

Framework of Basic Theory in Digital Earth

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ABSTRACT

On the basis of earth observation technology, the author discussed the digital earth scientific theory and prototype in a perspective of the earth system. The basic concept is to understand the past, present and future activities of the earth system information process, and integrate the theory and technology of Geo-sciences, information science, computer science, space exploration, digital communication, computation science and artificial intelligence to study the information progress of whole earth system (mechanical information process, physical information process, chemical information process and biological activity information process of the earth system). A special attention will be paid to the relation and interaction between earth system sphere information.

The digital earth will be studied in four aspects: basic theories, supporting technologies, system engineering and the establishment of china-style digital earth. The core part and objective is a kind of high resolution and four dimensional description of the earth system, able to embed a magnitude of earth information. It is made up of two parts: one is the quickly increased inter-connected earth information system with a four-dimensional earth graphical interface that can be used to browse all data in different resolution; the other is mechanism that can be used to integrate and display all kinds of information. The content of basic theory is to take earth system as a prototype to study the relation and interaction between every two spheres of the Earth (lithosphere, atmospheric sphere, hydro-sphere and biological sphere), on the basis of earth system science, information science and computation science and so on. Then a group of models can be established, such as prototype of occurrence and development of phenomenon in earth system, physical model, mechanical model, mathematical model, information model and computer model.

The content of supporting technologies of digital earth includes data collection, restoring, transmission, processing and display. The supporting technologies are composed of the establishment of wide-band data networks and national spatial data infrastructure, development of super computer, and restoring, management, simulation, emulation and virtual reality of large storage spatial-temporal data. The digital earth systems engineering is based on the basic theoretic research and supporting technologies above. By means of software development and hardware integration, the establishment of operational, distributed and open network information systems will be able to serve land resource exploration, environmental protection, disaster relief and prevention, socio-economic development, defense security, knowledge diffusion and scientific research.

Keyword: Digital Earth Basic theory Prototype

1. Background of Digital Earth

Digital earth is immediately concerned by all over of the world after being introduced. Although people have different comprehension and the realization of digital earth is superficial, the scientific concept of digital earth is the result of nowadays scientific and

technological development, and the front of integration between earth sciences and modern sciences & technologies, such as information science and space science. Digital earth provides a new thought & method for the development of space science, information science and earth science in 21st century. The foundation of digital earth will wholly alter human society activities and life styles, including:

- (1) Scientific and technological development strategy;
- (2) Requirement for sustainable development strategy;
- (3) Requirement of national economic development;
- (4) Enhancement of national defence security;
- (5) Sharing global data resources;
- (6) Supporting innovation and development of earth system sciences.

2. Study Methods of Digital Earth

2.1 Research Thought

In virtue of earth-observation technology, the author discussed the digital earth scientific theory and prototype in earth system standpoint. The basic concept is to understand the past, present and future actions of earth system information process, discussing the theory and technology of earth science, information science, computer science, space exploration, digital communication, computation science and artificial intelligence in order to realize the information progress of whole earth system.

2.2 Basic Concept

In his report, Al Gore indicated "The digital earth is a virtual system that is based on the earth coordinate, consisting of a magnitude of data and allowing multiple dimensional display of these data."

In the point of the authors' view, the basic concept of digital earth is that to take the earth system as the prototype, earth coordinate as reference system, and earth system science, information science and computer science as theory foundation to build and integrate a serial of different levels of prototypes, mathematical models, physical models, mechanical models, information models and computer models. At the same time, on the basis of high-new earth observation system and network technology, the establishment of multiple resolution, vast data and multiple kinds of data fusion, multiple dimensional presentation with multiple media and simulation, virtual technology and space, digital, network, intelligent and visualization technology systems. In a short word, digital earth is informationization and digitalization virtual earth. In general, digital earth is a technology system that is managed with computer network after information is digitized in order to find out the information process of earth system. A special attention should be paid to the information relationship and interaction of earth system spheres.

2.3 Objects of Study

The research objects are spatial-temporal, dynamical earth system and the technology system is earth observation, network and computer information processing.

2.4 Contents of Study

The digital earth research and foundation is divided into four parts: basic theory research, technology support, science engineering and china-style digital earth construction. The core part and aim is a kind of vast four-dimensional and high-resolution earth information description. It is made up of two parts: one is the fast increased network earth information system with a four-dimension earth graphical interface that can be used to browse data in kinds of resolutions; the other is mechanism that can integrate and display all kinds of information. Main research content of basic theory is based on the basis of earth system science, information science and computation science and so on. The author takes the earth system as a prototype, discusses the inter-relation and

interaction among the kinds of spheres (lithosphere, atmosphere, hydrosphere and biosphere etc.), and finally builds occurrence and evolutionary earth models, mathematical models, physical models, mechanical models, information models and computer models of the earth system phenomena. The main research content of digital earth technology supporting system contains data collection, store, transmission, processing, display technologies. In addition, it also contains the wide band data network establishment, national space data infrastructure foundation, super computer development, data storing management, and simulation & emulation, virtual reality display etc. Digital earth science engineering is supported by these basic theory research and technology supporting system. The operational, distributed and open network information system will be built through software development and hardware integration in order to serve china resources rational utilization, national defense, environment protection, disaster relief and prediction, socio-economy development, knowledge spread and science research.

2.5 Task of Study

The important basic task of digital earth realization is to deepen the understanding of the earth system itself, improving earth system research extent, deepness, precision and integration, and studying the occurrence, development process of earth system energy flow, material flow, human migration and earth system circulation.

2.6 Effect and Significance

Digital earth transfers primary data of the earth system into comprehensible information and social economy value knowledge. The kind of data not only contains earth system high-resolution satellite image, digital map but also economy, society and population information. The effect and significance as follows :

- (1) Digital earth will change human production and life style, and bring the wide society and business benefits in the fields of education, sustainable development decision-making, land utilizing, agriculture and crisis treatment. The digital earth plan will facilitate cooperation on the artificial and natural disaster problem and long times facing environment problems. The digital earth plan will facilitate large-scale industry increase and provide lots of working opportunity, also guide virtual foreign activity, striking criminal, keep biology diversification, forecast climate change and increase agriculture production etc.
- (2) The digital earth will provide satellite remote sense image with one meter even one feet resolution and the frequency of obtaining is very high, even one day. In order to realize this aim, United States is ready to launch lots of low orbit satellite to cover the globe. Who master the information, who will master the initiative right and obtain the success. Digital earth not only has great economic significance, but also politic and strategic significance.
- (3) By utilizing the scientific experiment condition created by digital earth, people not only can have future accident and process experimentation but also can have past system process deducing experimentation, which will both provide knowledge innovation and theory research base. The deducing experimentation provided by digital earth is never done ever before.
- (4) In the science experimentation aspect, utilizing digital earth, you can do what you want to do, although it can't include everything, it includes most parts experimentation besides physical and biologic virtual experimentation. Digital earth, the information earth not only is the important part of national information, but also provides the new scientific experiment condition and scientific experiment base of earth science knowledge innovation and theory research.
- (5) Digital earth creates scientific experiment condition that is never done before for earth science, realizes the very complicated-structure earth system process that can't

have done in the past time, provides the science experiment base of earth science knowledge innovation and theory research and strong force for the earth science development.

2.7 Frame of Study

See Fig. 1

3. The Prototype of Digital Earth----The Earth System

Earth science is science synthetically studying the parts of earth system interactive mechanism in order to explain the earth dynamics, earth evolving and global change. Earth system is an interactive integration made up of earth core, mantle, lithosphere, hydrosphere and biosphere.

Describing the parts of earth system, and interaction, function and process of these parts that will continue developing in all spatial-temporal scales will obtain all whole of earth system comprehension in the global level in order to know whole earth system' all kinds of process. In especial, the information relations and interactive rules of earth system cycles are noticed, in order to improve human ability to realize and forecast the earth change.

Designing digital earth requires integrating all of geographical (earth) reference information, above all making the earth itself clear. No other than deeply known of earth system, foundation of the digital earth models will have significance and value. However, earth system is the digital earth prototype. In other words, digital earth is a digitized form of earth system. So, the important basic task of digital earth is to deepen the realization of earth system itself, improving the earth system science scope and deepness, precision and integration degree, they are inter-active relations. The contains of inter-active relation includes:

Complexity and dynamic models of earth system. Research kinds of complicated global variety models will create the basis for digital earth global application and abstract digital earth information models.

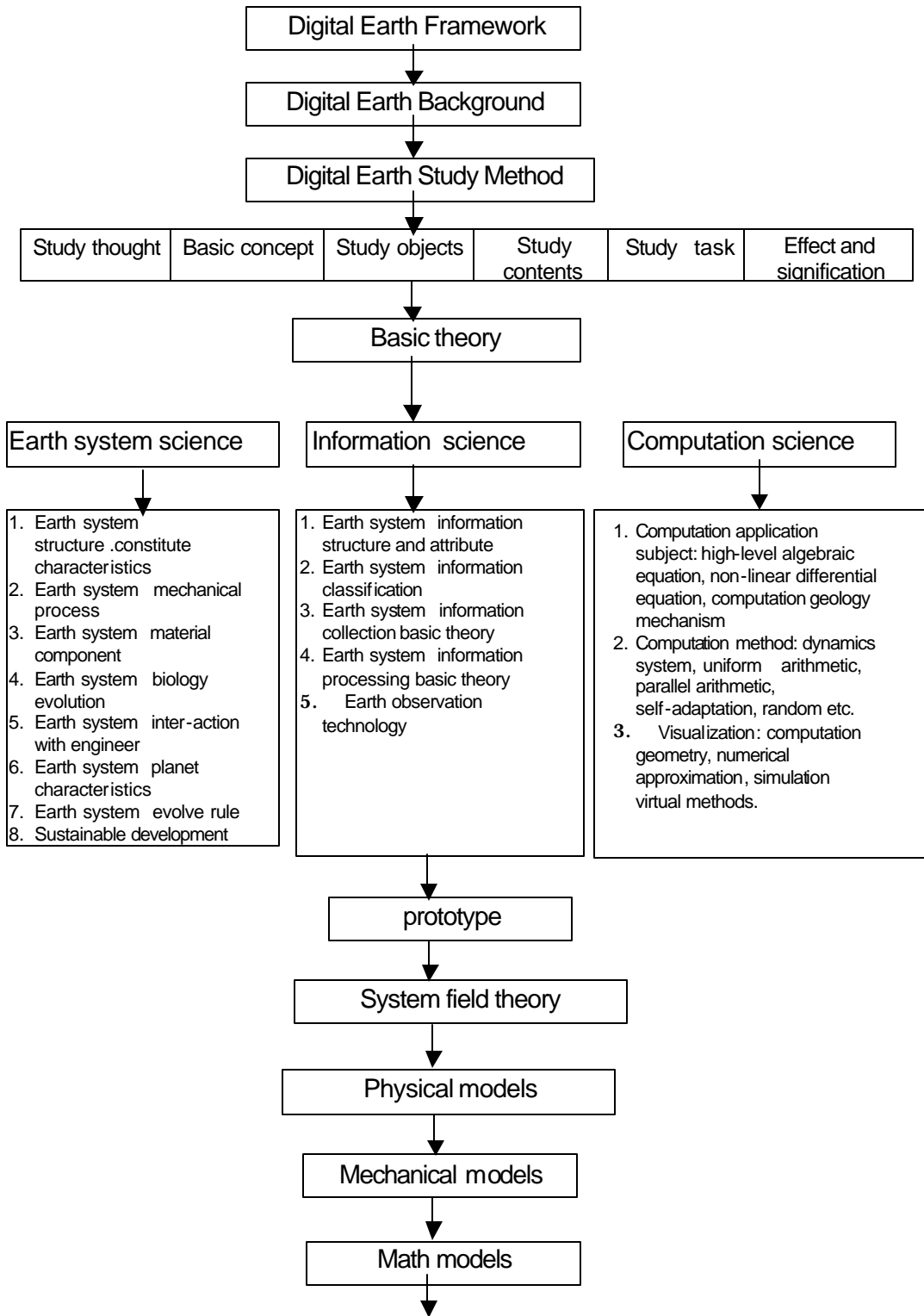
Math models and spatial-temporal coordinate system of earth system. It will research and build a set of math models describing kinds of geological(earth) coordinate reference in earth.

Object models and formalization expression of earth system. Abstracting and expressing the earth system entity in order to express the earth information models with earth system math and spatial-temporal coordinate.

Earth system information mechanism and models is a set of earth system information mechanism and models, built on the base of above three aspects.

The prototype of digital earth includes :

- (1) Planet characteristics of earth system;
- (2) Substance constitute of earth system;
- (3) Dynamic process of earth system tectonics;
- (4) Biology evolvement Law of earth system;
- (5) Human activity effect of earth system;
- (6) Resources characteristics of earth system;
- (7) Environment change of earth system;
- (8) Disaster Law of earth system;
- (9) Social economic activity response of earth system ;
- (10) Social development strategy of earth system.



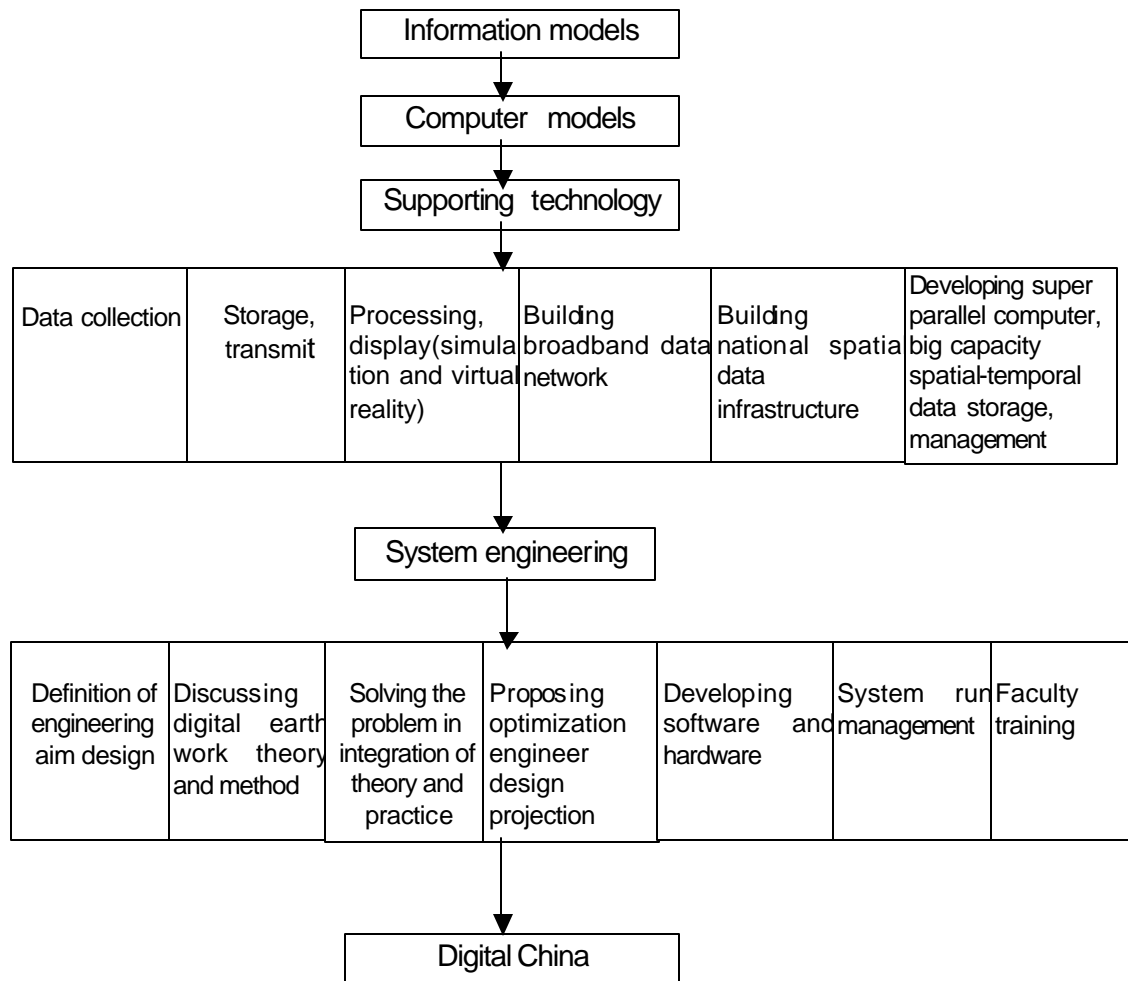


Figure 1 Framework of digital earth pilot study

4. Fundamentals of Earth System Fields

From Galileo and Newton, 300 years of physical development is condensed as 9 groups basic equation to describe the variety basic rule of physic world. These equations are concluded by these rule as fellows : mechanism and gravitation, electromagnetism field, thermodynamics, statistics, narrow sense relativity, wide sense relativity, quantum mechanics, dynamoelectric and criterion field. So far among three fields, the first field is Maxwell' theory, the second field is Einstein' wide sense relativity, the third field is Yang zhenning criterion' field. It is said that Yang-Smith uniform field theory and weak electric uniform theory leads Einstein' uniform field theory into light. According to Einstein' uniform field theory, the author integrate system science, modern mechanism, math, non-linearity science with earth system science and try to put forward "system field theory" conception –"system mechanism " that is digital earth and earth system science'

theory foundation to describe and study the earth system complexity. Main research contents as follows:

- (1) Foundation of system fields theory;
- (2) Basic type of earth system field ;
- (3) Gravitation field of earth system;
- (4) Ecological field of earth system ;
- (5) Principle for earth system field analysis .

5. Physical Model of Digital Earth

Physical models of the digital earth system are very important for studying digital earth and realizing earth system prototype.

5.1 The Self-rotation and Reference System of the Earth

Earth self-rotation is not only astronomy problem, but also geo-dynamics problem. In astronomy, the earth is taken as a planet. Studying the earth self-rotation variety has the important role in studying celestial body origination and evolution and celestial body direction. In digital earth research, whole earth self-rotation movement has the close relation with earth local movement: crustal movement, oceanic movement and atmospheric movement. Moreover, earth self-rotation has the certain relation with earth inner constitution and movement. The relation between earth self-rotation and earthquake exploding, earth magnetic field, continent drift and globe surge spectrum is paid attention to by geology domain. We must build a suitable reference system to describe the earth kinds of movement and shape form during studying kinds of movement and dynamics phenomena because movement and position is only described relative to a reference norm.

- (1) Earth self-rotation velocity variety ;
- (2) Self-rotation axis movement in space;
- (3) Self-rotation axis movement in ground;
- (4) Geo-dynamic reference coordinate system;

5.2 Shape of the Earth

Shape of the earth is important component part of studying earth whole characteristic. The earth sphere is formed during earth itself extraction process. The earth ellipse sphere is the result of the earth long time self-rotation role. The earth three axis ellipse sphere maybe has the relation with earth inner material movement; Under the influence of solar and lunar gravitation, the earth will deform and it's force parameter has the relation with earth inner structure. In sum, earth shape is whole expression of earth evolution, earth self-rotation and inner movement. Vice verse, deducing these three facet from earth shape is a interesting science problem.

- (1) Earth shape basic conception;
- (2) Macla formula and Cralo equation;
- (3) The earth flattening of measurement methods;
- (4) Earth shape precise study;
- (5) Solid tidy and burden tidy.

5.3 The Earth's Velocity Spheres and Study Approaches

Earthquake method, often referring to earthquake wave method, is most high development level among electromagnetism method, gravity method, geothermal method etc. Earthquake mainly is ascertained the earth media velocity layers and it's great advantage may get different deepness or layers high revolution direct information, local area and low layer velocity distribution belong to small measure structure.

- (1) Ascertain velocity distribution method;
- (2) Computation density and elastic parameter algorithm;

(3) Global velocity structure earthquake study;

(4) Crust velocity structure earthquake study;

5.4 Transmission and Radiation of Electromagnetic Wave

5.5 The Earth's Electromagnetic Nature and Its Study Method

Electromagnetism method is inferior to earthquake method and often includes earth electronic and earth magnetic studying earth inner physics attribute, in special, in some area where earthquake can't be made use of, for example observation belt belong to earthquake "blind area" and crust low velocity layer or upper mantle soft stream layer micro structure that earthquake can't get sure conclusion, in these area electromagnetism have a special role.

(1) Electromagnetism wave transmit;

(2) Electromagnetism wave radiation;

(3) Earth magnetism field spectrum analysis;

(4) Earth magnetism field long time variety;

(5) The cause of formation of earth magnetism field;

(6) Study method of earth electricity attribute.

5.6 The Earth's Density Distribution and It's Study Methods

Gravity, earth gravitation is a kind of expression of material universal gravitation. Gravity method is an important earth physical method in addition to earthquake method and electromagnetism method. This method is used to calculate and ascertain earth inner dense distribution.

In fact, earth inner density distribution not only reflects earth gravity field distribution but also planet orbit movement variety and earthquake wave velocity distribution. So, density distribution can be calculated by velocity distribution and planet orbit movement variety. But these method are indirect. These results may compare with those direct result with gravity method.

(1) Gravity balance and balance anomalies ;

(2) Gravity detection explain method;

(3) Gravity effective detection depth.

5.7 The Earth's Thermal Nature and It's Study Method

Earth thermos status research is an important content of the digital earth system physical models. Earth thermos attribute has a degree relation with other physics attribute. Besides concluding the deep temperature by directly measuring crustal thermos stream, mechanism of infrared and thermos radiation is also studied.

(1) Thermos infrared and thermos radiation;

(2) Thermos vibration of the crystal atoms;

(3) Hot stream flux and hot stream distribution;

(4) Hot source distribution and hot transfer mechanism.

5.8 Mechanics and Characteristics of Optical Models

(1) Geometry optics;

(2) Light particle character and wave-particle character;

(3) Behr atom model and Einstein radiation theory;

(4) Scatter.

6 Mechanics Models of Digital Earth

Everything from large universal celestial body to small particle physics is moving anytime. Moving material can't depart from force role. It is built on the Newton law and classic thermodynamics base in the past. Now it widens micro-level described by quantum mechanics. At present, the subject integrating earth science with mechanics mainly includes Newton celestial body mechanics, geo-dynamics, geology mechanism

and earth hydromechanics and so on. Main studying contents are as follows:

- (1) Multi-body system mechanics of the digital earth;
- (2) Non-integrity system mechanics of the digital earth;
- (3) Changeable mass Geological system mechanics of the digital earth;
- (4) Collision system mechanics of the digital earth;
- (5) Breakage system mechanics of the digital earth;
- (6) Fluid system mechanics of the digital earth;
- (7) Extremeness system mechanics of the digital earth;
- (8) Explosive(eruption) system mechanics of the digital earth.

7 Mathematical Models of Digital Earth

Computer is the production of integrating math and engineering technology. At every development historical moment, mathematics plays a key role. Scientific calculation, theory and experiment constitute three backbones of contemporary science research. Main study contents as follows:

- (1) Computation application subject: computer can solve complex math equation that includes high level algebra equation group, theory of Numbers, non-linear differential equations and so on approximating to answer. The series of calculation application subjects are : computation mechanics, computation hydrodynamics, computation physics, computation biology and computation geology etc.
- (2) Algorithms: study of calculation method will lead uniform arithmetic study trend. It is inverse to trend that arithmetic study is divided into more and more fine, and scope is extended more and more wide. By aid of new math theory tools for example dynamics system, micro-calculation math will strength arithmetic inner structure and level analysis study for example algebra structure optimize, localize, parallel, random, self-suitable and so on. Integration between high-powered computer and design, structure optimization will be famous characteristic of new generation arithmetic.
- (3) Scientific visualization: science visualization is transforming the science calculation result into picture, image and animation and displaying them on computer screen. It helps people more well observe, understand scientific calculation results and find out the rule. Scientific visualization depends on algorithmic geometry and numerical approximation, and queuing theory etc. Its realization can't be implemented without advance algorithm, graphic operation and high-speed computer.

8 Information Models of Digital Earth

Information models of digital earth basic theory is based on presentation and cognition of earth system energy stream, material stream and human stream, spatial-temporal and movement. It relies and exists on energy stream, material stream, and human stream. It studies the characteristic of the earth system information mechanism, information production, information collection, processing method and information transmission laws. Concretely, we should begin from earth system information mechanism and information stream to discuss earth system information structure and attribution, earth system information realization and classification, earth system information acquisition, processing and application basic theory and so on. Main study contents as follows:

- (1) Fundamentals and models about the formation of the earth system's substantial and energy flows;
- (2) Information models of the Earth system;
- (3) Cognitive model and information map-spectrum of the Earth space;
- (4) Information Feature of the earth space field;
- (5) Holographic information and memorial information models of the Earth system.

9 Information Acquisition and Virtual Reality Technology Of Digital Earth

Information Acquisition and Virtual Reality Technology Of Digital Earth is the important support of digital earth basic theory research. Its main contents include data collection, storage, transmission, processing and display etc, also include building wide-brand network, constituting national spatial information infrastructure, developing super computer, vast spatial-temporal data storing, managing, simulating emulation and virtual reality, displaying and so on.

Simulation begins with natural phenomenon observation. We want to calculate all variables that influence greatly earth system status, and then simulate these phenomena activity according to different running hypotheses of all kinds of process. Because of complicated reality and need to give enough free degree to describe objects, these simulation need to use computer to process the differential equation. These pattern may compose integrator; in principle, if giving suitable input and output information, you will integrate the separate parts or sub-procedure and needn't know every detail running mechanism. This characteristic provides strong tools that extract knowledge from different subject and specialty to form the general system integration description.

- (1) Global Earth Observation;
- (2) China's Earth Observation System;
- (3) Integration of RS.GIS and GPS;
- (4) Non-linearity and Complexity of the Earth System Simulation;
- (5) Presentation of the Earth System Patterns;
- (6) Stepless Scale Data management Technology of The Digital Earth;
- (7) Virtual Simulation and Emulation Technology of The Digital Earth;
- (8) Data Models and Data Structures of 'The Digital Earth' .

10. Spatial Information Infrastructure of Digital Earth

NII is high speed, great capacity communication device and related technology system. It is made up of computer, fiber, communication satellite and ancillary device, hardware and software, and kinds of interface and protocols. It can fast transmit great capacity information and connect every office or family 's computer communication device all over of whole country, even globally. Realization of NII will change human society production and life style.

NSII is a national level information infrastructure after NII. NSII is an infrastructure that correspond basic geographic spatial data collection, manage, distribution and sharing. Basic geographic spatial data become national infrastructure because geographic data has the important basic role. It is absolutely necessary during social development and economy construction. NSII is mainly made up of four parts: policy, technology, standard and organization. Every country and area has its NSII strategic consideration, so, at present every country NSII component content and definition is different. We place emphasis on technology factor and think NSII mainly includes national data standard, basic spatial frame data, spatial data exchange network and metadata and so on. On the base of NIDI, NSII includes kinds of spatial information processing technology and application infrastructure. Main contents contain spatial information framework and system structure in order to realize spatial information integration, fusion and inter-operation.

- (1) National Information Infrastructure;
- (2) Internet and Web;
- (3) Next Generation of Internet;
- (4) New Development of Communication Network;

- (5) National Information Infrastructure of China;
- (6) Concept of National Spatial Information Infrastructure;
- (7) Spatial Information Infrastructure;
- (8) Spatial Data Infrastructure and its Progress of Standardization;
- (9) Spatial Information Framework;
- (10) System Structure of Spatial Information Infrastructure;
- (11) Planning of National Spatial Information Infrastructure;
- (12) Overview of USA National Spatial Data Infrastructure Framework.

11 Technology and Methods of Digital Earth

(1) Interoperability of Geographic Information and Open GIS Norm

Geographic information inter-operation is one of research initiatives of UCGIS. Inter-operation has theory, forecast and practicability in present GIS system. At present, open GIS inter-operation criterion has been built and improved continually.

Inter-operation is that two or more than two entities under isomer environment can communicate and cooperate each other to finish a special task although their realization language, executive environment and models are different. These entities include application procedure, objects, system run environment and so on. In order to solve inter-operation of different information, different system, above all cognition and expression of geographic information system must be understood.

.Geographic information cognition, presentation and inter-operation;

.Open GIS criterion;

.Current GIS inter-operability.

(2) Key Technology of Digital Earth

In Gori' paper, key technologies of digital earth contain scientific computation, vast storage, broadband network, satellite data collection, metadata, inter-operation. These are similar to technologies in advantage research plan of the geographic information science and priority research field of geographic information science, for example geographical cognition, computer realization of geographical concepts, geography in information society, spatial data acquisition, integration, distribution or calculation, geographic information inter-operation and so on. Therefore, the key technology of digital earth is provided by summing up advice of NCGIA, NSF, VCGIS, OGC and so on. According to these points of view, many experts' advice and our opinions, key technologies of digital earth mainly contain earth spatial data obtaining, earth spatial storage and disposal, super media spatial information system, geographic information distribution calculation, spatial data warehouse, non-level scale data base, spatial data fusion, virtual reality technology and metadata and so on.

.High resolution satellite remote data fast obtaining technology;

.Vast data quick processing and storage technology;

.High speed computer information network technology;

.Hyper-media and distributed spatial information system technology;

.Geographic information distributed calculation;

.Earth data non-level scale information integration technology;

.Spatial data warehouse;

.Spatial data warehouse models and data mining theory research;

.Data fusion technology.

(3) Spatial Data Metadata of Digital Earth

The information standardization is the key of information sharing. Standardization is a social activity that changes reality world with productivity development. It is the uniform prescription of important things and concepts. Its essence is management. Geographic

space information is expression of the geography research meaning. By means of abstraction and conception of geographical objects, spatial data standard describe the essence of geographical objects in qualitative and quantitative method. It is carrier of building geography objects description standard and main component part of spatial information standard research.

In fact, metadata research has great difference in international society. The content metadata contains 10 parts in CEN/TC 287, 7 parts in FGDC, 8 parts in ISO/TC 211. Therefore, how to study and divide metadata system on earth is greatly paid attention to by all organizations. Metadata basic content, theory and models are briefly introduced as follows :

- .Metadata development background;
- .Current metadata standard;
- .Metadata theory basis ;
- .Metadata standard system construction;
- .Metadata implementation;
- .Metadata research trend.

(4) New Technologies of Digital Earth

With the development of computer science, computation technology and network, Bill Gates provides new research direction, for example Digital Nervous system model, Network Action or Network Lifestyle and System Progress mechanism that have very nearly relation with digital earth technology system. At present, theory and method of computer and network technology, brain nerve science, and artificial intelligence have made great progress. But analogy research of computer network and brain nervous system is on stage of discussion. In special, application of them in digital earth is not well-studied yet.

Digital earth is digital and information expression of the earth system. The earth system has the same self-organism characteristics of life system character as well as ecosystem, including selfcontrol, self-adapting, self-development (evolvment and inheritance) etc. The digital earth is complicated and open vast system. It is made up of data collection system, computer processing and storage system, high-speed communication information sub-system, a great number of distributed database and WebGIS, Com GIS sub-system, device sub-system, study, development and user-end sub-system. The vast, complicated technology system is similar to the brain nerve in topology and information interaction. Once it forms network system, it has the "life" and self-organization, self-adapting, self-control, selfdevelopment character. Database, web GIS, com GIS are similar to nerve cell and network is similar to nerve, which form the digital earth nerve system. People is core of whole nerve of digital earth, information or data is flowing blood of the body, while network nodes take charge of managing network and computer. Besides sending the procedure, it has the nerve cell role. Main study contents :

- .Digital nervous system;
- .Network lifestyle ;
- .Digital earth evolutionary mechanism study;
- .Geology intelligent technology;
- .Brief introduction to multi-dimension information network space ;
- .Information space of the digital earth.

12. The Digital China

"Digital earth" concept of United State is US national goal and global strategic demand. Similarly, whether china ought to develop "digital earth" not only lies on "digital

earth” concept itself but also china national goal. During china's development at the turn of 21st century, realizing society and economy sustainable development and creating science & technology self-innovation ability are two “basic policy & strategic goal”. According to china’s goal, we need to build “digital China”.

Foundation of the china special “china digital earth” will provide a new view, new technology, new technology framework for building a whole, uniform, high-efficiency, advance nation public information basic network and setting up information facing up kinds of affair and application. This will directly promote a series of application information system and industry policy such as national economics information network, land resources information network, nation flood prevention direction system engineer, Yangtse rive area monitor network, china public information spread network, china sustainable development information network and macro control system. It not only accelerates the development of the developed areas and cities but also blazes a new way in developing education, popularizing science technology, developing economy, getting rid of poverty in vast countryside and undeveloped areas. The emergence of “digital earth” realizes the probability of science analysis and objectivity forecast and prediction of earth system complexity action

Digital earth is the front of integration of earth science and modern sciences such as information science and space science etc. The establishment of digital earth will provide human beings with an informationization and digitalization earth. People can obtain digital information at anytime and carry through science research, effective enterprise management and decision-making, and deal with daily business from digital earth. However, the establishment of digital earth is an arduous, which refers to a great large of disciplinary knowledge and requires scientists to explore and study continuously. Including:

- (1) Overview of Digital Earth Study;
- (2) Digital Earth Plan in China;
- (3) Digital China;
- (4) China's Spatial Data Inter-exchange Networks;
- (5) China's Spatial Data Framework;
- (6) Establishing China's Spatial Information Standards.

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