



南京信息工程大学

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Professor

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Zhaochong LEI

Training and working Experience

- 1968 - 1978 Weather Forecaster, Yuxi, Yunnan Province
- 1981 - 1986 Ph D, Edinburgh University
- 1986 - 1992 Professor, NIM (teach Fluid Dynamics, NWP, Atmospheric General Circulation)
- 1990 - 1991 WMO Training Expert, Qatar
- 1992 - 2007 Chief of Weather Prediction and Tropical Meteorology Division (WWRP), WMO
- 2008 - RTC, NUIST



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Multi-Hazard Early Warning System



*Communicating emergency warning from Great Wall in
ancient China* *burning dried dejecta of wolf at the tower of the Great Wall*



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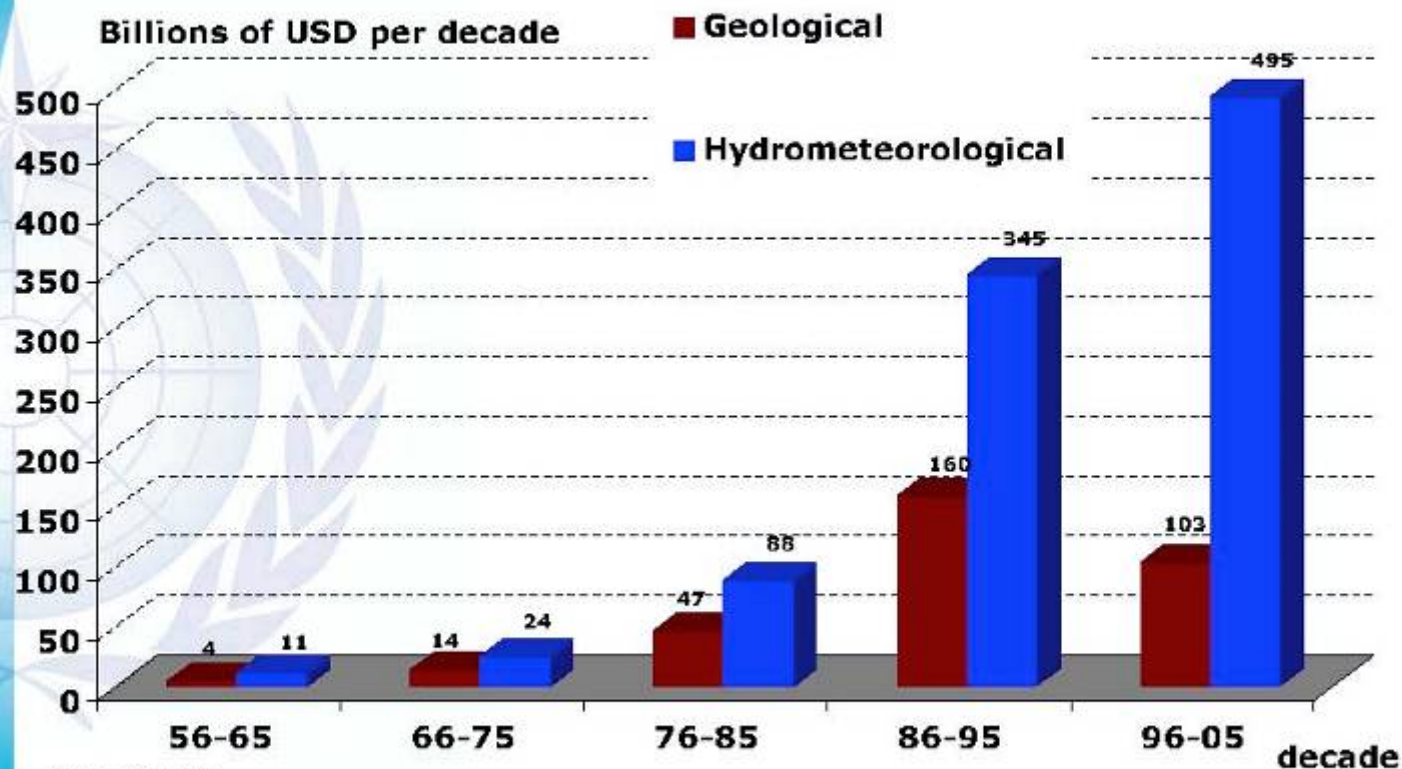
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PART ONE

Early Warning Systems: a Fundamental Component of Disaster Risk Management



Economic Losses Related to Disasters are on the Way Up



Source: EM-DAT:
The OPDA/CRBD
International Disaster
Database - www.em-dat.net - Université
Catholique de Louvain
- Brussels - Belgium



International Attention on Early Warning Systems with “Multi-Hazard” Approach

- **First International Early Warning Conferences** (*Postdam, 1998*)
- **Second World Summit on Sustainable Development** (*Johannesburg, 2002*)
 - **Johannesburg Plan of Implementation**
- **Second International Early Warning Conferences** (*Bonn, 2003*)
 - **Platform for Promotion of Early Warnings**
- **World Conference on Disaster Reduction** (*Kobe, January 2005*)
 - **Hyogo Framework for Action 2005-2015**
- **G8 Summit and UN General Assembly** (*2005, 2006*)
- **Global Early Warning Survey** (*2006*)
- **Third International Early Warning Conference** (*Bonn, March 2006*)
- **WMO First Symposium on Multi-Hazard EWS for Integrated Disaster Management** (*Geneva, May 2006*)
- **First Session of Global Platform for Disaster Risk Reduction** (*5-7 June 2007*)
- **Second International Symposium on EWS with Multi-Hazard Approach** (*5-7 May 2009*)
- **Second Session of Global Platform for Disaster Risk Reduction** (*16-19 June 2009*)



In many countries, early warning systems are not an integral part of disaster risk management

Communities at risk

National to local governments

hazard warning

post-disaster response

NATIONAL SERVICES

Meteorological

Hydrological

Geological

Marine

Health (etc.)...

hazard warning

hazard warning

hazard warning

hazard warning





What is an Effective EWS?

2 COORDINATION AMONG NATIONAL SERVICES

- Meteorological
- Hydrological
- Geological
- Marine
- Health (etc.)



4 Community Preparedness



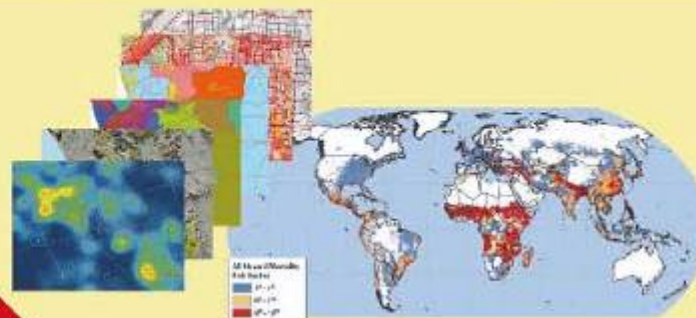


Effective Early Warning Systems

National to local disaster risk reduction plans, legislation and coordination mechanisms are critical to ensure emergency planning and response involving 4 technical components



Hazard Data and Forecasts



Risk Information



Coordination and Collaborations



Communication and Dissemination Mechanisms



Preparedness and Early Response



MHEWS identified challenges along four technical components of EWS

1) Early Detection, Monitoring and Warning Services

- **Strengthen observation systems**
 - Coverage
 - Sustainability
 - Inter-operability
 - Multi-use of networks (where practical)
 - Built on "system of systems" concept
 - Data policies
- **Prediction and forecasting**
 - Methodologies, accuracy and lead time
 - Multi-disciplinary



MHEWS identified challenges along four technical components of EWS

2) Risk Knowledge and Integration in Warning Messages

- **Data gaps, quality, accessibility, sharing**
 - Hazard
 - Vulnerability (e.g. socio-economic, topographic...)
- **Standardized methodologies and expertise** (e.g. hazard analysis, risk modelling)
- **Understanding of the changing patterns of risk** (e.g. hazard, vulnerabilities)
- **Local capacities**



MHEWS identified challenges along four technical components of EWS

3) Dissemination and Communication

- **Effective warning messages**
 - Incorporation of information about risks in warning messages
 - Understandable warning messages
 - Authoritative warnings (Authentication of sources)
- **Dissemination networks**
 - Interoperability (use of international standards)
 - Redundancy and resilience of networks
 - Same distribution channels for warnings of different hazards (cost efficiency, reliability and effectiveness)
- **Standard warning terminologies**
 - (nationwide, and across borders, traffic light concept)



MHEWS identified challenges along four technical components of EWS

4) Integration in Preparedness and Response Processes

- **Education and awareness** (emergency responders, authorities, risk managers, emergency responders, media, public...):
 - Understanding of warnings and uncertainties
 - Awareness of less frequent events
- **Cross-Training of Operational Agencies**
- **Operational planning**
 - Drills
 - Community preparedness

+ Need for Strong Governance, Organizational Coordination and Operational Processes



National Example: Cyclone Preparedness Programme in Bangladesh



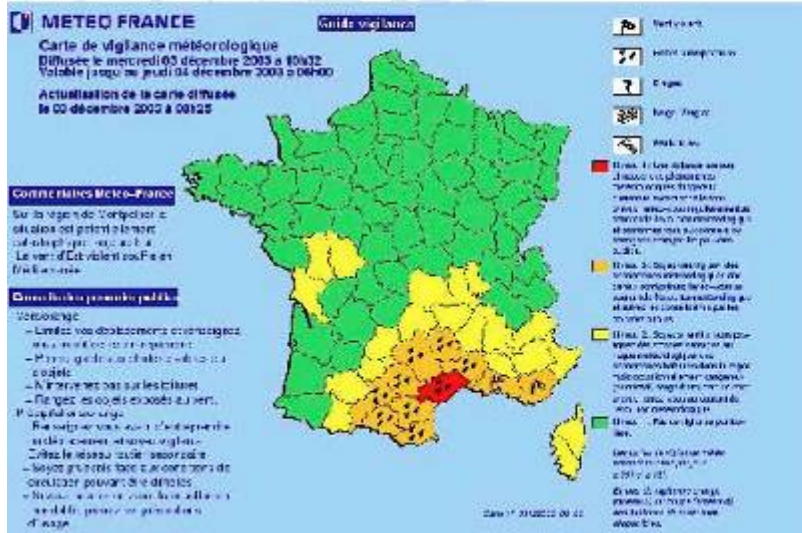
National Example: France Vigilance System

Hazards

- Strong wind
- Strong rainfall
- Thunderstorm
- Snow/Ice
- Avalanches
- Heat waves

Level of warning

- Level 4
- Level 3
- Level 2
- Level 1



Initiated in coordination by Météo-France and French civil security, Vigilance system activates cascades of preparedness and response plans, actions and responsibilities

- Legislation
 - Planning
 - Organizational linkages
 - Training and feedback
- }
- national to local authorities**



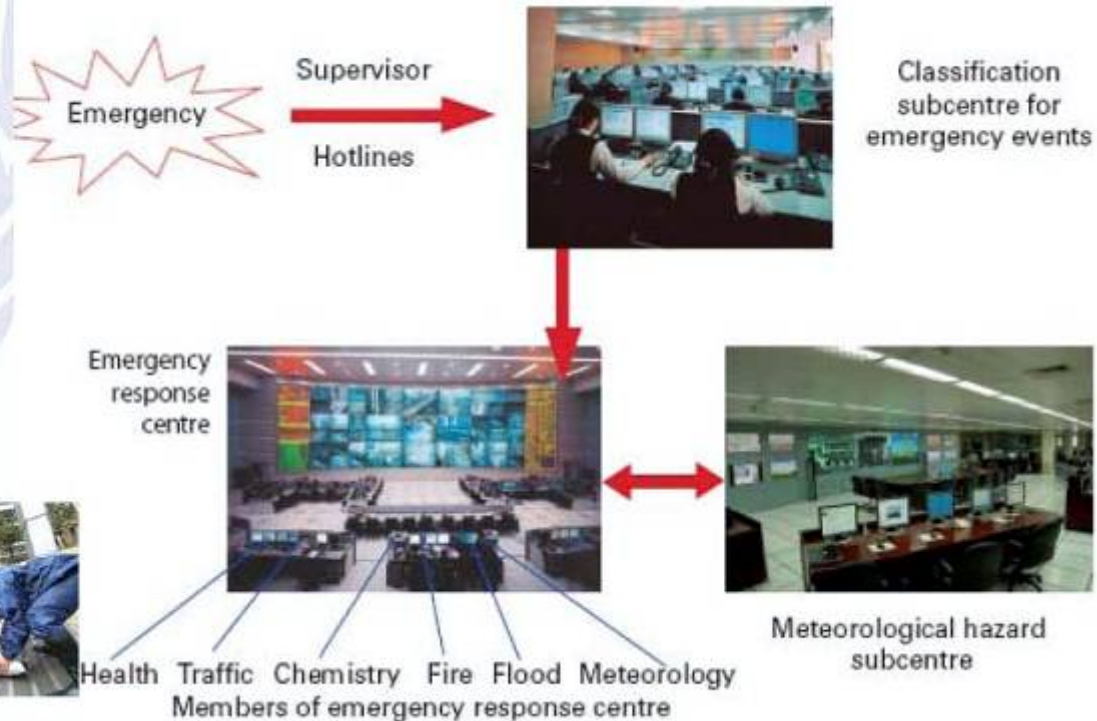
National Example: Shanghai City: Multi-Hazard Early Warning and Emergency Response Programme

Governance : (mega) city-level.

Organisational: Top-down (monitoring, forecasting, warning) and bottom-up

Operational: Community-based + high tech monitoring and alerting tools

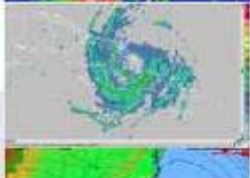
Multi-Hazard Approach:
Services are specialized but shared for alert dissemination and response mechanisms.



National Example: Cuba Cyclone Early Warning

**Small country, 99% access to media (radio & TV),
coordinated top-down warning and response mechanisms**

ANALYSIS AND
NUMERICAL
MODELS



Warning

DIFUSSION OF
WARNINGS



TV



RADIO



PHONE - FAX



INTERNET

RESPONSE
ACTIONS

GOVERNMENT,
CIVIL DEFENSE,
RESIDENTS





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PART TWO

An Introduction to

Shanghai Multi-Hazard Early Warning System

Demonstration Project



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OUTLOOK

I. Background

II. Outline of the Project

III. Case Study



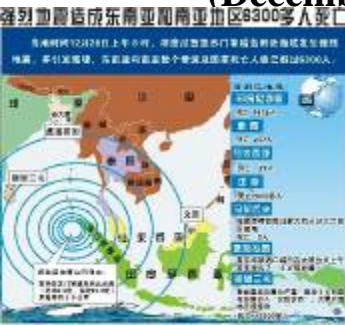
Background of Shanghai MHEWS

International Developments Related to Early Warning Systems

- **The Second World Conference on Disaster Reduction (Kobe, Japan, January 2005)**
Hyogo Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disasters (HFA).
Shifts Paradigm from Post Disaster Response to **a Comprehensive Approach with Strong focus on Prevention and Preparedness.**
- **2005 United Nations' Summit Conference (New York, September 2005)**
“Building World-Wide Multi-Hazard Early Warning Systems”
- **The Third International Early Warning Conference (Bonn, Germany, March 2006)**
There still remain gaps and challenges to ensure that **early warning systems are integrated in disaster risk reduction strategies, in all countries. From concept to action.**

WMO Facilitating Multi-Hazard EWS with Demo Projects

- **WMO Multi-Hazard EWS Symposium (May 2006)**
Identified Four Good Practices, One is Shanghai Emergency Preparedness System.
- **The First WMO Natural Disaster Prevention Programme Coordination Meeting (December 2006) Demonstration Approaches have been initiated.**





Shanghai Meets Basic Requirements for MHEWS Demonstration four requirements for candidates

- **Frequent occurrence of natural hazards;**
- **High concern about disaster prevention and mitigation by local government;**
- **Integrated infrastructure for hazard detection and early warning;**
- **Great importance attached by local and national-level meteorological departments.**



Introduction to Shanghai

Shanghai is a mega-city situated on the shores of the East China Sea and the Yangtze River Mouth:

a) dense population——

population: 19million

area: 6,340 square kilometers

b) built-up structures——

20-plus-story buildings: >1600

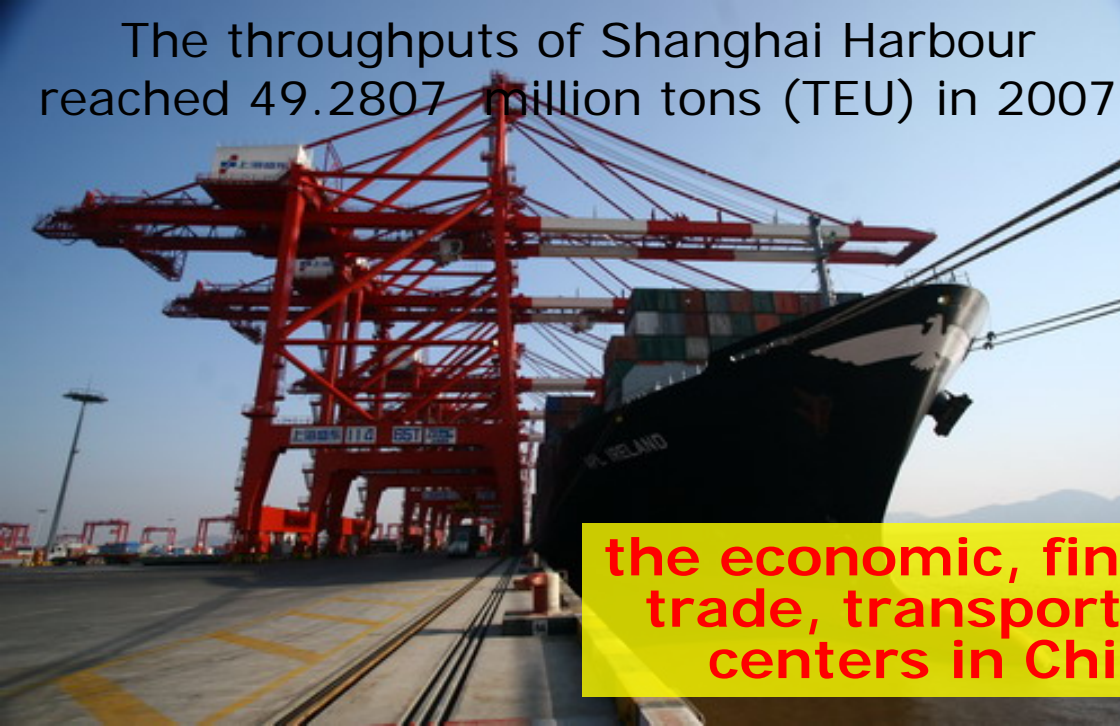
30-plus-story buildings: >200

c) rapid economic development——

double-digit GDP growth for 14 consecutive years



The throughputs of Shanghai Harbour reached 49.2807 million tons (TEU) in 2007



**the economic, financial,
trade, transportation
centers in China.**



Threat of Multi-Hazard to Shanghai

Shanghai is frequently affected by natural hazards such as **typhoon**, **heavy storm**, **thunder and lightning**, **fog**, **haze**, **heat-wave**, and **storm surge**. Severe weather hazards may bring many other disasters, which further threaten city safety. Weather factor resembles the first piece of domino, and will impact other aspects of social activities.

Climate Average

Typhoon 2-4

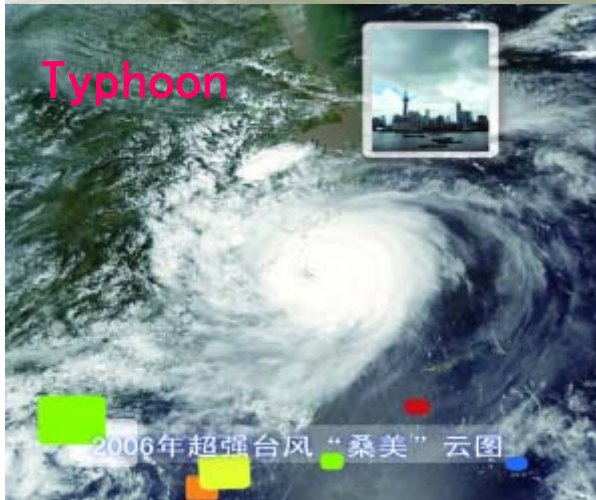
Thunderstorm Days 49.9

Rainstorm Days 11

High Temperature Days 28

Strong Wind Days 24.5

Heavy Fog Days 39





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Big Events Safety Assurance

Time: May 1 to Oct 31, 2010 World Expo
(high impact period in a year)

Theme: Better City, Better Life

Objective: To attract more than **200** official participants and **70** million visitors





Shanghai Meets Basic Requirements for MHEWS Demonstration

- **Frequent occurrence of natural hazards;**
- **High concern about disaster prevention and mitigation by local government;**
- **Integrated infrastructure for hazard detection and early warning;**
- **Great importance attached by local and national-level meteorological departments.**



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High concern about DPM by local government

-- Establishment of powerful organizations

The **Shanghai Emergency Response / Mitigation Committee** was established on 5 March, 2006.

About **50** members from government departments and agencies related to the issues of **flooding, severe weather, fire, traffic accidents, chemical accidents, nuclear power accidents, public health, earthquakes, and marine emergencies.**

SMB is one member of the Committee.



High concern about DPM by local government -- Action Plan System for Emergency Preparedness and Response

Shanghai has developed action plans for emergency preparedness and response consisting of *one overall city-level Action Plan for Emergency Preparedness and Response, 19 district/county-level Sub-plans, 51 special and department Sub-plans.*

- **Special working plan for Emergency Preparedness and Response on Meteorological Hazards, such as *Heavy Fog, Snowstorm, Strong Convection* events have been developed and issued.**

On 1 Oct. 2006, Shanghai People's Congress passed "Shanghai Implementation Regulation of the Meteorological Law of the P. R. China". It makes clear the mandate of SMB in DPM.



High concern about DPM by local government

-- Complete Action Plan for Emergency Preparedness and Response

- Establishment of warning products co-development and co-issuance mechanism

---Meteorological hazard warning signals issued by SMB



---Corresponded Flooding warning signals issued by water affairs



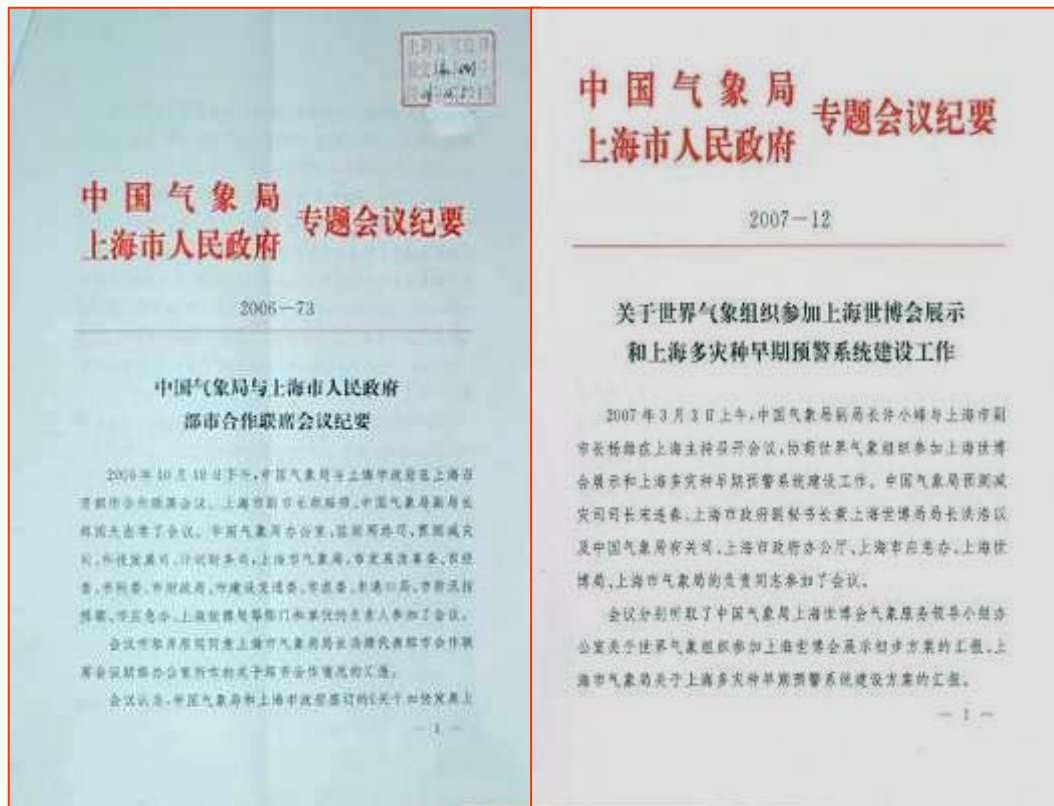


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High Concern about DPM by National and Local Government

-- Overall Cooperation Agreement between CMA and SMG.



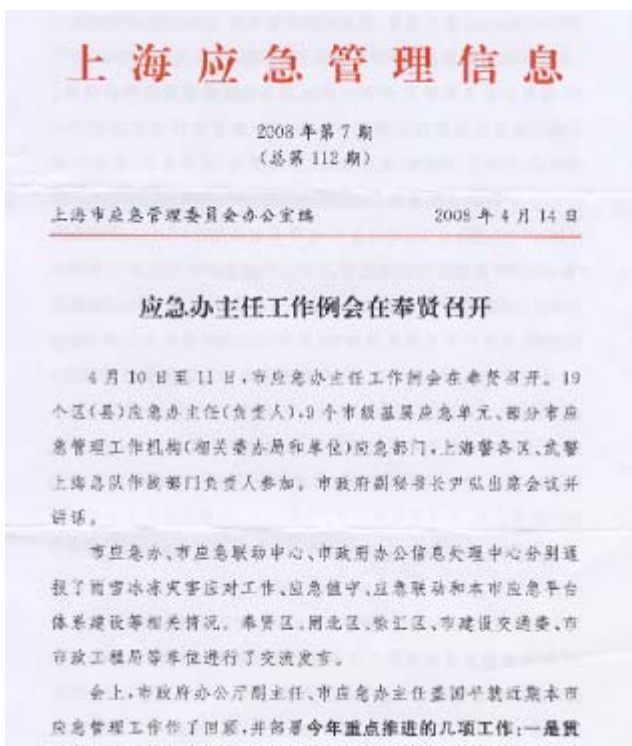
Outcomes have been reached, which include the joint efforts both in the implementation of MHEWS and WMO – CMA joint participation in Expo 2010 Shanghai.



High Concern about DPM by National and Local Government

--Key Projects of CMA and Shanghai Municipal Government

- The Project has been identified as **a demonstration project of CMA.**
- The system construction has been demanded as one of 4 key projects by Shanghai Municipal emergency office. And the office calls for the related departments' support and information supply.



“安全世博”做好各项工作。四是建设多灾种预警系统示范项目。该项目以气象部门预警业务系统为预处理平台，整合气象、防汛、海洋、卫生等多部门的灾害预警信息，建设相关灾害的监测和预警信息数据库，建立综合预警信息共享平台，各部门和单位要予以支持和配合。

尹弘同志在讲话中指出，今年上海雨雪冰冻灾害的应对工作，得到了中央领导同志和市委、市政府的充分肯定，这是全市党政军民共同奋战的成果，与应急管理战线上同志们辛勤工作是分不开的，特代表市政府向与会人员表示感谢和慰问。当前，一要进一步认识加强应急管理工作的重要性和紧迫性。今年是奥运年，又是改革开放三十周年，大事多、喜事多，2010年上海还要举办举世瞩



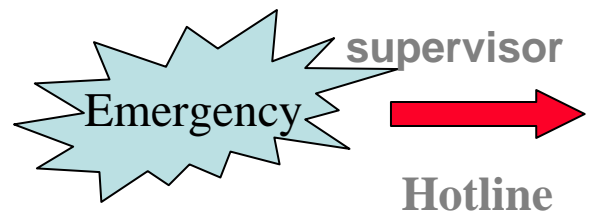
Shanghai Meets Basic Requirements for MHEWS Demonstration

- Frequent occurrence of natural hazards;
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- Integrated infrastructure for hazard detection and early warning;
- Great importance attached by local and national-level meteorological departments.



Integrated infrastructure for EWS

-- Emergency Response Facility



Classification Sub-Center for Emergency Events



Met. Hazard Sub-center

- health
- traffic
- chemistry
- fire
- Anti-flood
- meteorology

Membership of emergency response center



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Integrated infrastructure for EWS

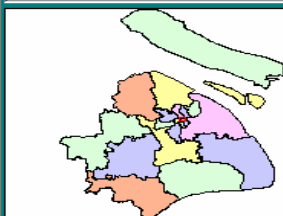
-- Grid Management

EWS Interacts with Supervisor



- 公共交通
- 公交线路
- 公交线路
- 公交站点
- 公交站点
- 交通
- 交通线路
- 交通站点
- 的出入口
- 道设置
- 名称
- 服务站
- 车服务中心
- 车电调中心
- 陆岛交通
- 行驶路线
- 起讫点
- 运

- 发车站点
- 全市枢纽站



放大系数: 1 : 32 线段长度: 上海市交通局和上海虹云信息技术有限公司共同开发 2002年1月4日 星期五 10:01:58 AM

Integrated Information based on GIS in Early Warning System, 1300 Supervisors at 2,700 **B**asic **G**rid **U**nits in Changning District.



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Integrated infrastructure for EWS -- Grid Management



Information provided by a supervisor at a grid point over a basic unit area, with 24 hr. a day on duty shift.

Information delivered from the District Center to special agencies and departments.



Shanghai Meets Basic Requirements for MHEWS Demonstration

- Frequent occurrence of natural hazards;
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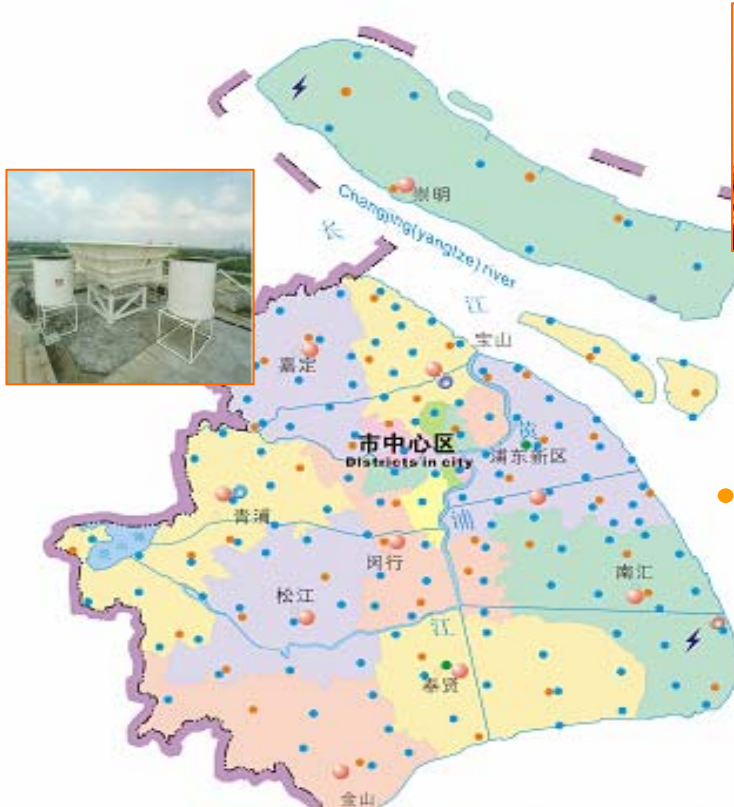
Integrated infrastructure for EWS-- Early monitoring and detecting hydrological monitoring sites

上海市排水管理信息系统

I 工具 M 图层管理 Q 信息查询 I 信息管理 E 打印

hydrological monitoring sites

GIS



- AWS
- Rain Gauge
- Island AWS
- Doppler Radar
- Wind Profiler
- Lightning Sensor
- GPS/Met
- Ship Observation
- Mobil Observation



Shanghai Meteorological Observation System





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Integrated infrastructure for EWS

-- Seamless and all-reaching information dissemination system

•Multi-approach

TV : 3 TV news channels

Radio : four broadcast frequencies : AM 990, AM 792, FM 97.6, FM 105.7

Mobile Phone : 400,000 users

Hotline: 12121, 969221, 969222 (English)

Electronic Display Board: 25,000

MMTV : in taxi, bus, Metro...

Website: <http://www.soweather.com/pubw>

Newspaper, Internet, Building TV

•All-reaching: public locations, factories, enterprises, schools, hospitals, villages, etc.





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OUTLOOK

I. Background

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Design

**Multi-Hazards
Integration**

**Multi-Agency
Joint Response**

**Multi-Phase
Response**



The system covering 22 kinds of disasters that may happen in the fields of weather, marine, biology, hydrology, energy, agriculture, production security, communication, fire protection, public equipments malfunction, nuclear and radiation accidents, environment pollution accidents, public sanitation, food security, social security, earthquake etc.



**Multi-Hazards
Integration**

**Multi-Agency
Joint Response**

**Multi-Phase
Response**

Set up 36 different joint response mechanisms among 25 governmental departments of the city.

25 Governmental Departments: Municipal Emergency Management Office, Emergency Response Center, Education Commission, Development and Reform Commission, Bureau of Public Security, Commission of Construction and Administration, Water Affair Bureau, Harbor Administration, City Planning Administration, Food and Drug Supervision Administration, Environmental Protection Bureau, Public Health Bureau, Aviation Bureau of Eastern China, Air force, Disease Control Center, Agriculture Commission, Economic Commission, Taihu lake Administration, Electric Power Company, Culture, Radio Broadcasting, Film and Television Administration, Tourism Administrative Commission, Housing, Land and Resource Administration, Civil Defense Office, Safe Production Supervision Administration

36 Joint Response Mechanisms on governmental classified-command, smooth traffic, inspection of building construction, marine visa, ship supervision, the regulation and control of drain network, dispatching of fairway and airport, market security of coal, oil and electricity, price supervision of market necessities, food sales control, communication security, public health and disease control, fire safety of city, the transfer and reserve of disaster-relief materials, Insurance Relief, social rescue, evacuation and so on.

Through the system, the above departments can efficiently cooperate in emergency management.



Design

**Multi-Hazards
Integration**

**Multi-Agency
Joint Response**

**Multi-Phase
Response**



Early warning is the first step of emergency and penetrate the whole procedure of emergency management system. Through the multi-hazards early warning system, information can be shared effectively and be disseminated in time. Through the system, weather department will be able to do more in the public management of government disaster prevention and mitigation system.



WMO Projects which Support MHEWS

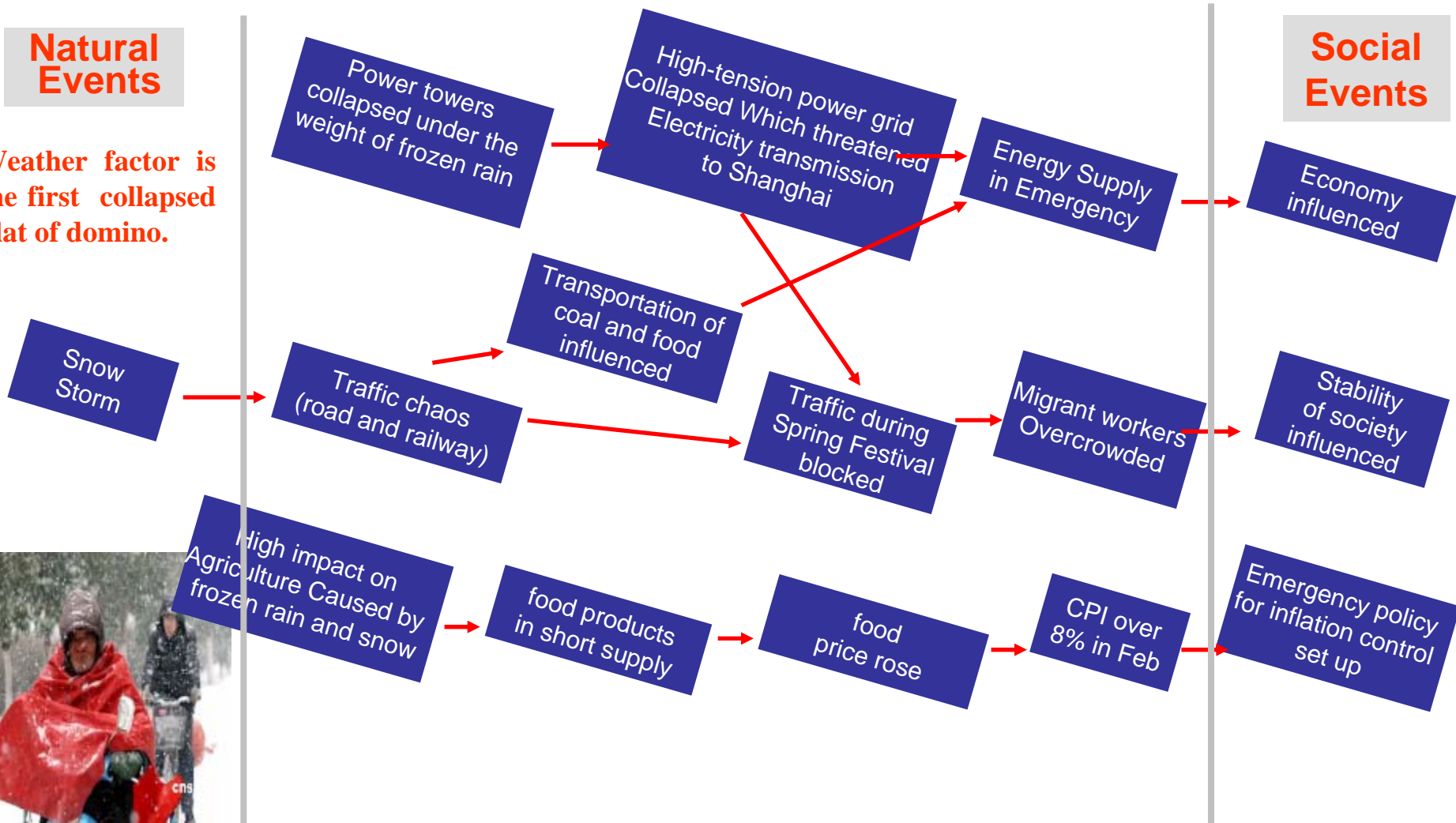
- **Air quality (GURME/GAW/AREP)**
- **Heat-health Early Warnings (CLIPS/WCP)**
- **Flooding (HWR, WWW)**
- **Strong Winds (WWW, WWRP)**
- **Tropical Cyclones (AMP)**
- **Application and Evaluation (PWS/WWRP)**

Hazard Domino Effect

Severe weather hazards may bring many other disasters, which further threaten city safety. Weather factor resembles the first piece of domino, and will impact other aspects of social activities.

Natural Events

Weather factor is the first collapsed plat of domino.

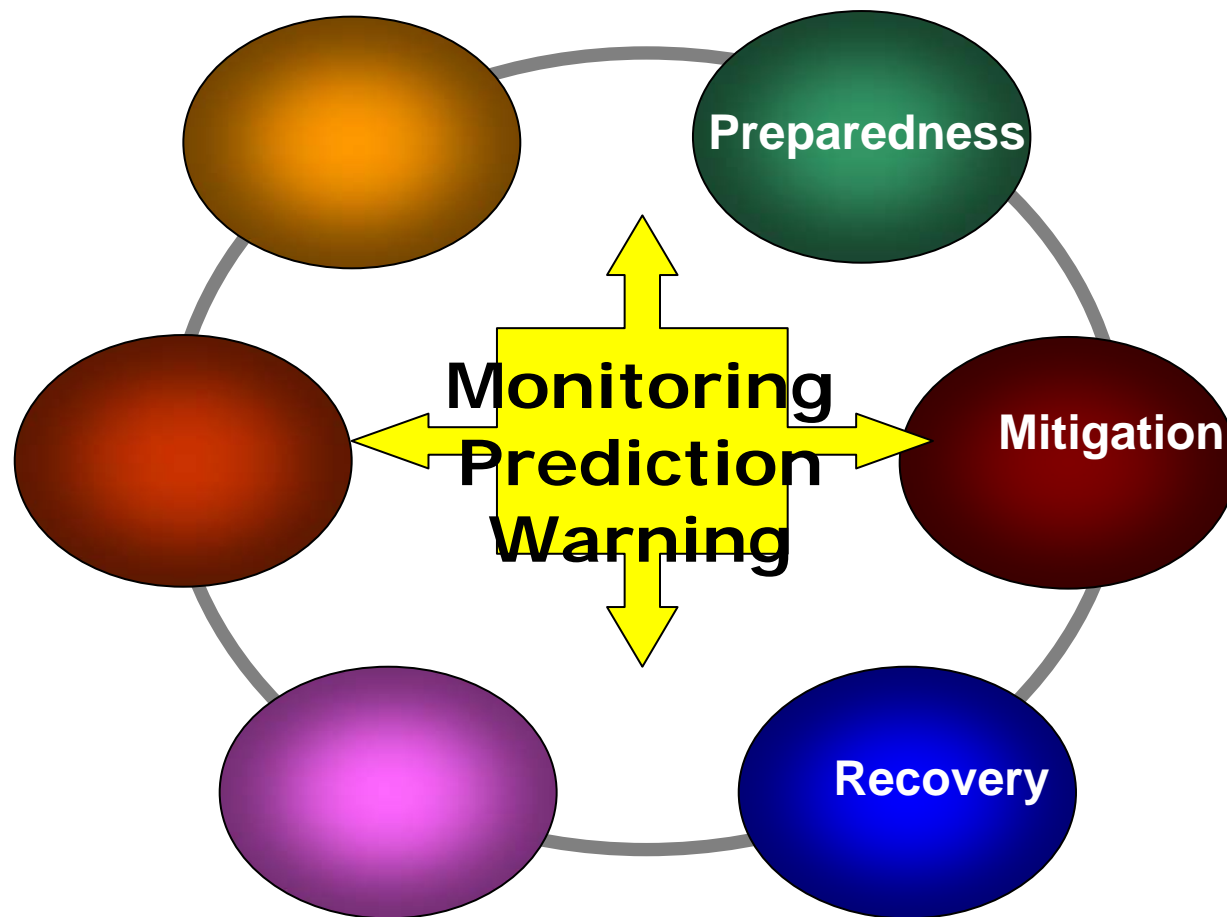




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Implications on Governance, Organisational and Operational Aspects



Multi-phase Response Framework to Multi-hazard



Multi-Hazard Classification

Three Categories of Hazards

I

**Weather and
Climate
Hazards**

e.g. Typhoon,
Severe Convective
Weather, Severe
Storm, Heavy
Rainfall, Fog, Haze

II

**Weather- and
Climate-related
Hazards**

e.g. Storm Surge,
Urban Inundation,
Human Health,
Epidemic Diseases,
Air Pollution, Oil
Spills, Chemical
Gas Leak

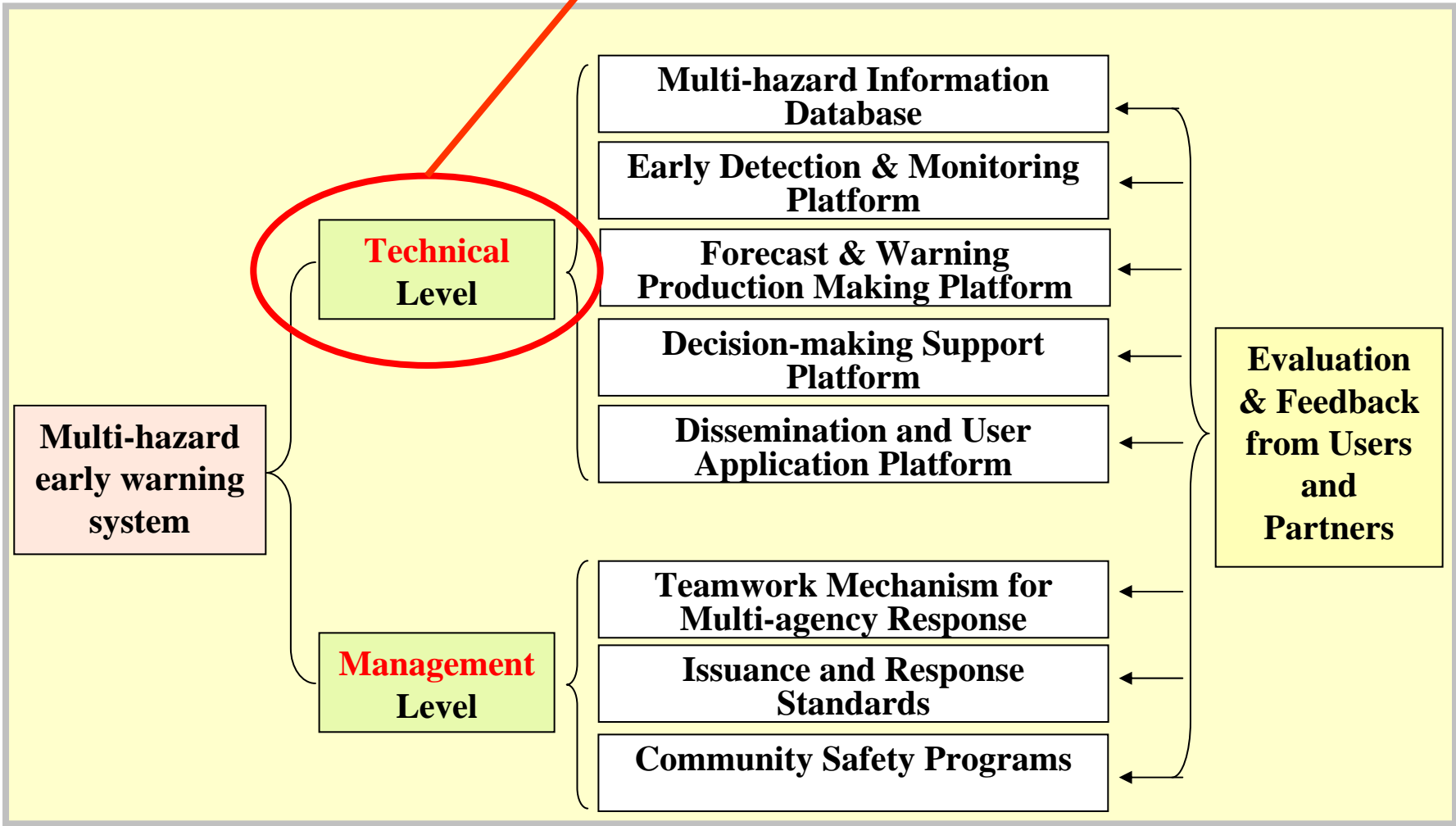
III

Other Hazards

e.g. Earthquake,
Tsunami



1. Technical Level

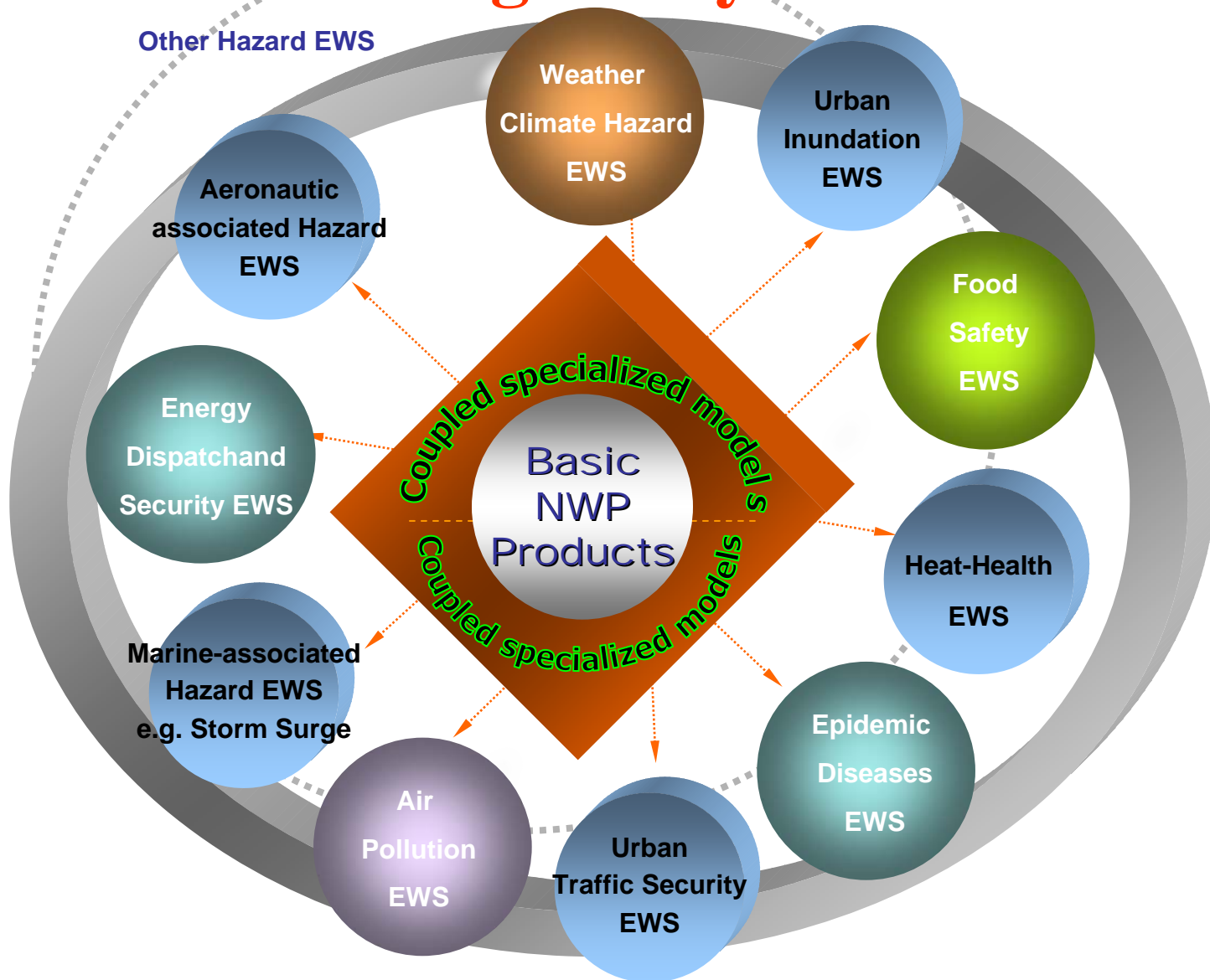




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Warning Subsystems





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Construction Principle

Government Lead, Government Application, Multi-Agency Joint Participation, Meteorological Bureau Host.

- **Government Lead:** A cooperated project supported by both CMA and Shanghai Municipal Government.
- **Government Application:** The system will become a technology support platform for shanghai municipal emergency management and will connect to the municipal government emergency hall after been set up and directly serve public emergency management.
- **Multi-Agency Joint Participation :** The system is constructed under the direction of municipal government, lead by municipal emergency office and SMB. All related departments are taking part in the construction.
- **Meteorological Bureau Host:** Shanghai Meteorological Bureau is responsible for the core issues, such as the system construction, information integration, early warning technology development, joint response mechanisms establishment, system daily operation.



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Multi-Hazard Information Database

Already built:

Data

Water affair (10years historic and daily materials of tidal level)

Marine (ocean wave and shipping information.)

Road traffic (highway and quick way information.)

Air traffic (Airport operation information and aviation report)

Food (15 historic and real time data of group poison accidents)

Sanitation (heatstroke and epidemic data)

Agriculture (reform of agriculture location, agriculture disasters)

Electric power (information of the civil power consumption load)

Public emergency (7,000 information of fire, death and injury, building collation. Real time data will be collected.)

.....still extending to other kinds of hazards.

Department

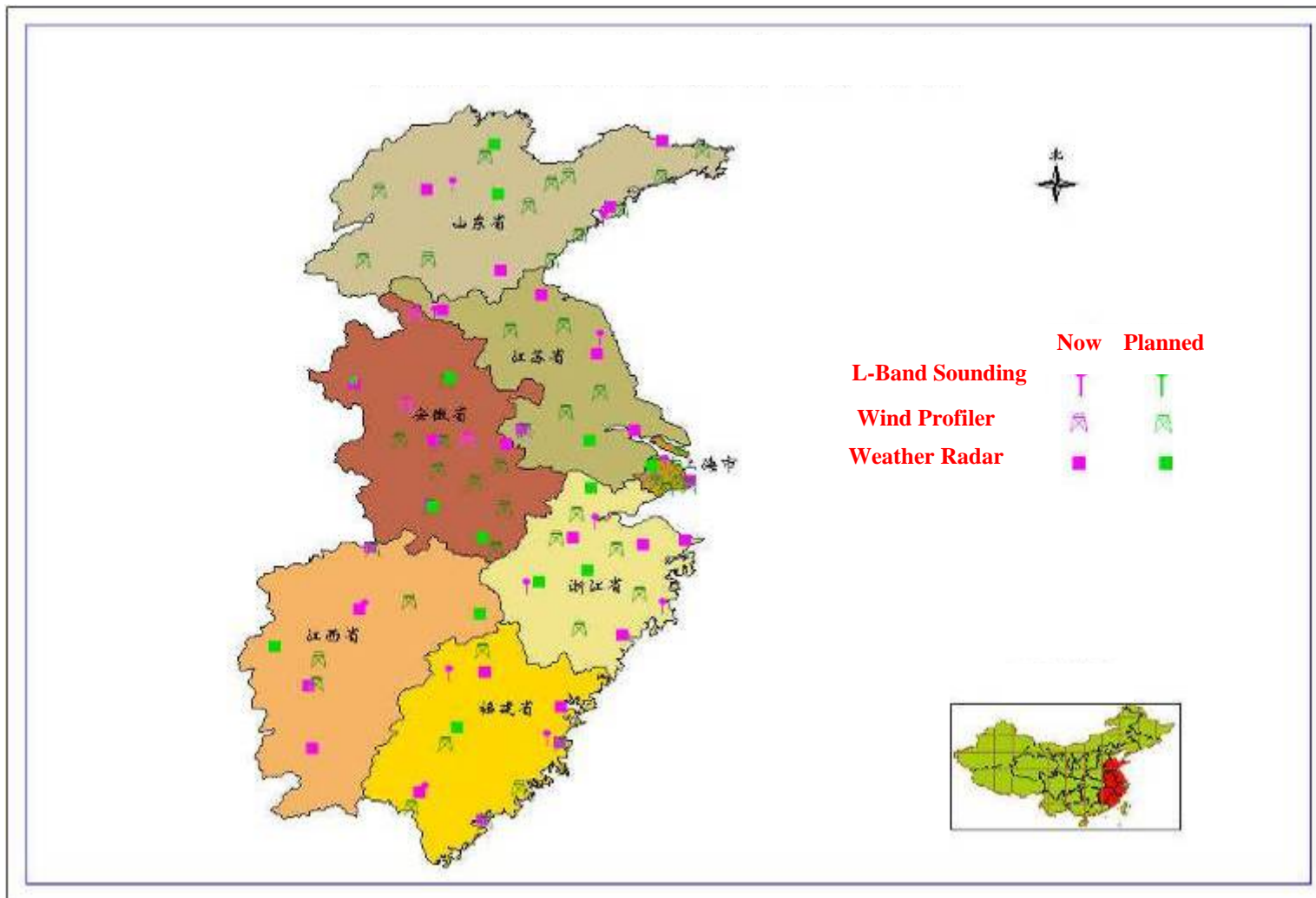
Taihu lake Administration,
Water Affair Bureau,
Harbor Administration,
City Planning Administration,
Food and Drug Supervision
Administration,
Environmental Protection Bureau,
Public Heath Bureau,
Municipal Science Association,
Aviation Bureau of Eastern China,
Air force,
Disease Control Center,
Municipal Emergency Joint
Management Center,
Agriculture Commission,
Economic Commission
Electric Power Company .etc



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Early Detection & Monitoring Platform



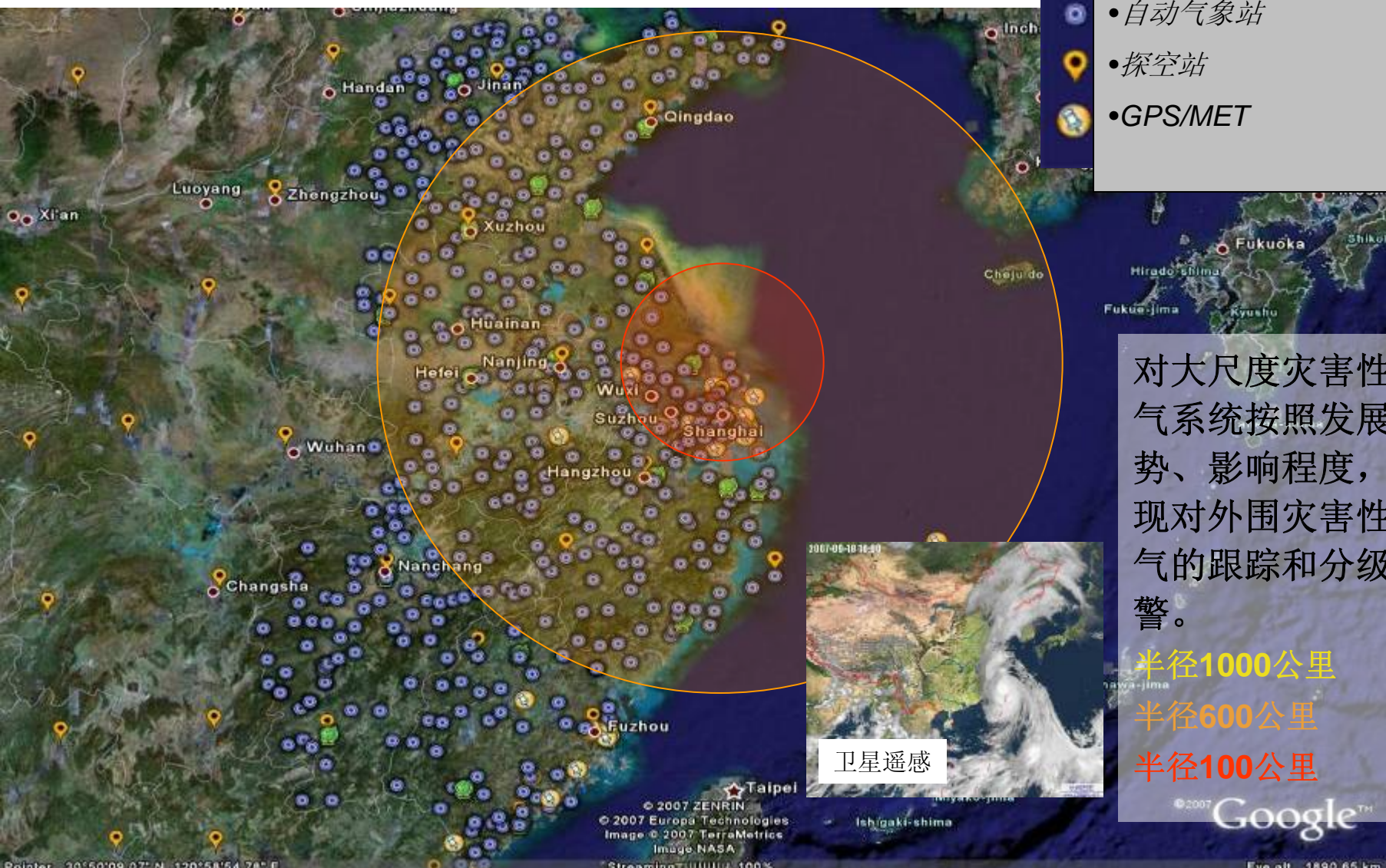
Early detection and monitoring system in East China



Early Detection & Monitoring Platform

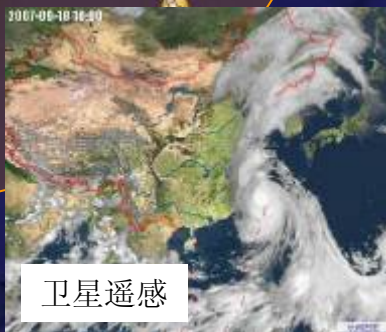
信息共享

- 天气雷达
- 自动气象站
- 探空站
- GPS/MET



对大尺度灾害性天气系统按照发展趋势、影响程度，实现对外围灾害性天气的跟踪和分级预警。

- 半径1000公里
- 半径600公里
- 半径100公里

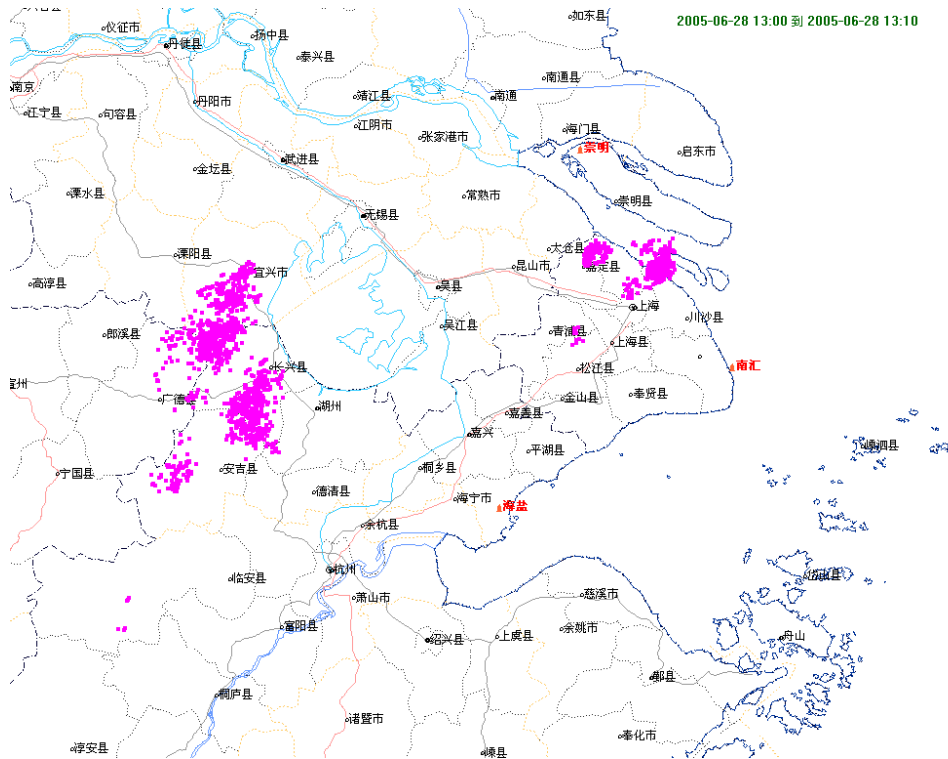




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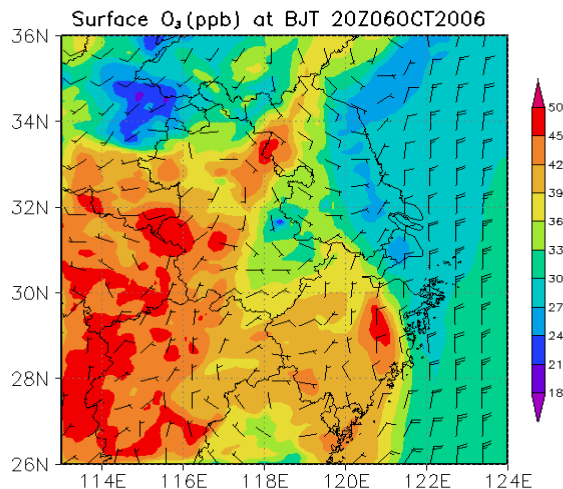
Early Detection & Monitoring Platform



Lightning early detection and monitoring system in the Yangtze River Delta



AWS in the Yangtze River Delta



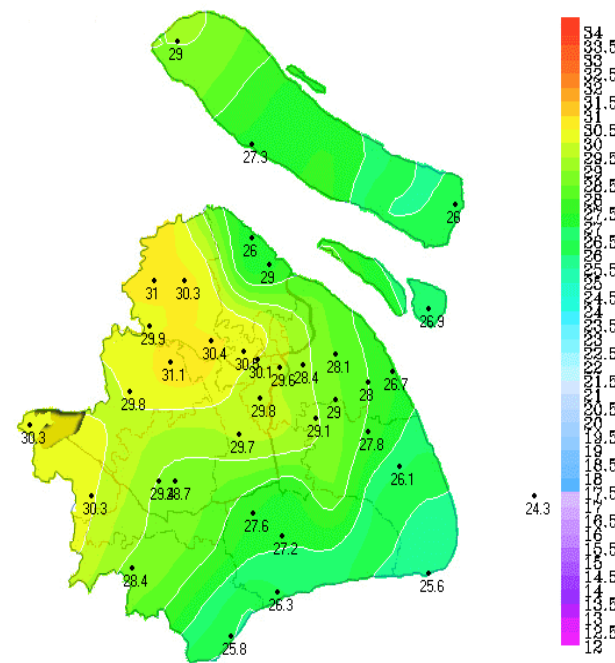
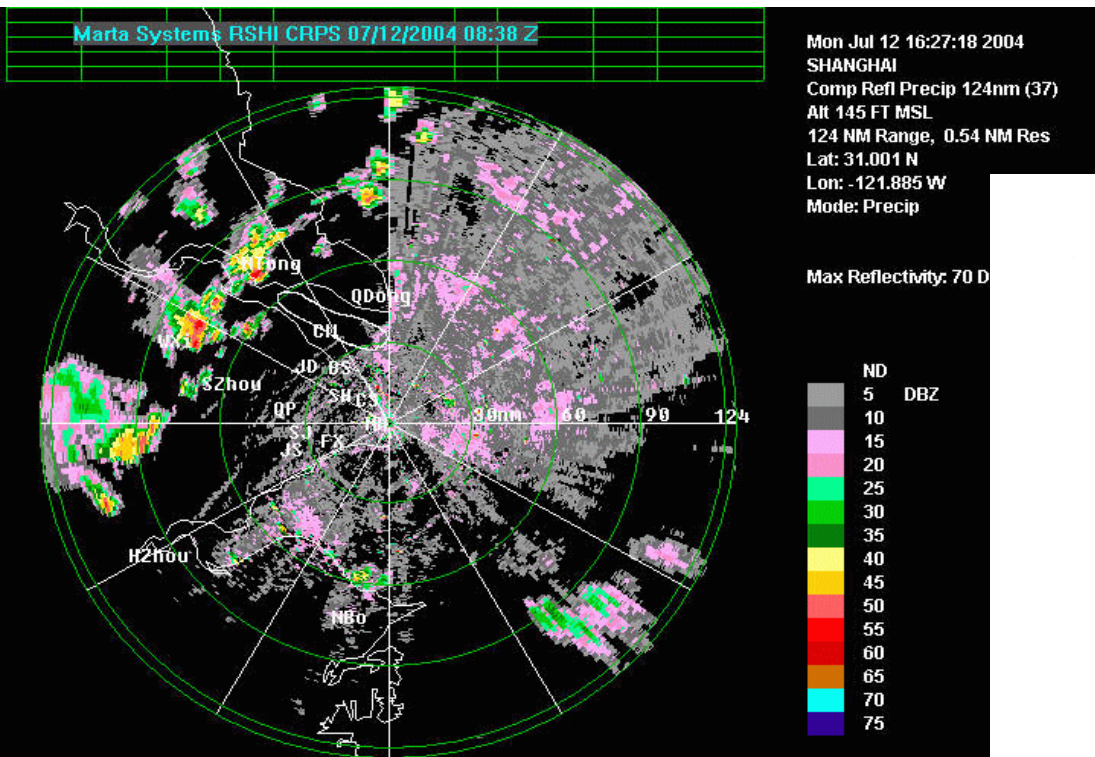
AQ prediction in the Yangtze River Delta by WRF-Chem



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Early Detection & Monitoring Platform



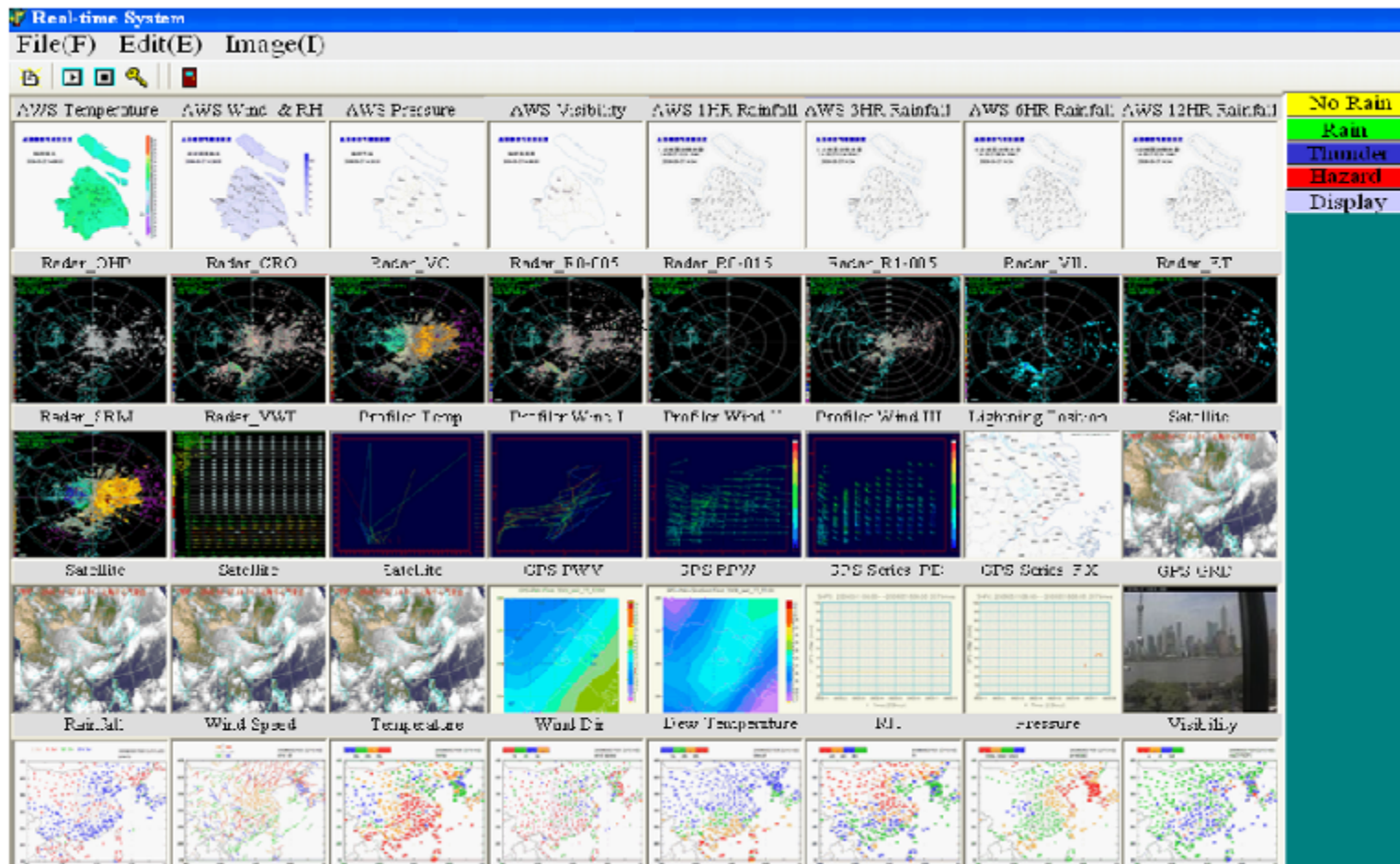
Early detection and monitoring system in Shanghai



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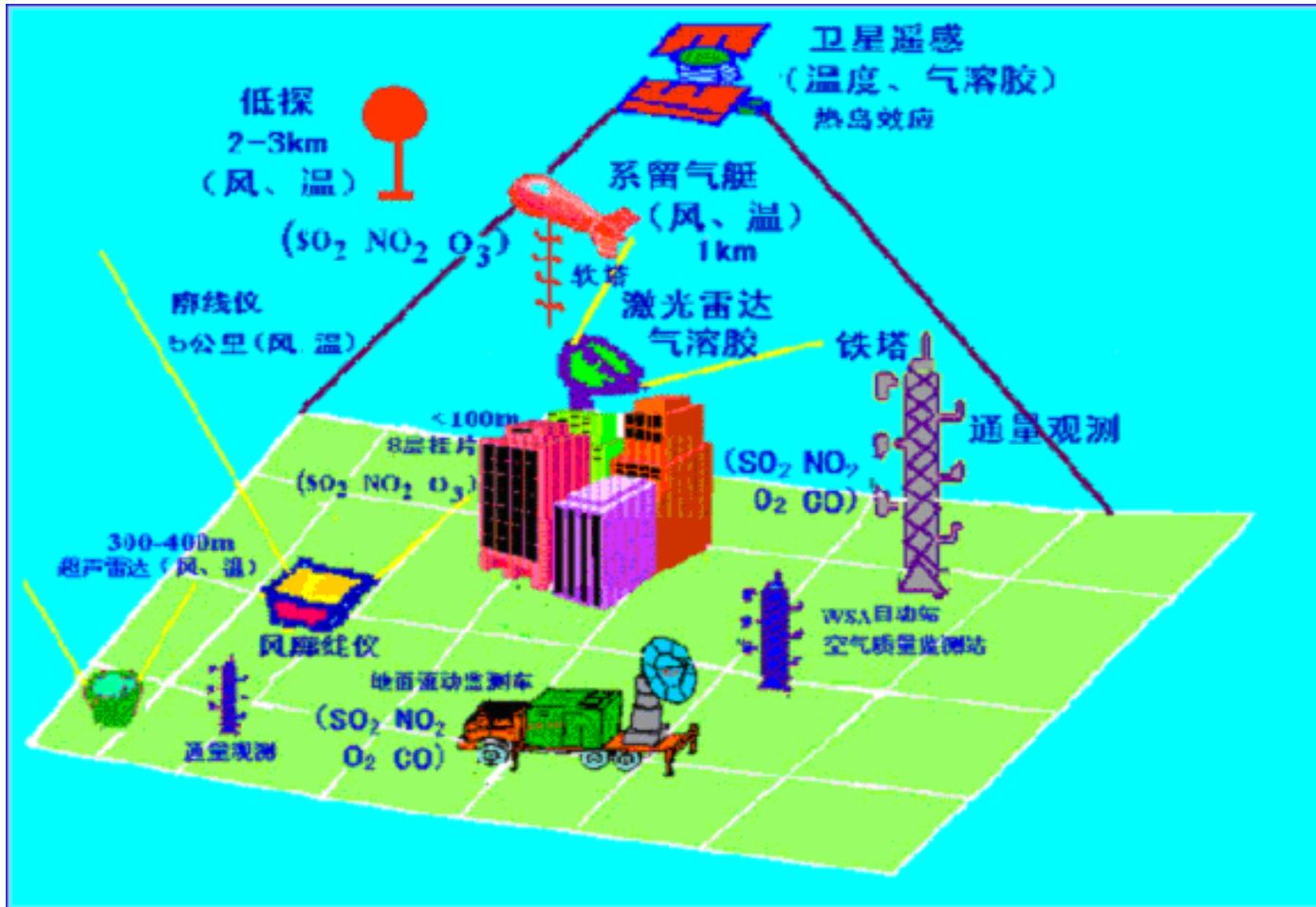
Multi-Hazard Early Detection & Monitoring Platform



Multi-product monitoring and early warning interface



City-scale Early Detection & Monitoring System



The comprehensive observation system of urban atmospheric boundary layer



Ensemble Prediction Systems

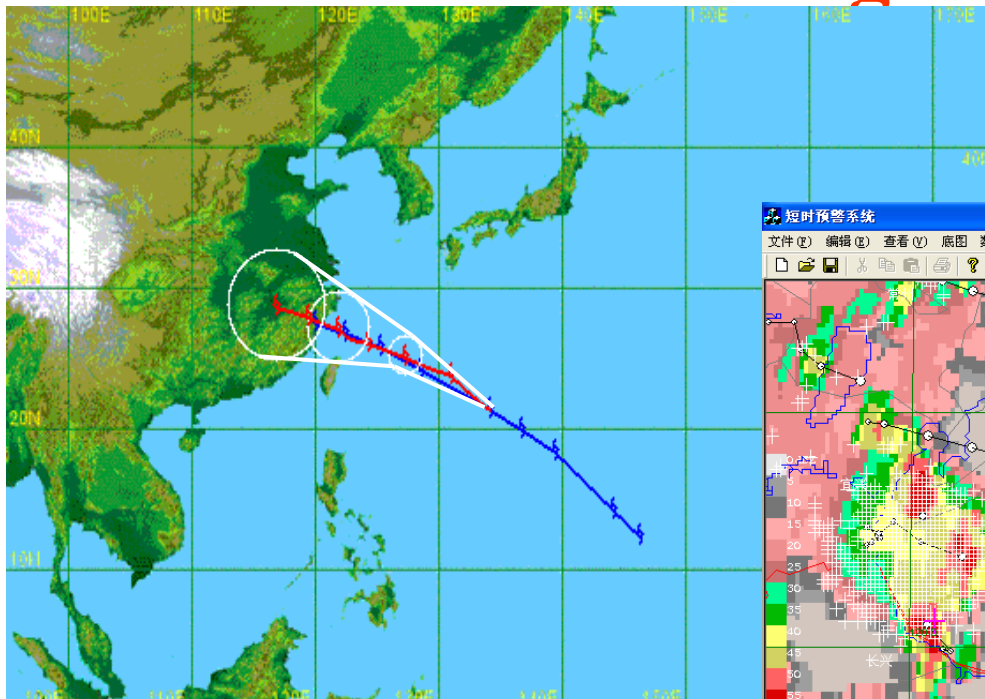
- Ensemble forecasts from **different centers** around the world might be shared with the Shanghai early-warning system. The main concerns will focus on medium-range, extended, and seasonal numerical predictions.
- The participating ensemble systems might provide both graphical and digital products in an **agreed format**;
- The products will be combined and integrated to form a **single** logical system in Shanghai;
- **Verification** will be included to assess the effectiveness of different ensemble systems;
- **Observation** data will be provided by CMA and SMB.



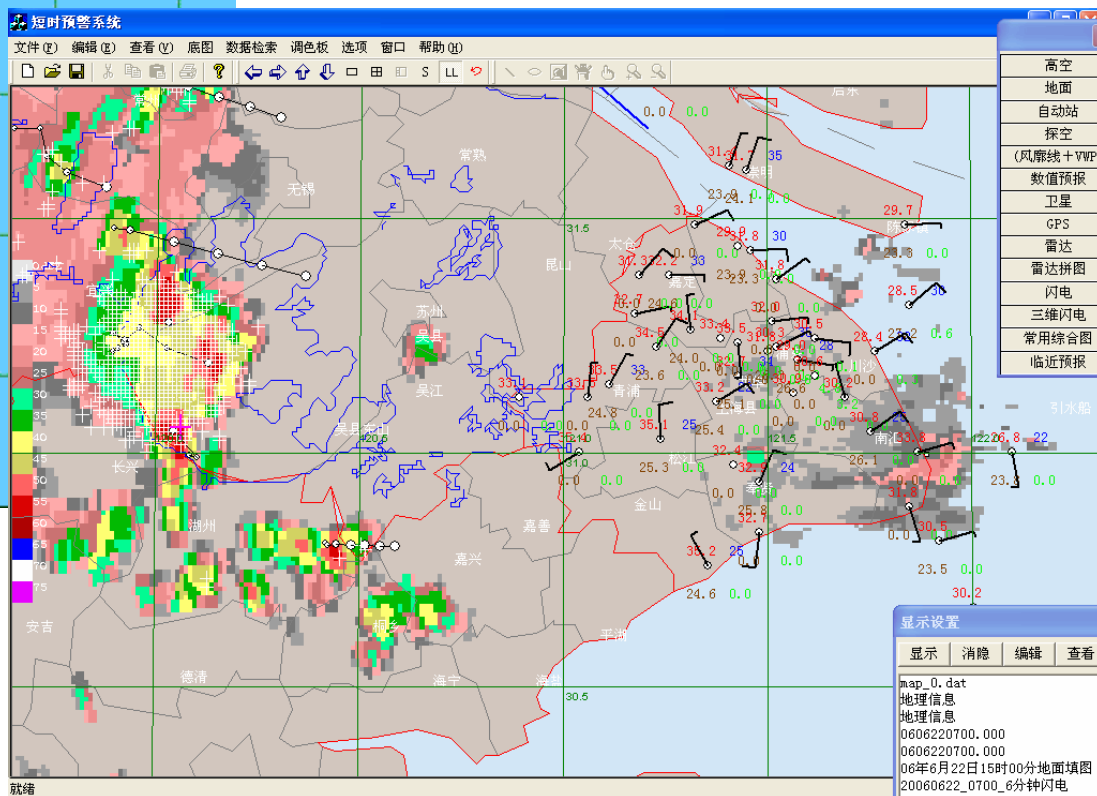
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Weather and Climate Hazard Early Warning Subsystems



Typhoon track prediction (red) of 70% probability, Blue-Observation



Severe convective weather early warning subsystem



Weather- and Climate-related Hazard Early Warning Subsystems

(1) Urban Inundation Early Warning Subsystem

- Partner: **Shanghai Water Affairs Authority**

- Inundation simulation model

- Meteorological data inputs

 - High-resolution output from NWP

 - AWS observations

 - Radar data

 - Hydrological data

 - ...

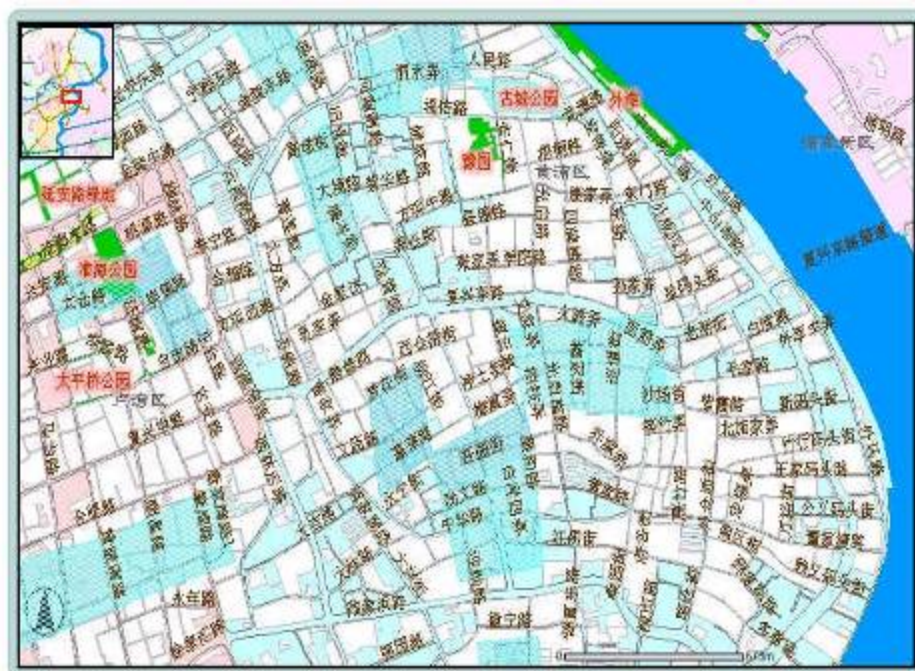
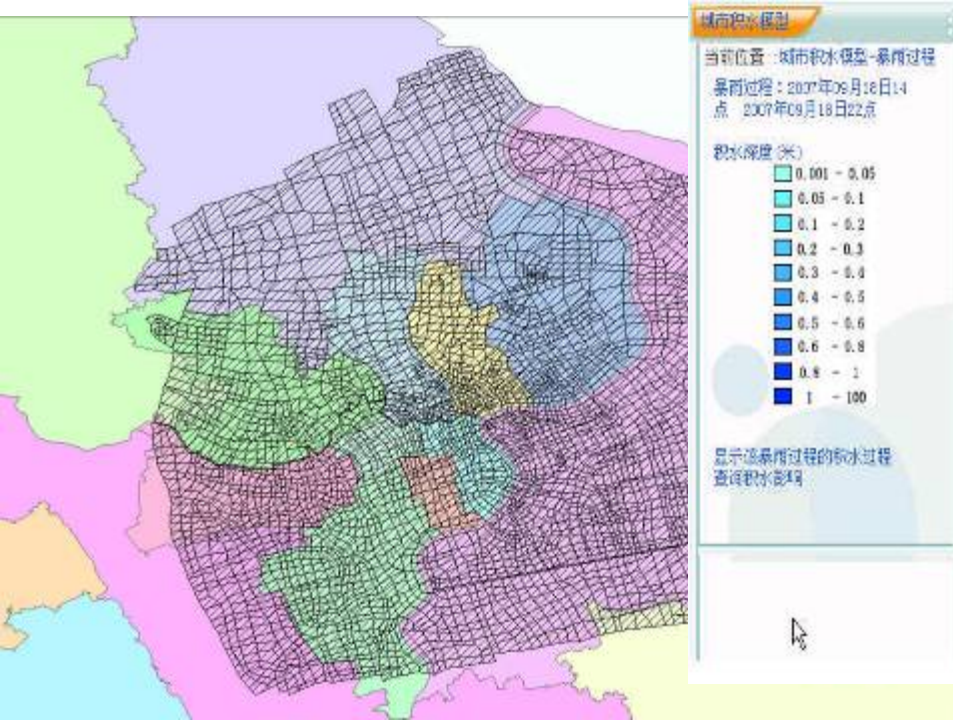
- Geographic Information System (GIS)



Weather- and Climate-related Hazard Early Warning Subsystems

(1) Urban Inundation Early Warning Subsystem

Shanghai area is divided into 4600 irregular grids according to topographical characters.
The urban inundation model and area precipitation forecast system have been set up.
The Urban Inundation EWS based on WEBGIS has been put into operation.





Weather- and Climate-related Hazard Early Warning Subsystems

(2) Bacterial Food Poisoning Early Warning Subsystem

- **Partner: Shanghai Public Health Bureau;**
- **To analyze and define categories and extents of food safety impact-factors;**
- **Food poisoning incidents during the past ten years will be investigated;**
- **Relationship between weather and food poisoning will be established.**



Weather- and Climate-related Hazard Early Warning Subsystems

(2) Bacterial Food Poisoning Early Warning Subsystem

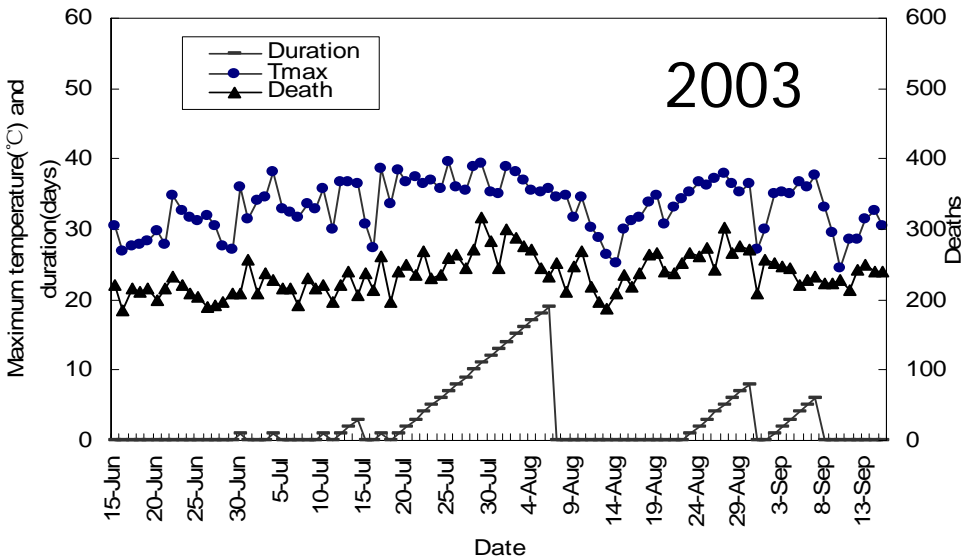
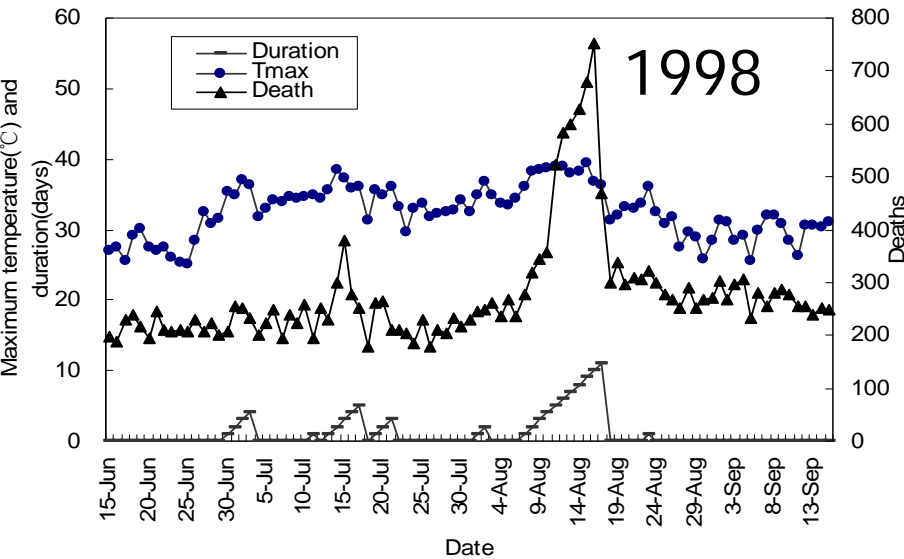
Cooperated with Municipal Food and Drug Supervision Administration, warning model of bacterial food poisoning has been set up and related warning signals have been defined. The system has been put into operation.

	-10	-8	-6	-4	-2	0	2	4	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	
40				0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0							
44					0	0	0	0	0	0	0	0	0	0	0	20	0	0	0							
48				0	0	10	0	0	0	0	0	0	0	0	7	0	25	25	0					0		
52				0	0	0	0	0	0	11	0	7	0	0	33	0	0	0								
56				0	0	0	4	0	0	0	0	3	3	0	11	17	13	10	25		0	40				
60					0	7	0	3	0	0	0	6	4	0	0	10	9	11	25	50	40	0	0			
64				0	0	0	0	2	4	0	0	0	5	8	6	4	11	9	16	22	26	17	100			
68					0	0	0	3	3	0	4	0	8	0	3	10	17	15	19	29	19	14				
72					0	0	0	0	2	0	5	6	2	0	4	13	12	18	25	19	16	25				
76						0	0	0	0	3	0	5	10	5	7	0	19	17	41	14	9					
80						50	0	3	0	2	2	3	4	3	9	6	12	12	14	12	11					
84						0	0	0	0	0	0	6	0	5	18	7	13	15	27	12						
88						0	0	0	0	2	0	3	0	35	6	8	20	24	13	0						
92							0	0	10	5	0	0	0	0	12	19	26	40	0							
96								0	0	0	0	0	0	17	17	0	0	33	0							



Weather- and Climate-related Hazard Early Warning Subsystems

(3) Heat-Health Early Warning Subsystem



Maximum temperature and deaths caused by the heat wave of 1998

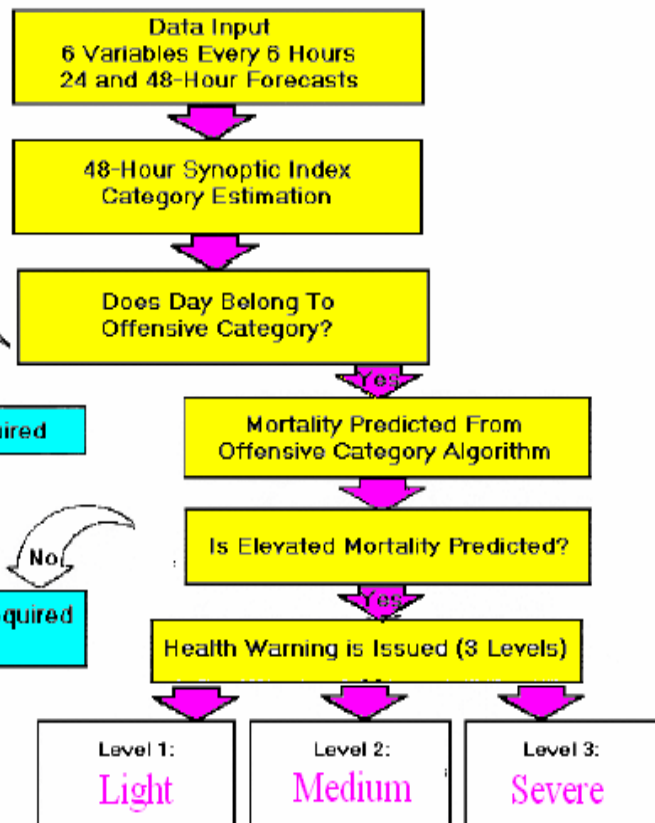
Maximum temperature and deaths caused by the heat wave of 2003

$$EM_i = - 82.8 + 2.48 \times T_{max_i} + 0.326 \times CdT_{max_i}$$

Cooperated with Public Health Bureau, Heat-Health EWS has been built up, and operated this year.



(3) Heat-Health Early Warning Subsystem



S/ S: HEAT EMERGENCY
Conditions oppressive - with a 97% chance of excess mortality

S/ 9: HEAT EMERGENCY
Conditions oppressive - with a 92% chance of excess mortality

			08/08				08/09			
DAY			05	11	17	23	05	11	17	23
TEMPERATURE	23	31	35	29	25	29	31	25	22	22
DEW POINT	22	22	23	23	22	23	23	23	23	22
CLOUDINESS				4						5
AIR MASS				HT+						HT+
DAY IN ROW				3						4

Forecast data provided by Meteorological Service of Canada - Ontario Region
Click [here](#) for the latest 5-day Public Forecast and latest observation at Pearson Airport

SYSTEM LEVELS

HEAT EMERGENCY
The likelihood of weather-related excess mortality occurring exceeds 90 percent.

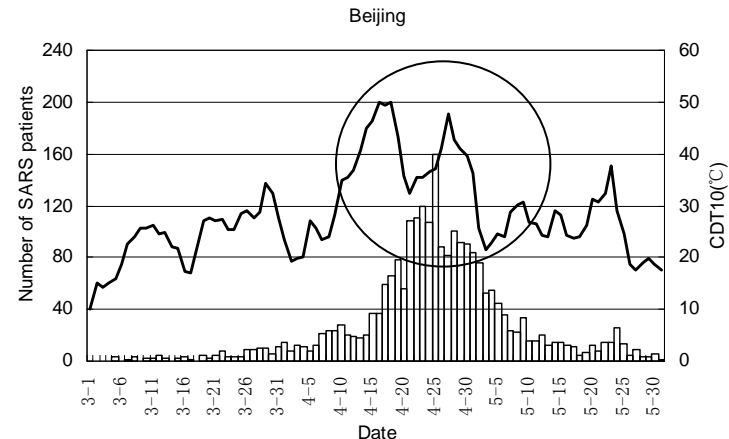
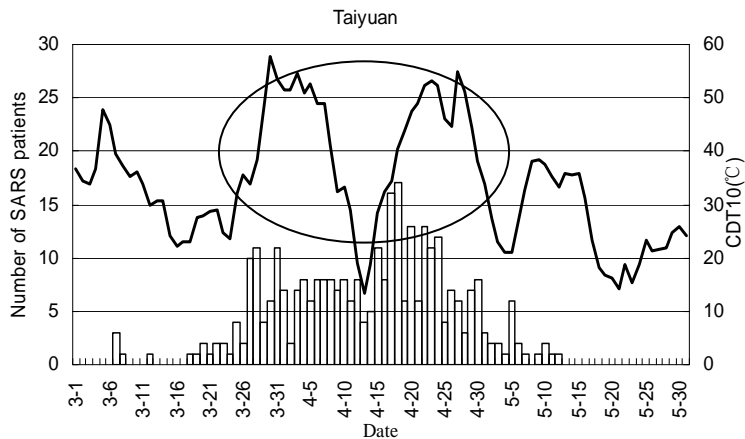
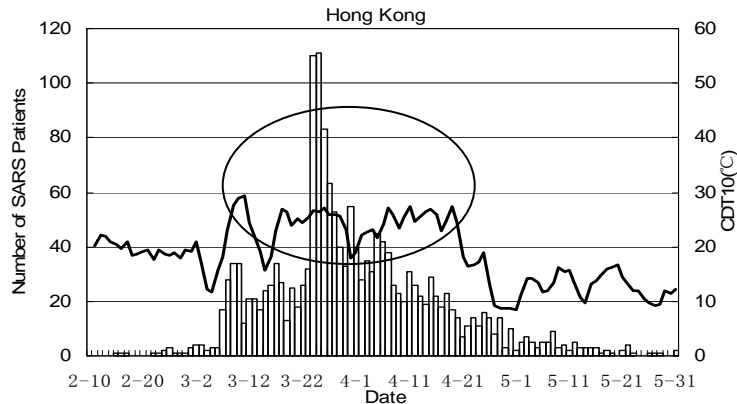
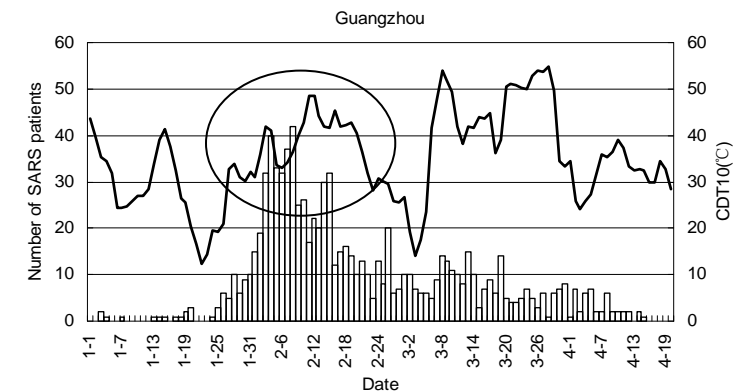
HEAT ALERT
The likelihood of weather-related excess mortality occurring exceeds 65 percent.

ROUTINE MONITORING
An oppressive air mass is forecast, although conditions do not suggest excess mortality is likely.

Heat-health early warning framework



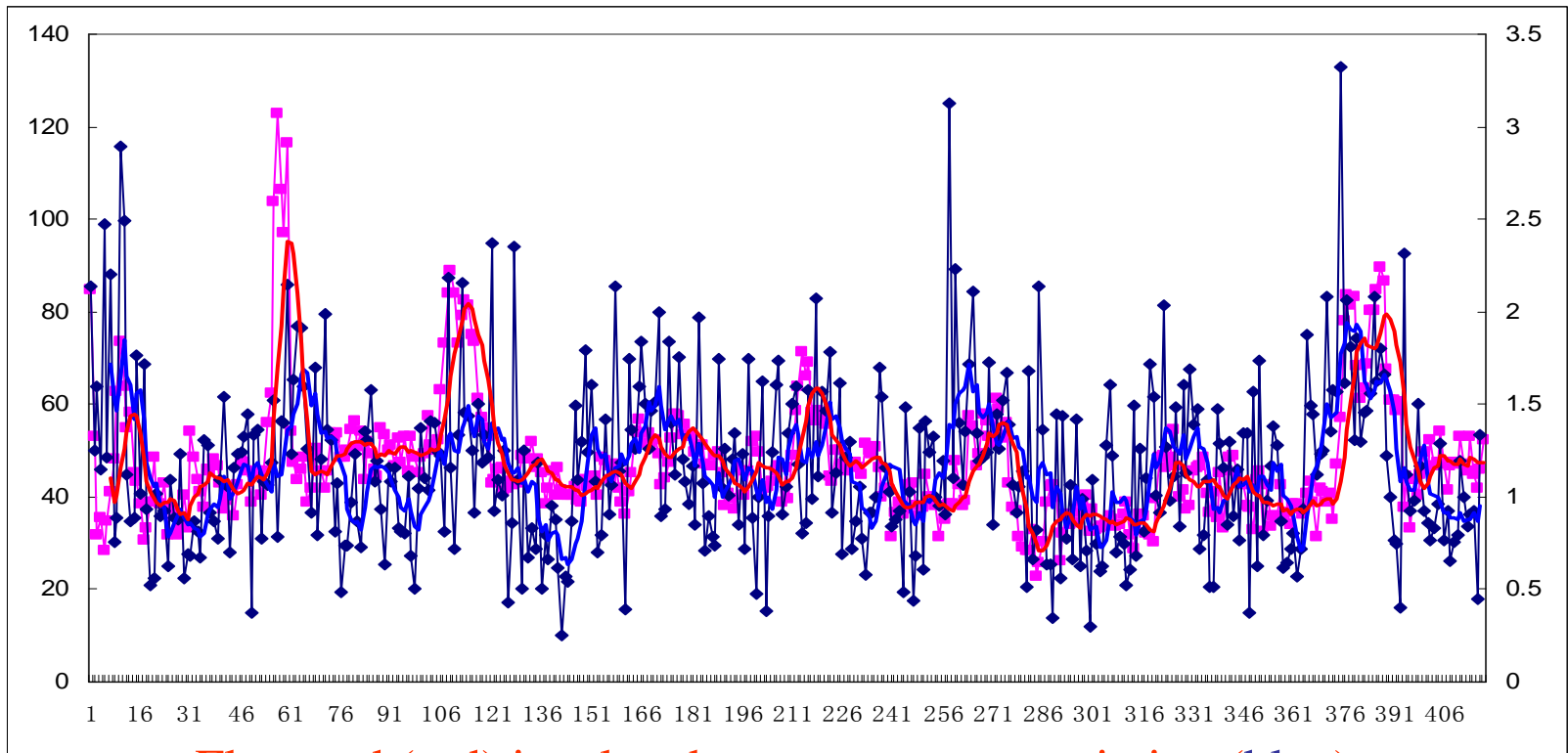
(4) Epidemic Diseases Early Warning Subsystem



SARS patient numbers and temperature variation in Guangzhou, Hong Kong, Taiyuan, and Beijing
Outbreak of SARS is closely related to cold air activities



(4) Epidemic Diseases Early Warning Subsystem



Flu trend (red) is related to temperature variation (blue)



(4) Epidemic Diseases Early Warning Subsystem

- **Partner: Shanghai Public Health Bureau;**
- **Collecting the weather/climate and epidemic data;**
- **Relation analysis of transmit and prevalence of main infection disease with weather/climate;**
- **Establishing the weather- and climate-related infection early warning model;**
- **Combining the infection early warning model with weather/climate forecast and issuing the warning information.**



(5) Urban Traffic Security Early Warning Subsystem

- **Partner: Shanghai Traffic Management Authority;**

- **Meteorological monitoring network along highway will be established;**

 - one visibility observation every 10 kilometer

 - one AWS every 20 kilometer



ROADS

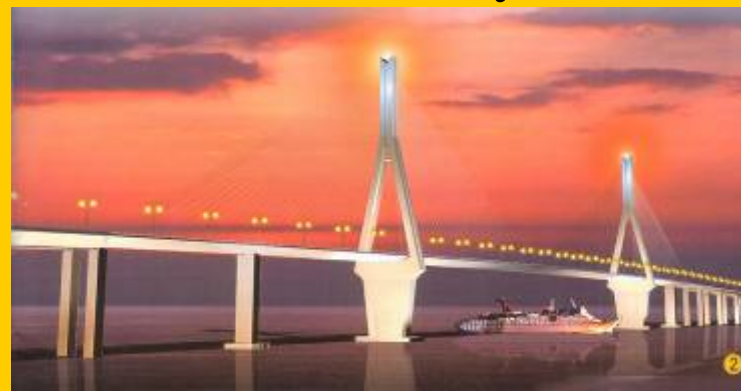
- **Weather services and prediction for urban traffic security**

 - visibility

 - precipitation

 - severe convective weather

 -





(5) Urban Traffic Security Early Warning Subsystem

The monitor network of urban traffic in Shanghai ;

The guidance on speed control, road closure of highway in case of low visibility;

The display system.

The low visibility warning system has stepped into operation.

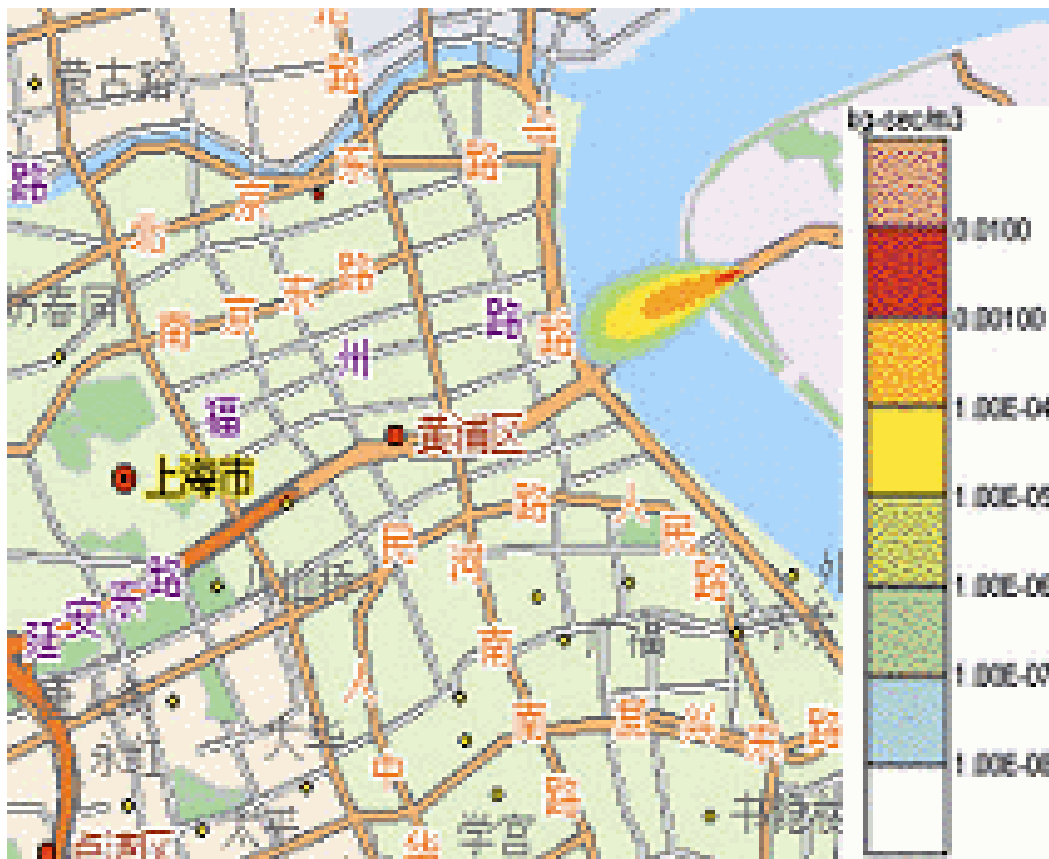




(6) Air Pollution Early Warning Subsystem -Chemical Gas Leak

➤ **Partner:** Shanghai Environmental Protection Authority

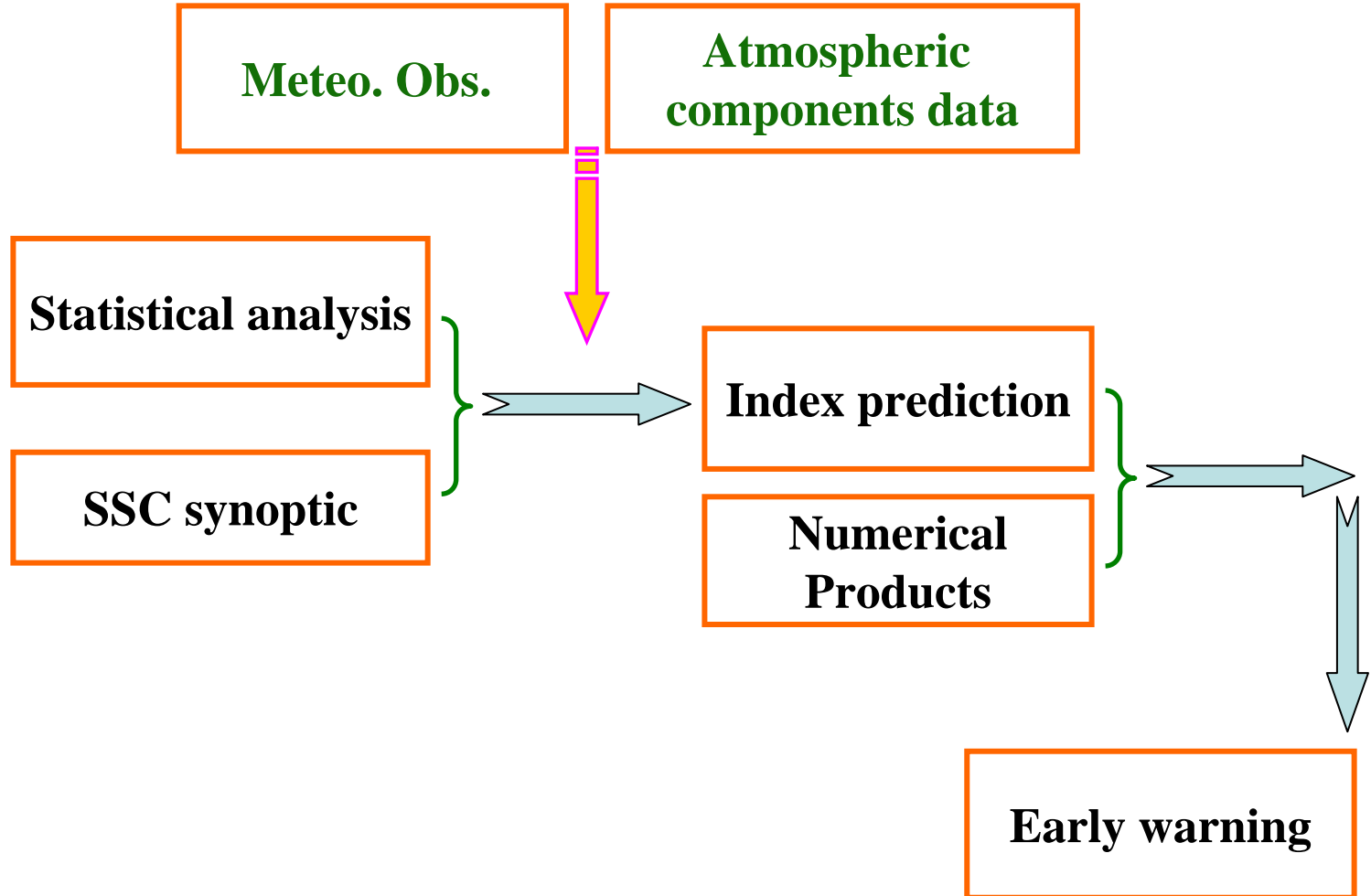
➤ To be supported by the Shanghai GURME Pilot Project;



Chemical gas leak simulation



(6) Air Pollution (i.e. Haze) Early Warning Subsystem





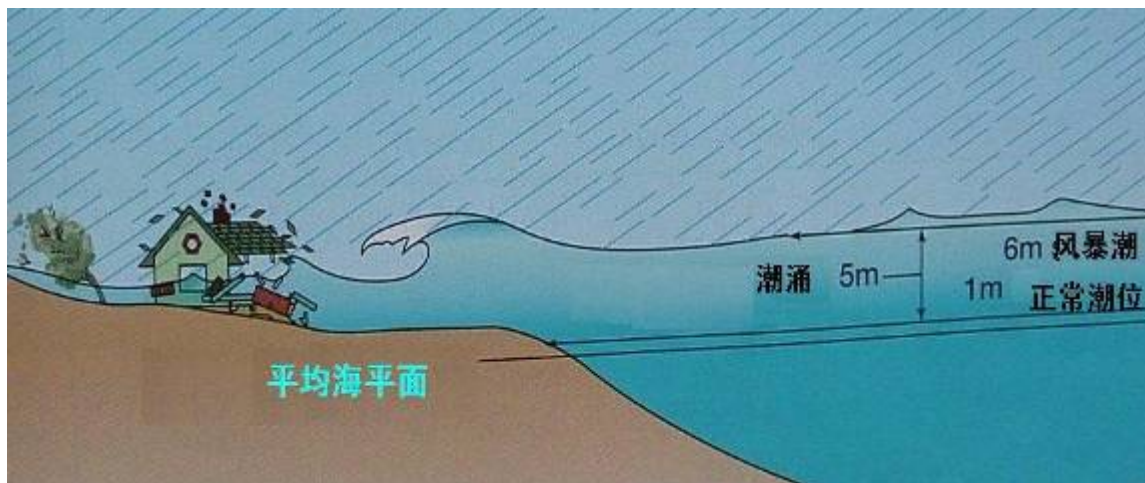
(6) Air Pollution (Fire Diffusion) Early Warning Subsystem

- Partner: **Shanghai Fire Services Department;**
- Fire incidents in the past ten years will be investigated;
- Statistical relationship between weather and fire accidents will be analyzed;
- Advanced fire diffusion prediction techniques or model will be introduced to SMB;
- Reaction-diffusion equations will be set up;
- Land use and building distribution will be taken into account;
- Fire risk index warning will be issued to the public every day.



(7) Storm Surge Early Warning Subsystem

- **Partner: Shanghai Marine Authority;**
- **A marine and coastal wind-wave forecasting subsystem has been developed based on NWP;**
- **Techniques for evaluating and forecasting the possibility and severity of storm surge using high resolution topography and weather data are needed;**





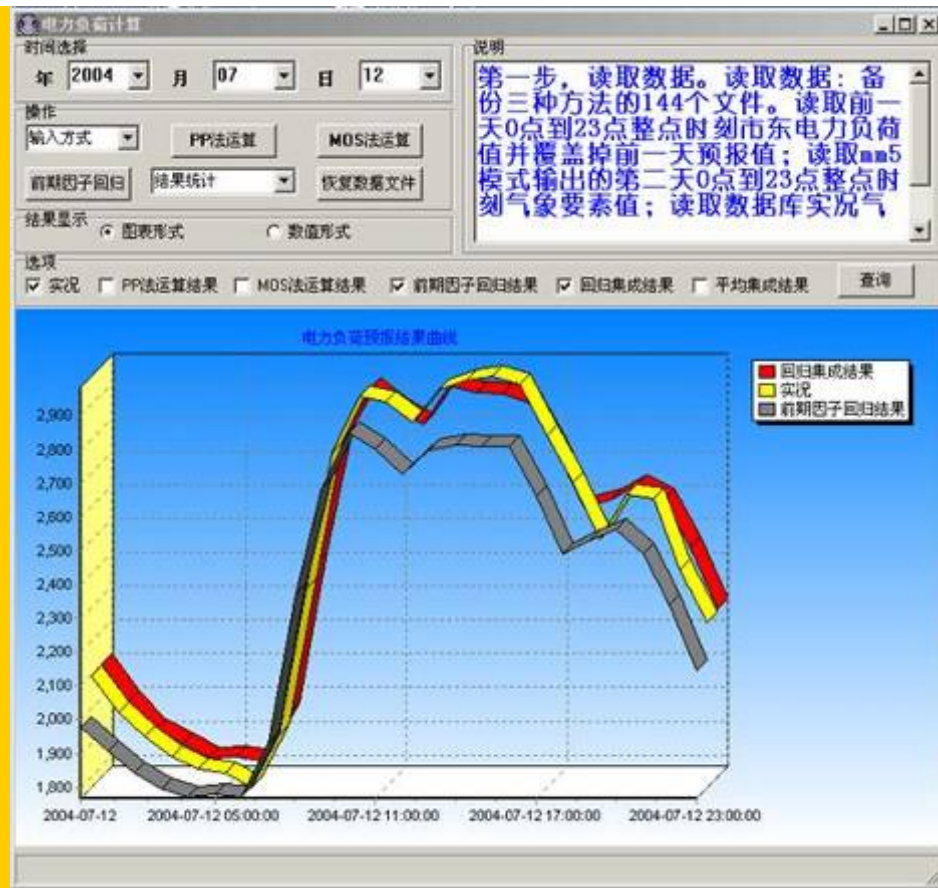
(8) Energy Dispatch and Security Early Warning Subsystem

•Partner: Shanghai Development and Reform Committee;

•Energy consumption, energy supply shortages, energy transportation and events affecting energy security will be included;

•Statistical relationship between weather and energy consumption will be established;

•Extreme weather and climate events will be also taken into account.



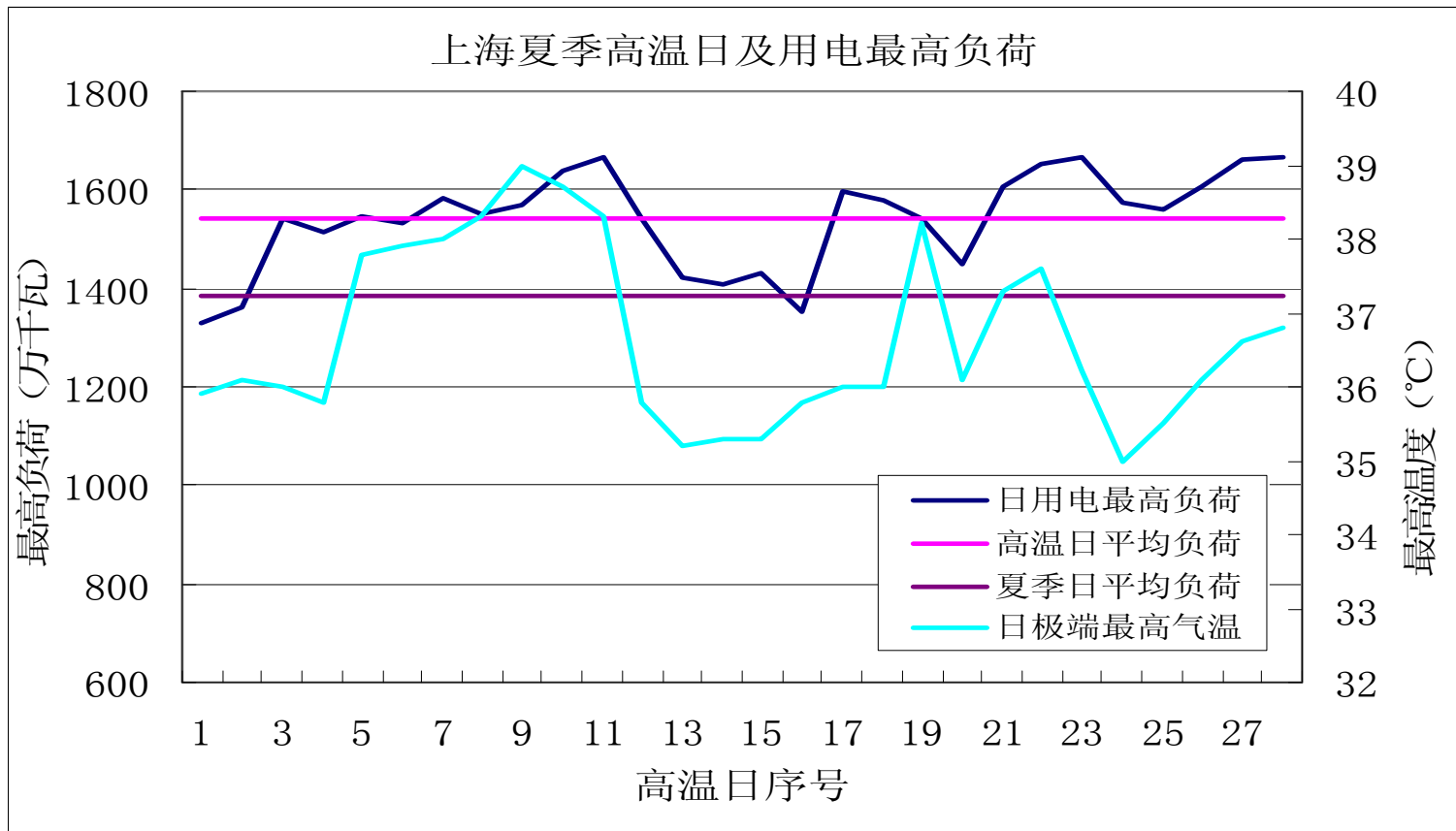
Electricity consumption forecast during one day



(8) Energy Dispatch and Security EWS

Combined with meteorological elements, electric power load and consumption forecast model has been set up.

Electric power security warning grades has been defined.





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Other Hazard Early Warning Subsystems

-Tsunami

- Issued by **Shanghai Earthquake Management Authority** and **Shanghai Marine Authority**;
- **Shanghai Earthquake Management Authority** observation network will provide real-time earthquake information;
- Offshore tide data will be provided by **Shanghai Marine Authority** and **SMB**;
- The system will connect with the **Pacific tsunami warning center**.



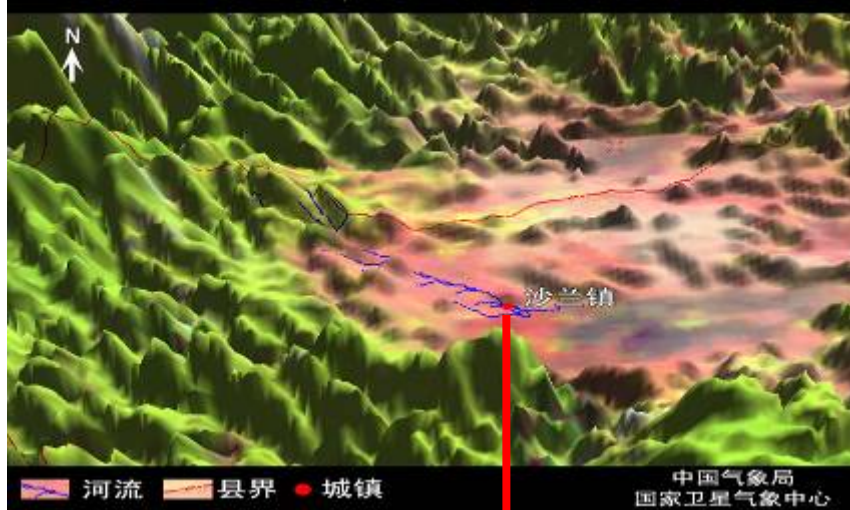
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Disaster Risk Evaluation

To analyze social, economic, and geographic vulnerability

黑龙江省宁安市沙兰镇三维地形影像图





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Disaster Risk Evaluation

Finished: Risk Regionalization and disaster evaluation of Typhoon, high temperature, electric power, windstorm, Inundation and agriculture.

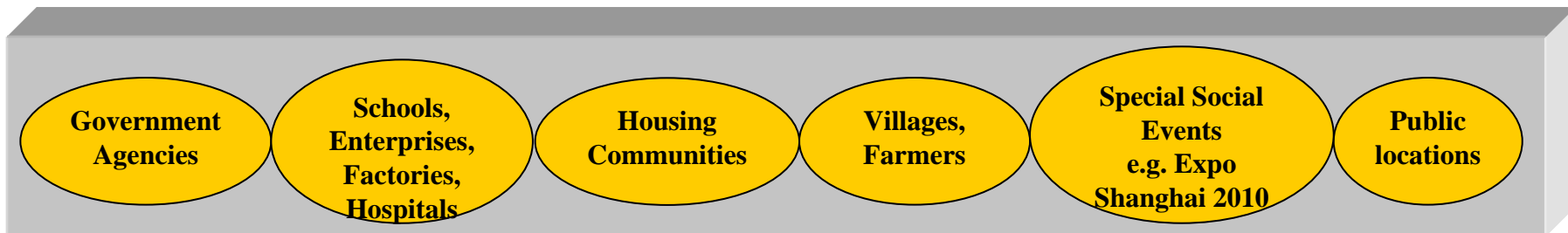
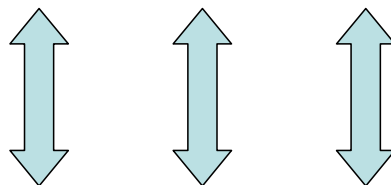
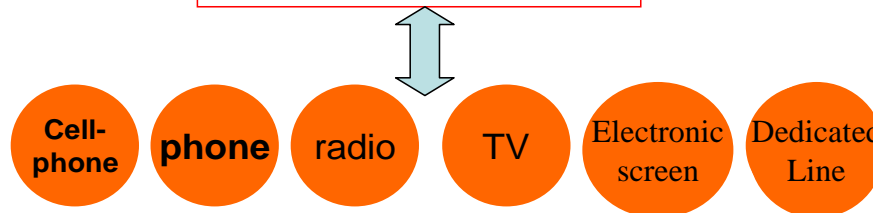
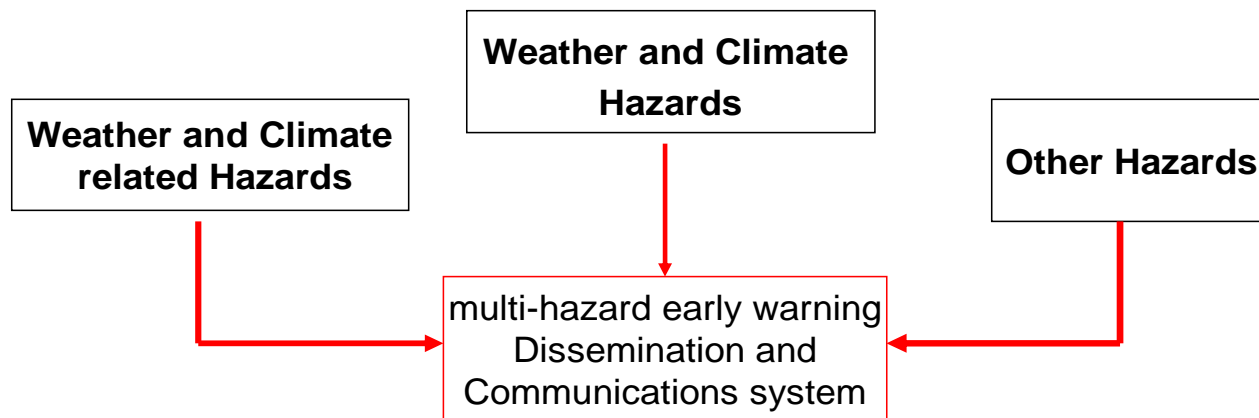
Through the cooperation within multi-departments and integration of multi-disciplinary, SMB is on the way of extending weather forecast to disaster forecast.



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Dissemination and User Application System



Operation Flow



Dissemination and User Application System

1. City-level Dissemination Platform. On the base of weather information dissemination platform, Municipal Emergency Office issues management information to **3000 stuff and 76 departments**.

2. Department-level Dissemination Platform (under operation). The cell phone message platform of SMB already sent warnings covering water affairs, flood prevention, sunstroke, food poisoning and community management. Information dissemination system covers more than **8000 residential areas, 1780 junior and primary schools and 300 agricultural units**.

3. Public-level Dissemination Platform (effectively used).

—The first **community warning light system** of the nation has been built up in Baoshan district, Shanghai. The system will be extended to each district and symbolizing Building.

—Cell phone message dissemination mechanism for serious disasters has been built up.

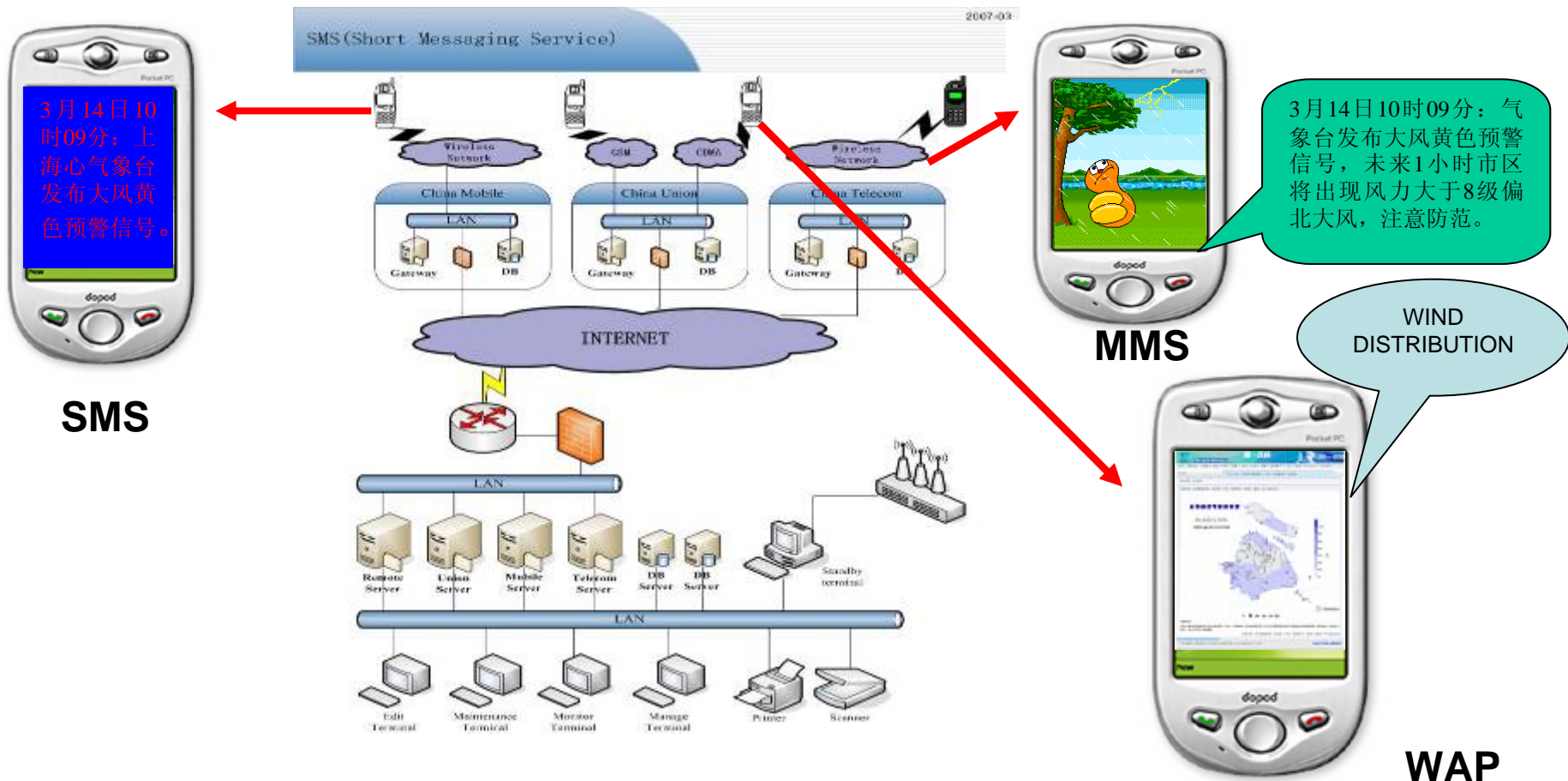
—Public warning dissemination network includes **50 000 public electronic screens, 2000 building TV screens, and 1000 electronic road signs**.





Dissemination and User Application System

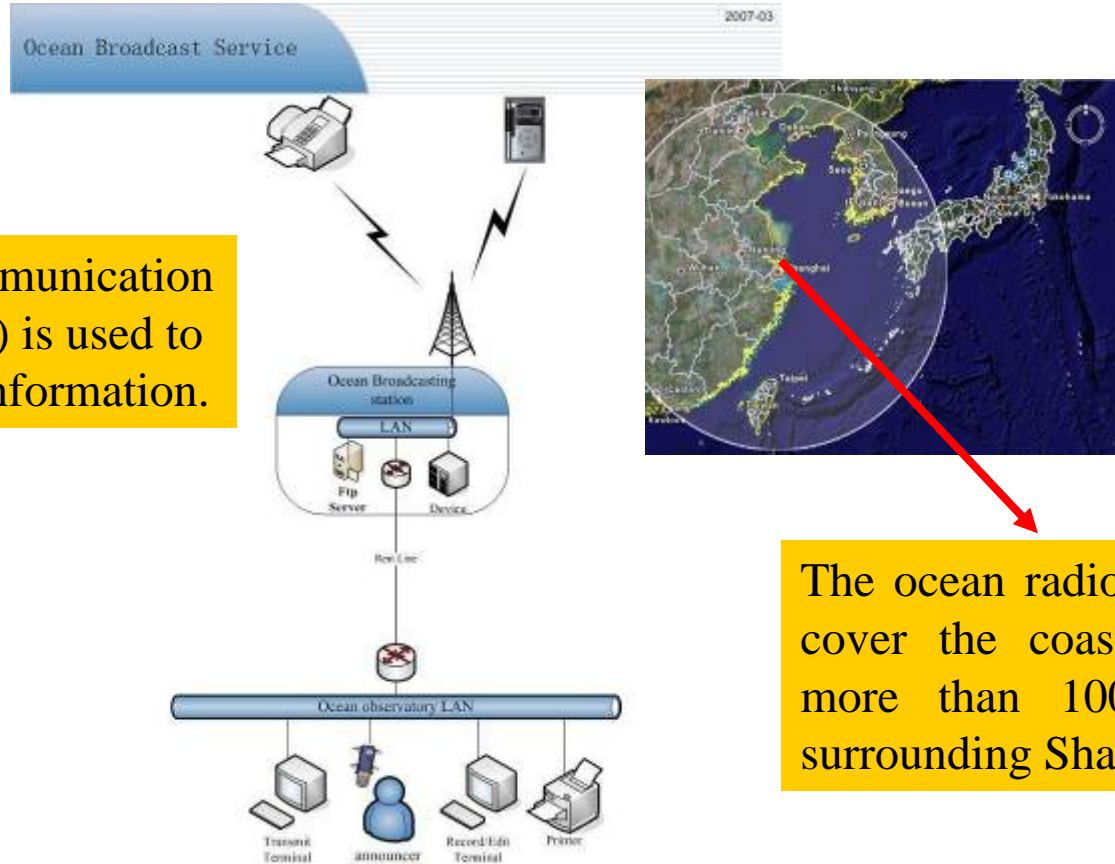
Cell-Phone dissemination subsystem (SMS, MMS, WAP) has been built, supported by the **layered user database**





Dissemination and User Application System

Radio Broadcasting Dissemination Subsystem



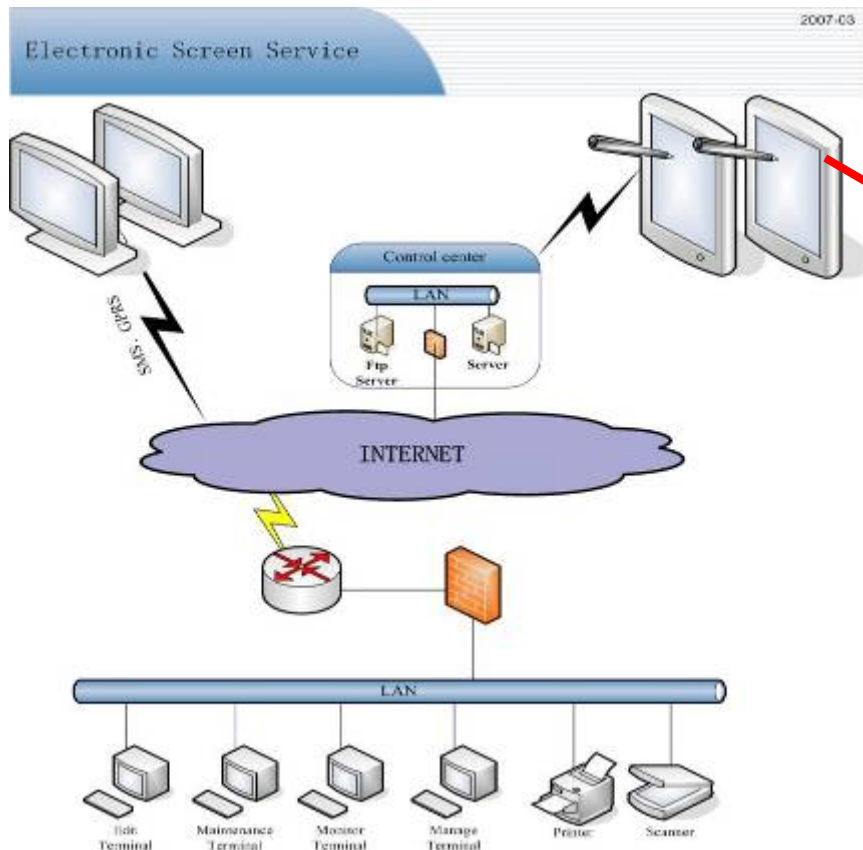
FM Subsidiary Communication Authorization (SCA) is used to broadcast warning information.

The ocean radio broadcast can cover the coastal water area more than 1000 km radius surrounding Shanghai.



Dissemination and User Application System

Public Electronic Screen Dissemination Subsystem



Early warnings are issued with guidance to prevention and mitigation via display screens in the streets and parks.

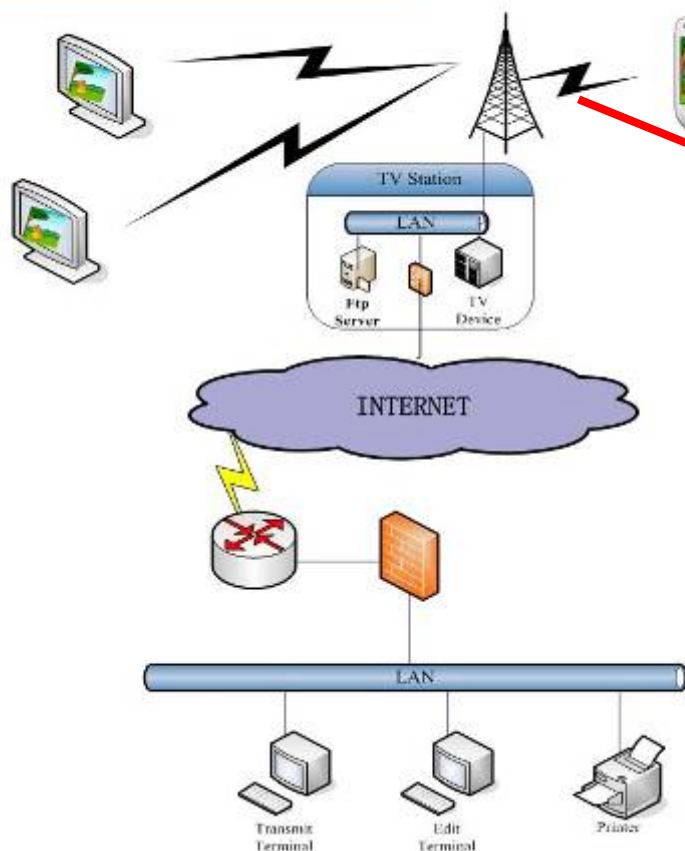


Dissemination and User Application System

Mobile TV Dissemination Subsystem

Motion Television Service

2007.03



You can catch the early warnings via Mobile TV in public transportation vehicles such as taxi, bus, and subway.

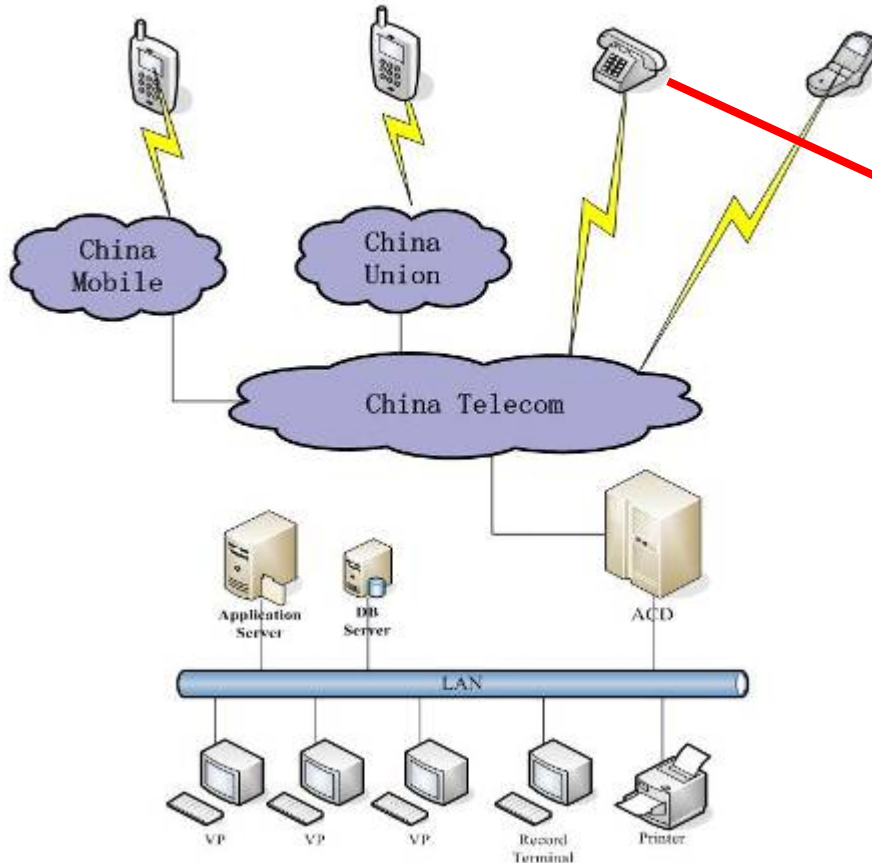


Dissemination and User Application System

Warning Call Dissemination Subsystem

2007-03

Telephone Service



Based on the 12121, 969221, and 969222 weather hotlines, active outgoing call service, named Warning Call, will be added to the subsystem (150 calls every minute).

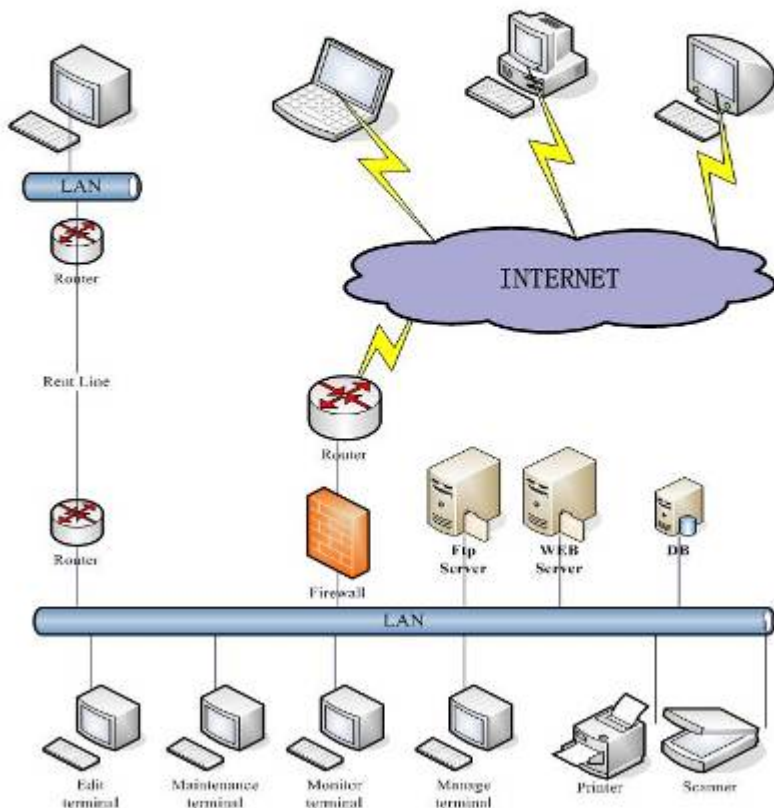


Dissemination and User Application System

Dedicated Line Dissemination Subsystem

Rent Line Service

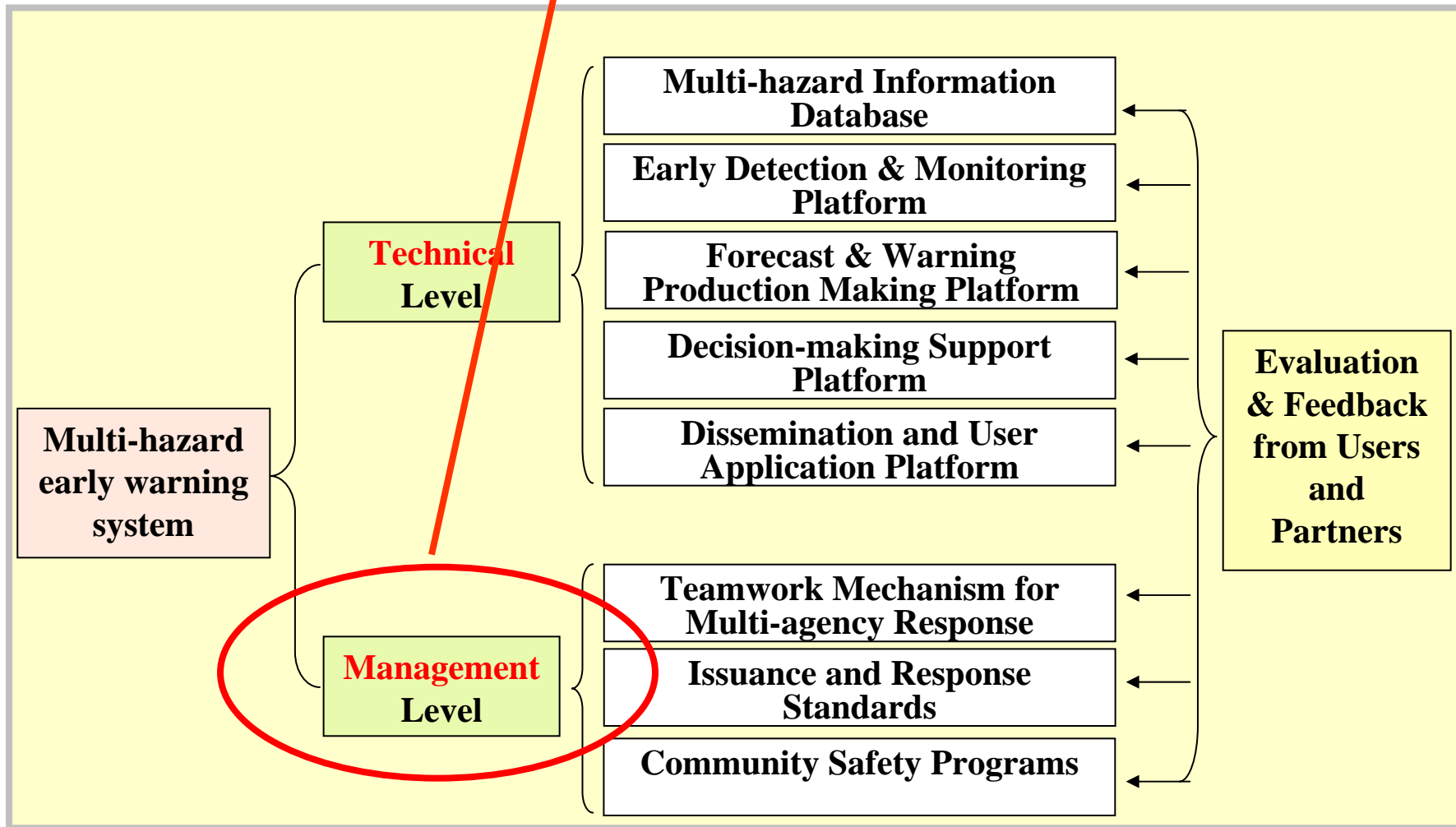
2007-03



Text and graphics are offered through Dedicated Line. The terminal display software can display the simulation images of the disaster's impact, development, and evolution for government agencies.

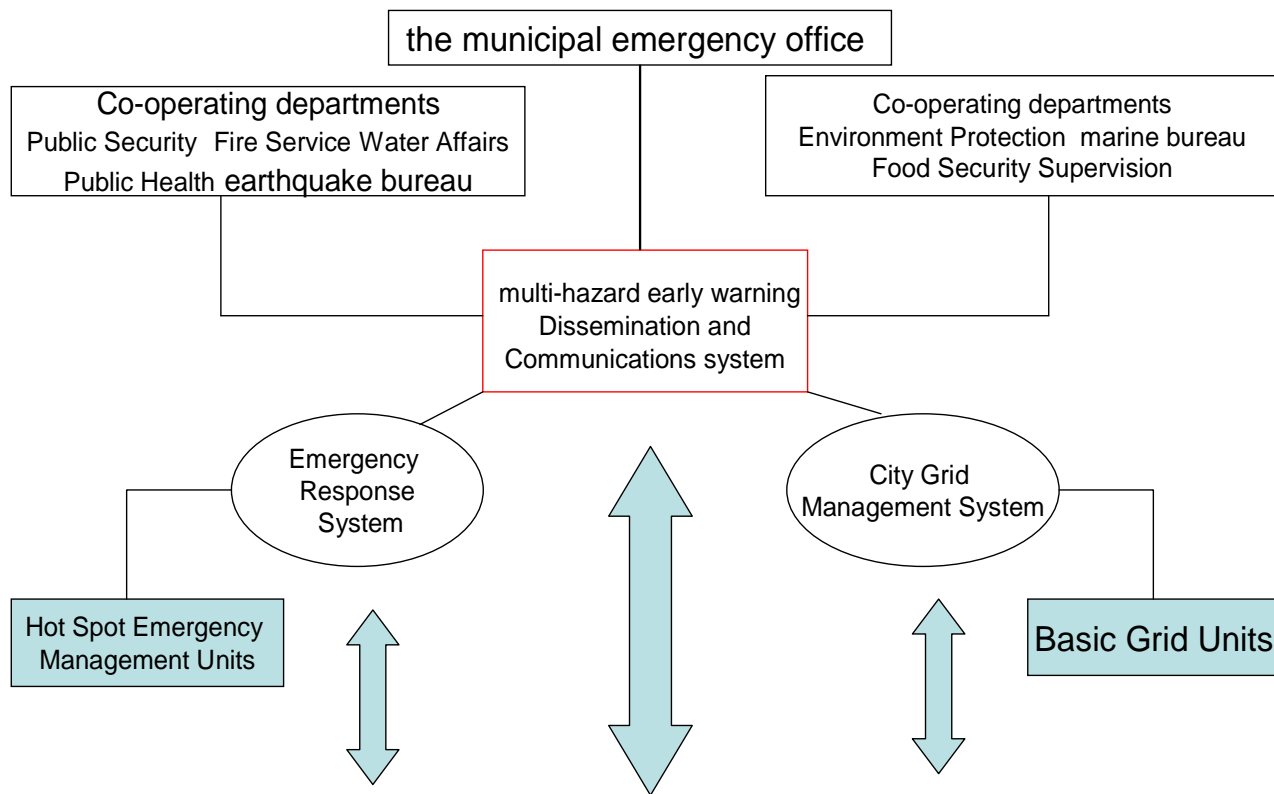


2. Management Level

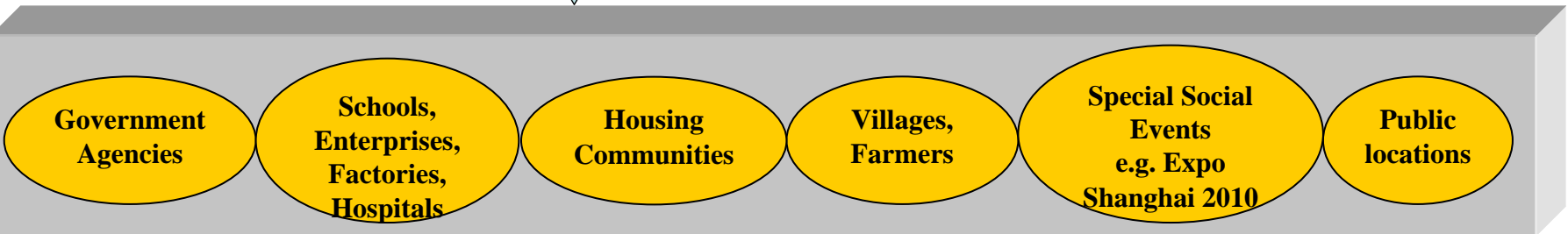




Teamwork Mechanism for Multi-Agency Response



To establish the framework of teamwork: managed by the municipal emergency office, worked by the weather bureau, co-supported by the related departments, based on cell-phone SMS Warning Dissemination System of the weather bureau and integration of every city parts basic units.





Teamwork Mechanism for Multi-Agency Response

The mechanism of multi-agency teamwork involves the following:

- a) The joint release of multi-hazard early warning information
- b) Joint actions in handling hazard events
- c) Information sharing in the post-hazard investigation

The joint release mechanism involves the following:

- a) Sharing of monitoring information among different agencies
- b) Triggering of the joint release
- c) Operational flow for the joint release
- d) Responsibilities and rights of each related agency

All aspects above will be developed into standards.



Issuance and Response Standards

a) Multi-hazard category standards

According to the severity and threat of the hazard, four colors of blue, yellow, orange and red will be used to represent light, moderate, severe, and extreme hazard respectively.

b) Multi-hazard warning information release standards

The users are separated into 4 levels:

I: governmental decision level (city and district), emergency headquarters, and multi-agency joint response center;

II: key joint response agencies, e.g. Expo Park and Yangshan deep-sea harbor;

III: managers of urban and rural grass-root units (housing communities, villages, schools, companies, and army) and the public;

IV: Basic Grid Units and key risk management units.



Issuance and Response Standards

c) Emergency response standards

The emergency response is divided into four grades: I, II, III, and IV. They represent extreme, severe, moderate and light events.

Grade I: municipal emergency headquarters response;

Grade II: multi-agency response;

Grade III: the related agencies response;

Grade IV: the BGU (Basic Grid Units) response.



Standardized Joint Response Mechanism

(a) Build up Consultation Mechanisms within different departments

Early consultation with municipal emergency office:

- Consult with municipal emergency office before warning issuance, keep the decision-maker fully informed to optimize decision-making procedure.
- Municipal office take other related information into consideration.
- Municipal Government start the emergency plan and organize the joint actions.



(b) Set up Standardized Department Joint Response Mechanism

36 Completed Joint Response Mechanisms

Flood prevention
Traffic control
Electric Power dispatch (Summer)
Agricultural disaster prevention
Food poisoning warning
Disease and medical resources control
Marine affairs securities
School Class suspending
Community Emergency disaster prevention
Construction sites security
Residential district security management
...

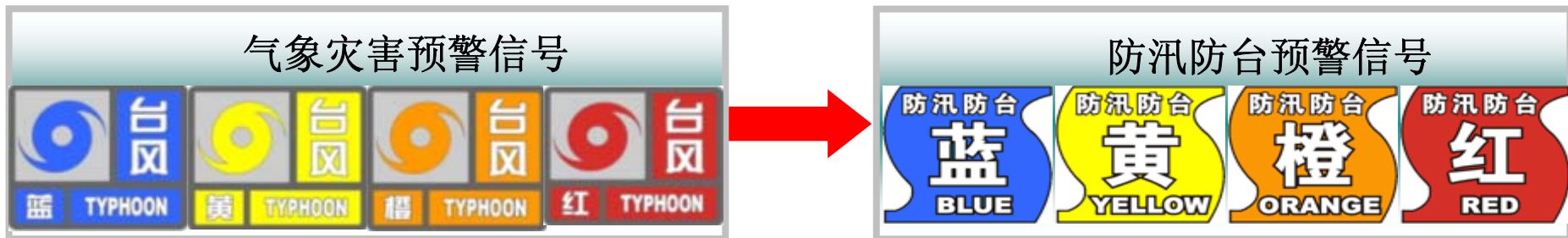
25 Departments

Municipal Emergency Office,
Emergency Response Center,
Flood Prevention office,
City Planning Administration,
Harbor Administration,
Public Health Bureau,
Agriculture Commission,
Economic Commission,
Electric power company
....



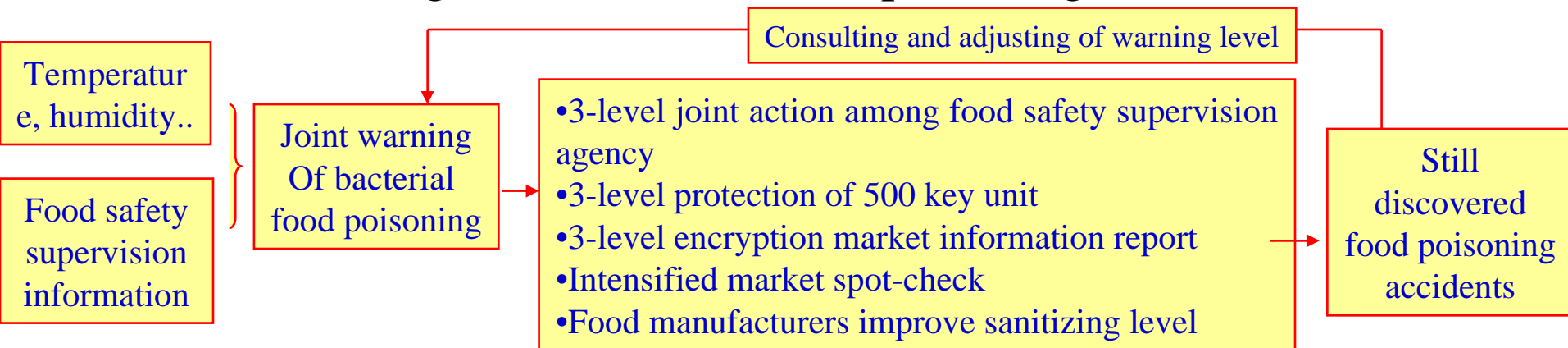
Example 1:

—Responding to hazardous weather warning signals, **a four-level emergency system** has been set up cooperated with municipal Flood Prevention Department. The system has been used 75 times in Shanghai.



Example 2:

—Joint warning mechanism of food poisoning





Community Safety Programs

a) Preparedness Plan, Security Certification

Wide converge of warnings together with emergency preparedness plan, security certification as well as disaster prevention training, consists the grass-root disaster prevention resolution.

b) Publication, Distribution, Education, Training, and Exercise

Publication and Distribution: Publish emergency response laws and regulations, risk avoidance guidance, self-rescue instructions, mutual assistance approach, etc.

Education and Training: Training of emergency response skills in community (grid area).

Exercise: Choosing the high impact hazards and rare events to carry out related emergency response exercises in communities.

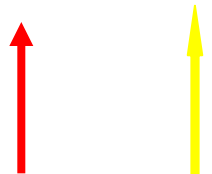
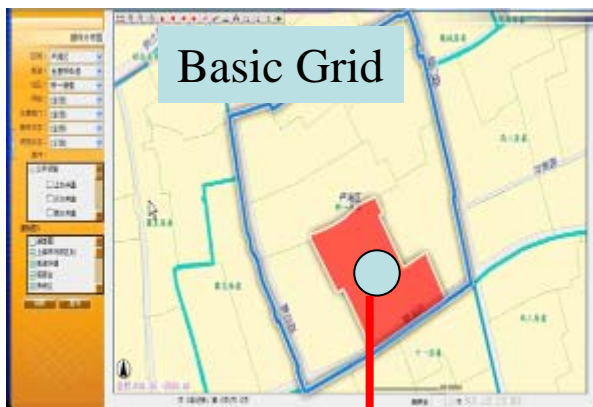
c) Emergency Response: Respond according to different areas, different warning categories, different characteristics of each basic emergency response unit; make hazard assessment; carry out corresponding response measures.



Community Safety Programs

--City Basic Grid Unit Management

City basic grid unit information interactive mechanism has been built up. Each grid manager become a warning receive and feed back point. Through this way all warnings and guidance reaches the grid units of the city.



Grid Management Information

Warning



Grid Manager





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OUTLOOK

I. Background

II. Outline of the Project

III. Case Study



Case 1 : The application in urban area and its suburb ---- taking *Songjiang* Town (suburb) and *Xuhui* District (downtown) as examples

Objective and characteristic:

- As a part of Shanghai MHEWS
- Meet the local needs to prevent the high impact disaster and its special need for mitigation.
- Expand the application functions of MHEWS



Songjiang (suburb area)

- ***one of the major satellite towns of Shanghai***, which have many high ranking tourism facilities, 7 famous universities, high-technology enterprises and agriculture farm land.

The area of Songjiang is 605.09 square kilometers. The population in the district is about 520,000, and therein 500,000 floating population, with a total population of more than 1,000,000. The GDP of the area is about 642.11 billion, with ranking the city's comprehensive total economic output in the third.



2. *It is a southwest Gateway of Shanghai*, facing to Zhejiang city-group of traffic throat. (Shanghai-Hangzhou railway, Shanghai-Hangzhou expressway, Jiajin highway, Huqingping expressway, Tongsan state highway and so on , forming a criss-crossing road traffic network). It's high-sensitive to typhoon, heavy rain, fog and accompanied suddenly traffic accidents, and it affects outbound traffic to the southwest of Shanghai as a whole.
3. *The topography of Songjiang is low-lying, and the river network is complex*, as one of the main city's water intake. (4 meters above sea level on average, with 2 meters above sea level to the minimum, and it's the bottom of the pot in Shanghai). *It's high-sensitive to typhoon, rainstorms and floods.*



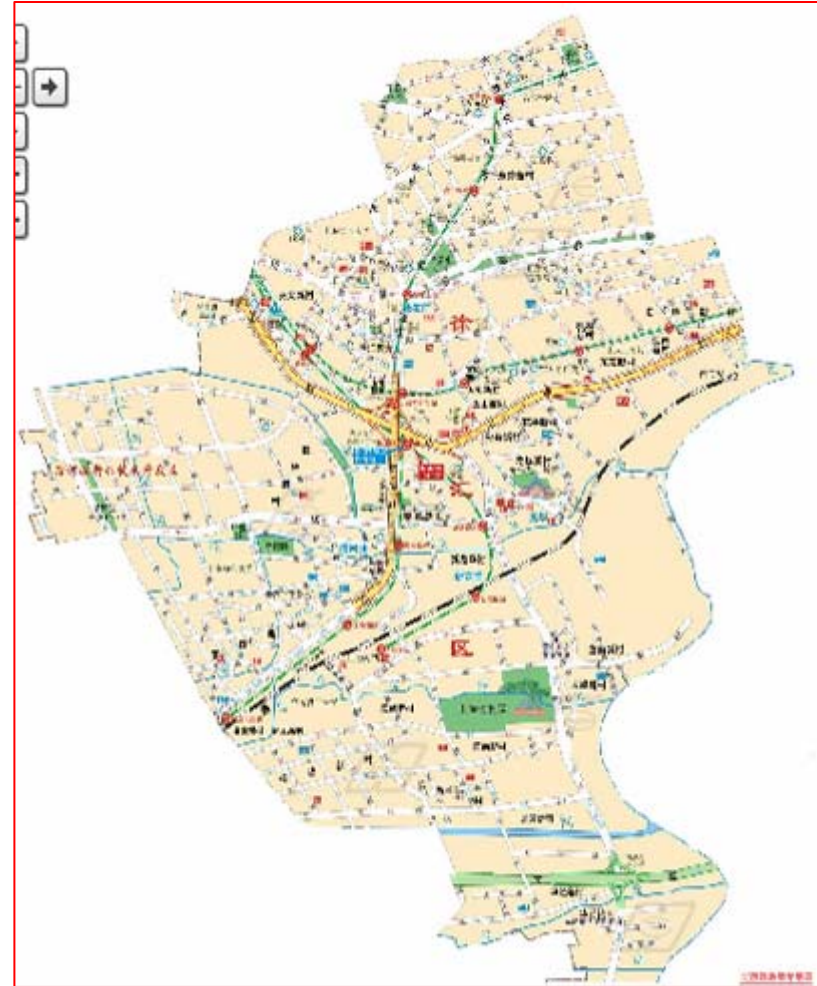
Xuhui (downtown area)

1. One of commercial centers in Shanghai. (54.8 square kilometers, with 891.8 thousand population and the density of 16286 people/square kilometer. GDP 65 billion RMB.) Thus it is a highly sensitive area to disaster, such as air pollution and public health.

2. Important Traffic hub in Shanghai (Shanghai South Railway Station and traffic hinge to suburban SW locates in Xuhui. There are 5 10000 dwt berths, and 12 thousands outdoor electronic displays in Xuhui.) Thus it is very sensitive to traffic accidents caused by typhoon, heavy rain, and heavy fog. At the same time, the safety of buildings are also threatened by strong wind.

3. Low-lying topography characters. (low natural gradient on earth-surface, which are all below high water level; Land subsides due to large-scale exploitation of underground water; The altitude is between 2.5-3 meters, with low-lying below 2.5 meters.)

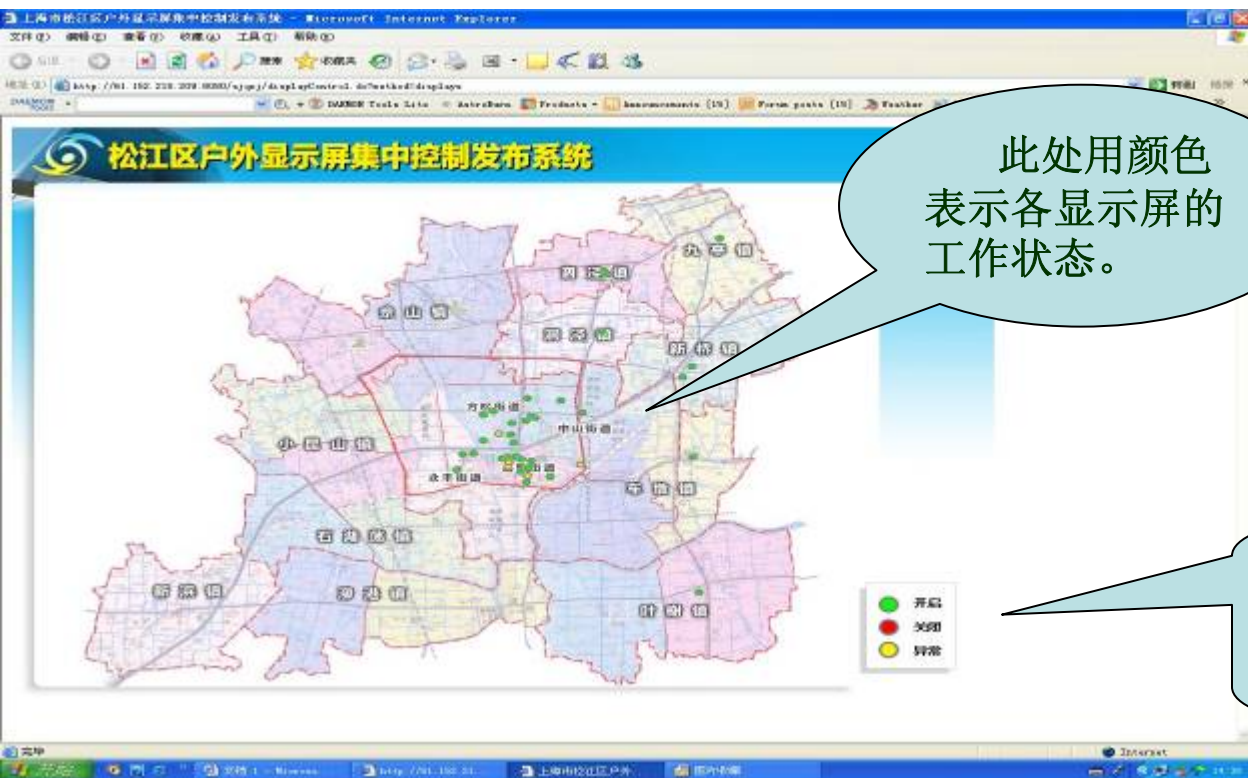
Thus *it is also sensitive to typhoon and heavy rain, as well as related hazards, such as urban inundation.*





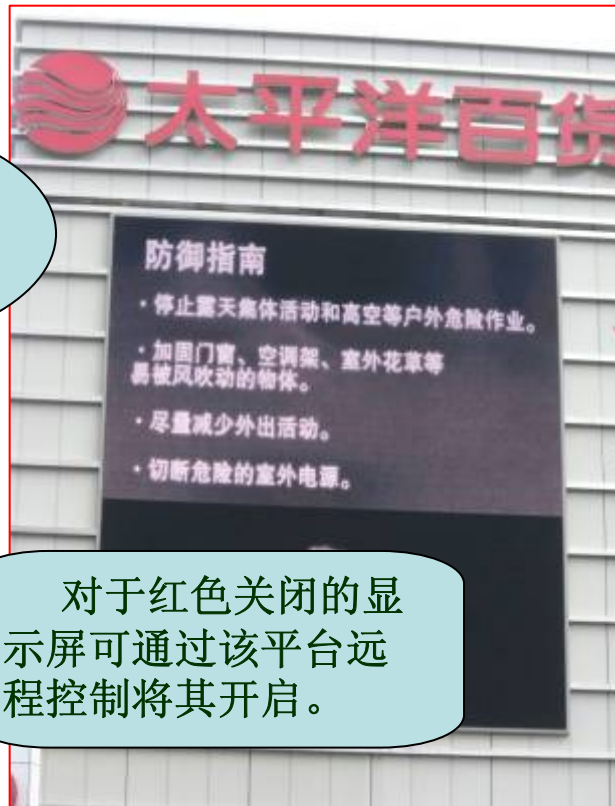
1. Outdoor Electronic Dissemination System

44 electronic displays have been set up in key areas of Songjiang, and there has been 9 large-scale ones located in center area of Xuhui District, disseminating weather warning, forecast, real-time weather information and action guidelines.



此处用颜色表示各显示屏的工作状态。

对于红色关闭的显示屏可通过该平台远程控制将其开启。





2. Grid Management Mechanism of MHEWS has been set up.

—Grid response management mechanism (Grid supervisor)

—Urban Grid Weather Disaster Messenger Mechanism
(127 in Songjiang, 182 in Xuhui)

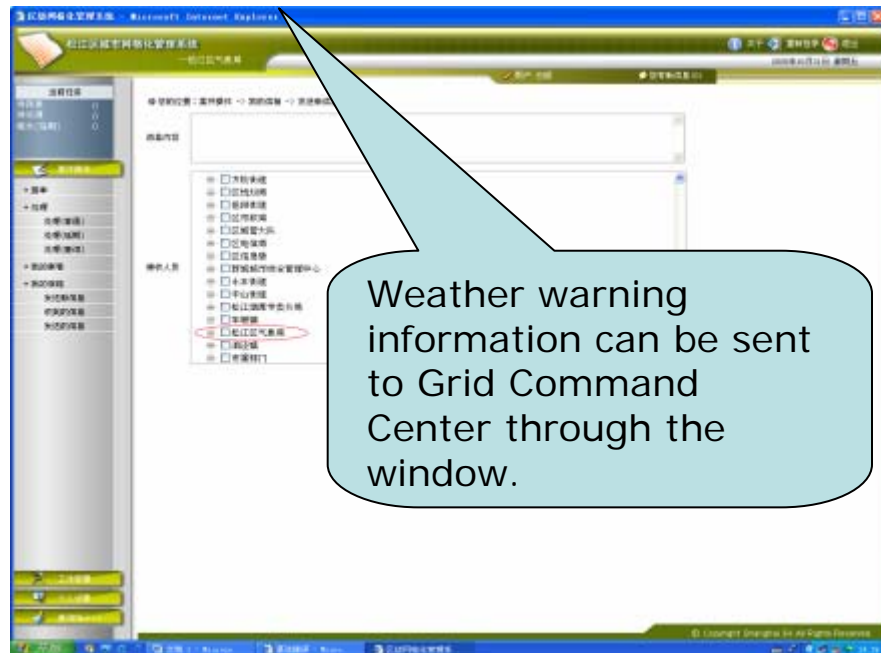
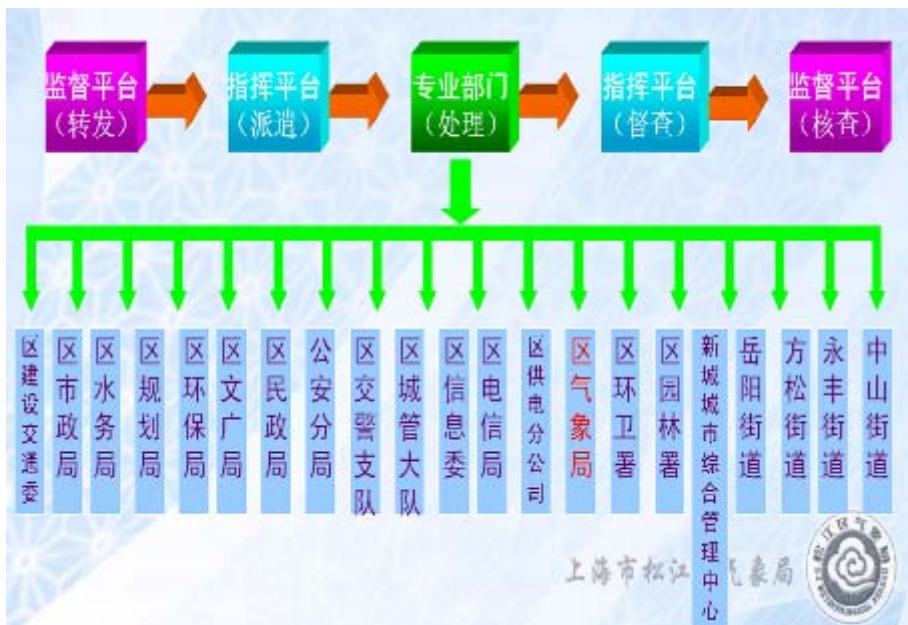
Grid supervisors act as urban weather messenger, responsible for inform disaster to SMB.

Grid supervisors are responsible for receiving weather warning information.

Grid supervisors are responsible for disseminating warning information and action guideline.

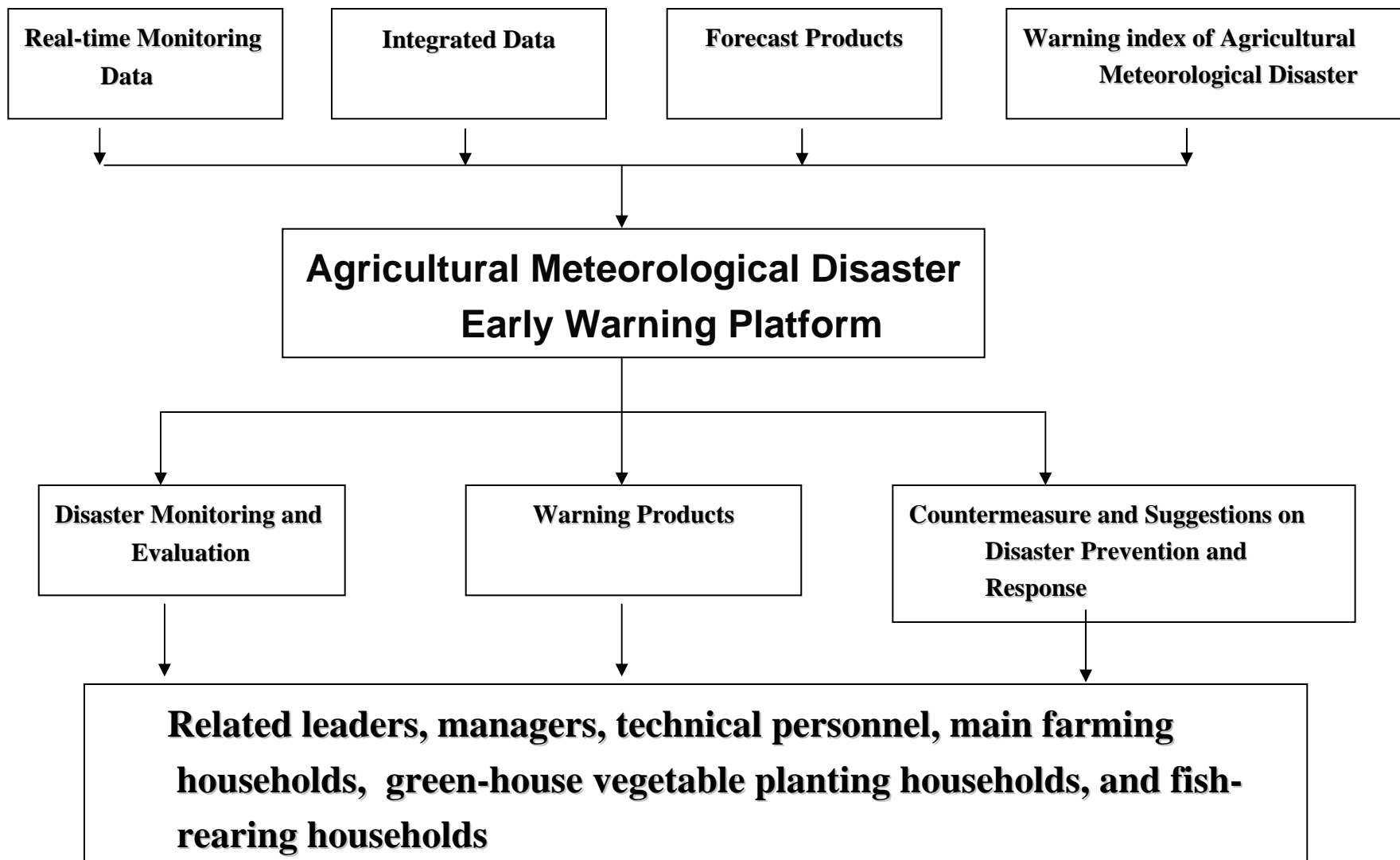
Grid supervisors participate in trainings on weather-related knowledge as basic technique and qualification.

MHEWS Information Sharing Platform has been developed in the mechanism.



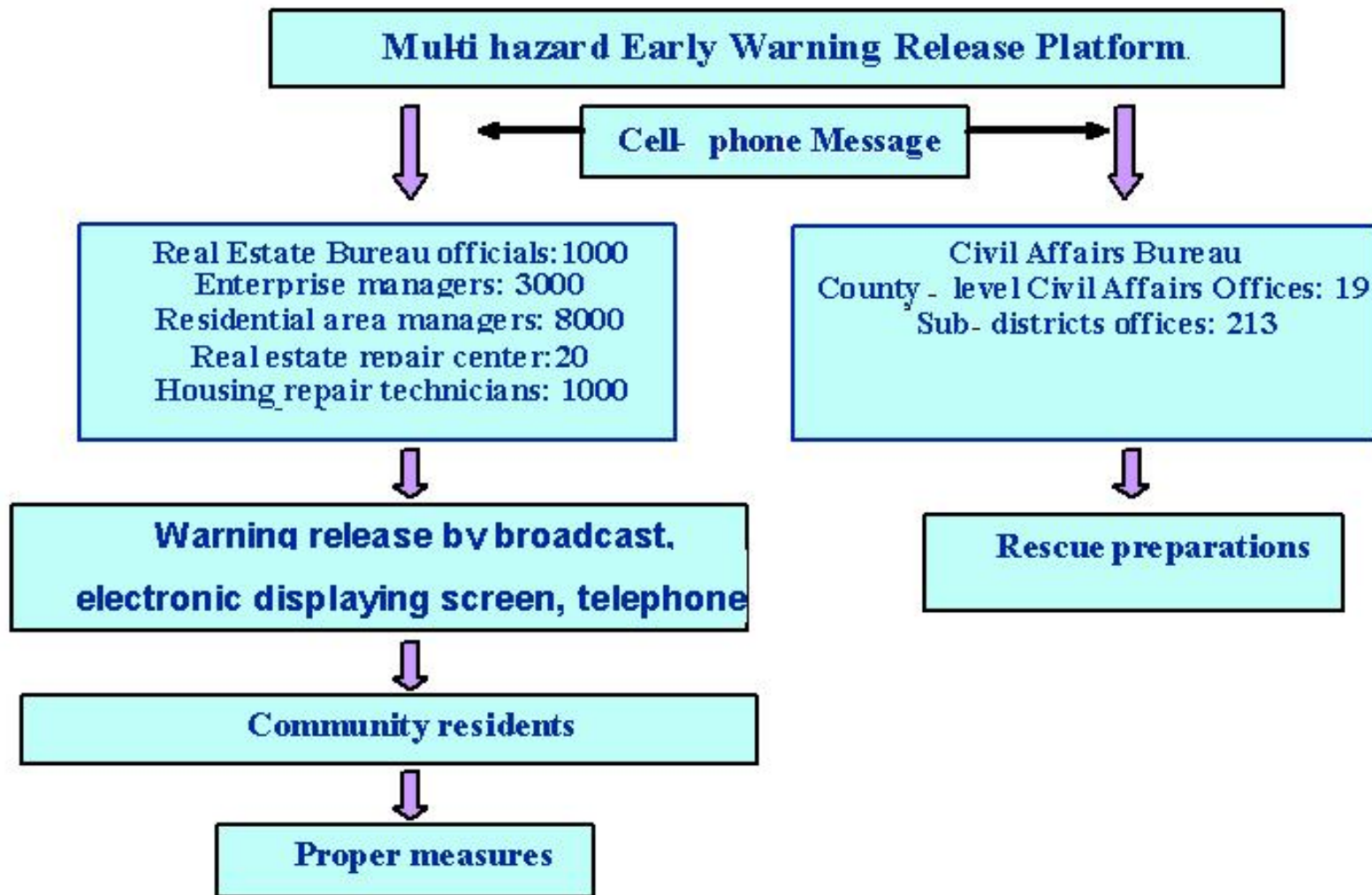


3. Early Warning dissemination platform for farmers' special use in Songjiang





3. Early Warning dissemination platform for residents' in communities in Xujiahui District





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Case 2: Snow Storm

From the end of Jan. to the early of Feb. 2008, Shanghai suffered from cold waves and snowstorms.





China hasn't experienced **weather like this in decades**. And as the country prepares for Chinese New Year, the disruption couldn't come at a worse time. Over 100,000 people are stranded in Guangzhou railway station in the south. It may climb to **as many as 600,000 as more people arrive to make their journeys home** for the Spring Festival.

Across China **around nineteen airports have shut** because of the weather. **Around half the provinces in the country have had to start rationing power**, according to the state media. **At least a dozen people died** over the weekend because of heavy rains and the snowfall.

The Spring Festival is China's most important holiday when people journey home to be with their families. For **millions of the country's migrant workers it's their only holiday**. Some two billion journeys were made during the festival last year, making it the largest migration of people on the planet. And even without the severe weather, **conditions on overcrowded trains and buses are terrible**. The holiday stretches China's transport system to its very limits.

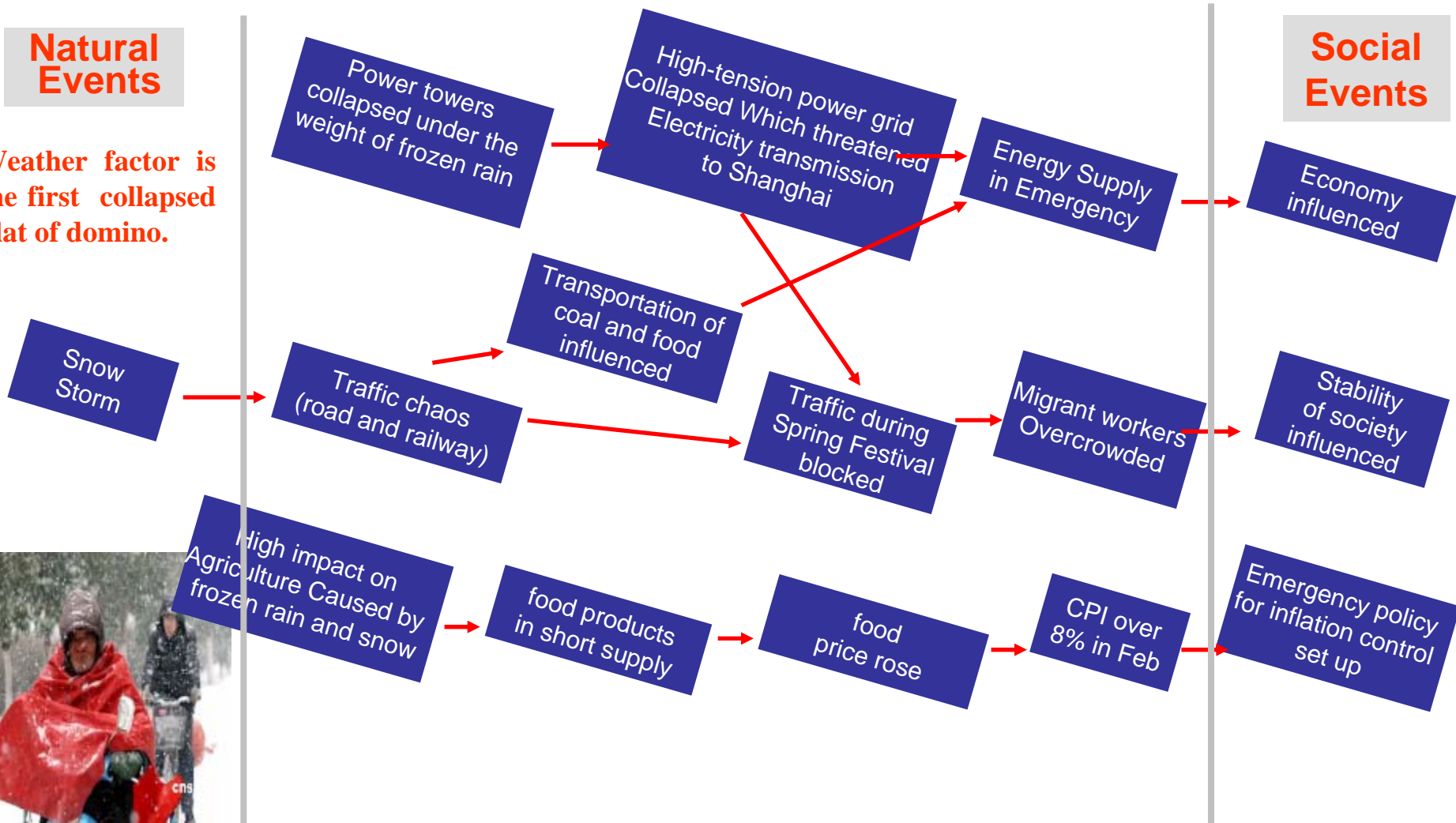
During the storms, **over 2,000 transmission towers [pylons] and a staggering 39,000 kilometers of power lines collapsed** under the weight of ice and snow. China's use of a high-tension power grid as opposed to more expensive underground cables, and its crushing dependence on coal – for 80 percent of its electrical power – left it **especially vulnerable to the storms**.

Hazard Domino Effect

Severe weather hazards may bring many other disasters, which further threaten city safety. Weather factor resembles the first piece of domino, and will impact other aspects of social activities.

Natural Events

Weather factor is the first collapsed plat of domino.





Case 2: Snow Storm

SMB issued **icing roads, cold wave, heavy fog warnings** during that period. The Emergency Response Management Office demanded that 300 government agencies should take the warnings issued by SMB as the **start-up of multi-agency actions on the risk response and prevention**. The Shanghai MHEWS concept sufficiently embodies in the multi-agency teamwork against the snow storm.

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Case 2: Snow Storm

The actions taken were as follows:

- **The Agricultural Department**---100 thousand farmers harvested their vegetables in advance.
- **The Government**---Issued snow removing notification and called on millions of citizens took the actions;
- **The Traffic Control Department** - took 'no road closed' decision to avoid traffic break after SMB issued road icing warnings.
- **The Public Health Department** - took the secondary level of emergency response action to require all hospitals ready for medical treatments to help people who was injured from frostbite and tumble.



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END

Thank you