corporation	A Distributed Water Balance Model (LUO-TAMAI Model)
20	Narasaki Sangyo Co., LTD	High Performance Computer
21	Kyoto University	OHyMos
22	Pacific Consultants Co. Ltd / Chuo University	An Integrated Flood Simulation Model (PCKK-SWMM)
23	Tokyo Construction Consultant	Flood Hazard 3-D Simulator
24		
25	ASIA AIR SURVEY CO.,LTD.	Particle Image Velocimetry (PIV) Current Meter-Flood Discharge Observation System by Video Image – (AAS)

Organization List (2/2)

26	River Bureau of Ministry of Land, Infrastructure and Transport of Japan (Foundation of river and basin integrated communications)	Data Management Center of National Land with Water Information
27		
28	Public Works Research Institute	WEP MODEL (Water and Energy Transfer Process Model)
29	Civil Engineering Research Institute of Hokkaido	Interactive Calculation System For Flood Runoff Procedure
		Long-term Water and Heat Balance Model (Snowy, Cold Region Version)
30	NIKKEN Consultants, Inc.	Sediment Movement Model in Sediment Transport System
31	Kyowa Engineering Consultants Co., LTD	RIVER INFORMATION DATABASE MANAGEMENT SYSTEM (KEC)
32	Ministry of Land, Infrastructure and Transport	Waterway Network Reference Display System
33	Japan Institute of Construction Engineering	River Planning Simulator, Bed Formation Calculator System
34	KGT Co. Ltd	Grid-Cell based rainfall-runoff simulation system
35	Kajima Corporation	Advanced Urban Flood Simulation System
36	River Division, National Institute for Land and Infrastructure Management, Ministry of Land, Infrastructure and Transport	3D FLOW NUMERICAL MODEL TO ESTIMATE HYDRODYNAMIC FORCES ACTING ON RIVER STRUCTURES IN FLOOD
37	Pacific Consultants Co. Ltd	SIPHER-MODEL (Simulation of phenomena through the medium of water)
38		Hydrologic cycle model of watershed WCAP
39	Gunma University	The Comprehensive Simulator for Tsunami Disaster
40	YSI Co., Ltd	River Serveyor
41	SEA Co., Ltd	Work Horse ADCP

Total Number of Exhibitors and Participants

	Exhibitors	Participants
University	5	70
Government, National Institute, Independent Organization	4	64
Local Government	0	19
Foundation, Corporation	4	31
Private Company	28	236
Total Number	41	420

The Expo'04, Models and Computer Software for Hydrological Cycles

Memorandum

by Tadashi Yamada, Chuo University

Paradigm Shift:

From life in "my" local community, city, prefecture(state), nation

to

Life in "our" river or catchment area.

Hydrological Cycles = Hydrological Processes

- Meteorology, Atmospheric Science, Land Surface Processes.
- Hydrology, Hydraulics, Environment Science and Engineering.
- Eco-System.

Spatial Scale

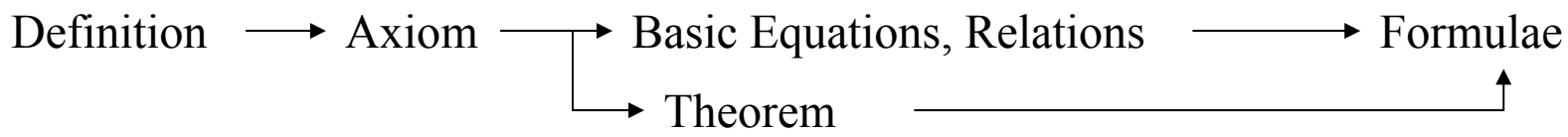
$O(100\text{m}^2) \rightarrow O(1\text{km}^2) \rightarrow O(10\text{km}^2) \rightarrow O(10^2\text{km}^2)$

$\rightarrow O(10^3\text{km}^2) \rightarrow O(10^4\text{km}^2) \rightarrow O(10^5\text{km}^2) \rightarrow O(10^6\text{km}^2)$

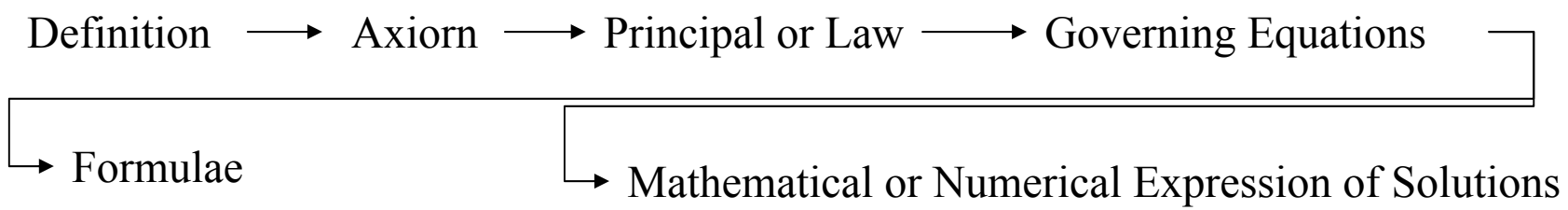
Point scale → Catchment scale → Regional scale → Global scale

Theory and Model

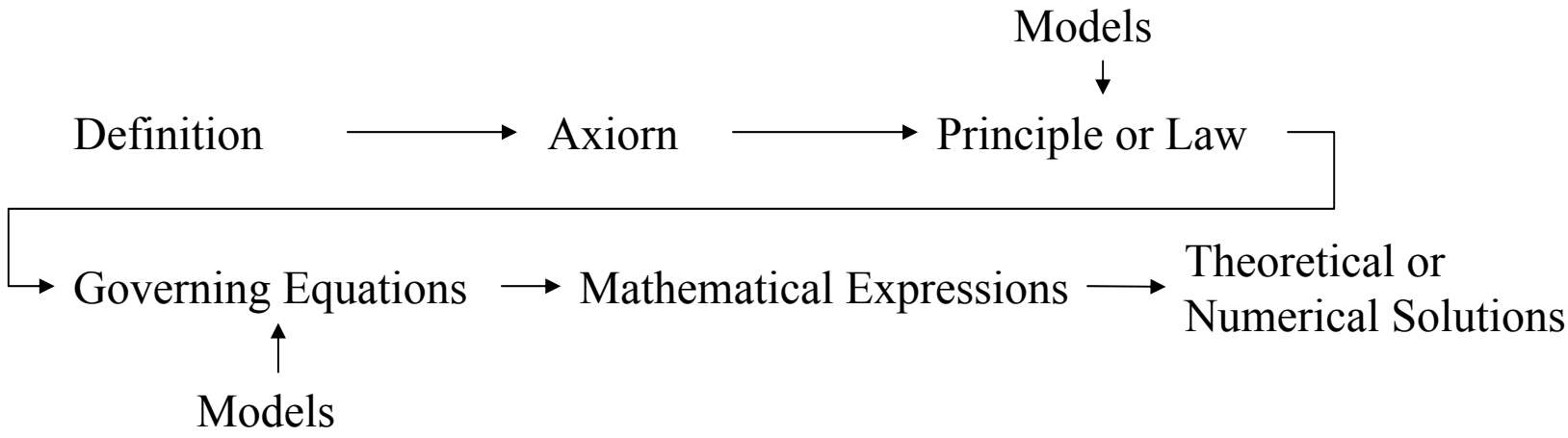
- Mathematics



- Physics



- Model based Natural Science and Engineering



Computer Software:

Variety of usage and recognition

- “Only I” can handle it.
  “Only I” can understand the result.
- Everyone from students to experts can use it.
  Everyone can understand it.
- “Only experts” can use it .
  “Only specialist” can understand the meaning of the output.

- Everyone of un-experts can understand it.

Various rights relevant to Computer Software.

The rights of ownership and use.
property rights.

- Who owns the original idea?
- What kind of rights and obligation do SE's(system engineers) have?
- What kind of rights and obligation does the company or institute concerned have?

The relation between an organization and a receiver of an order of computer code.

⇒ Various business rules or custom in various countries or regions, contract custom

Disclosure and non-disclosure of Computer Software Code

because of products from our tax

because of marketing

in order to guarantee

the quality of…

the reliability of…

- How to formulate a system to evaluate and acknowledge the computer software.
- What do they evaluate and acknowledge ?
- Ensuring the impartiality or fairness of evaluation.
- Disclosure of the evaluation.

- Promotion of reliability for persons engaging in public works and their technology from the citizens of the community.
- Promotion of efficiency of work and information transmission.
- Publicity and disclosure ⇒ Society of equal opportunity and freedom to participate.
- Usage of CG tech.(Computer Graphics technology) to explain the planning to the citizens.
- Dual-communication between experts and citizens.
- Promotion of disaster prevention technology by CG.

- Classifying based on the finesse
  and the generalization-level of the models
  and Ranking due to reliability and applicability.

- Construction of hydrological wide use date base.

- Construction of water relating-information system.