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Introduction to the Shanghai Pudong New District Urban Flood Warning System

上海市浦东新区洪涝预警预报系统介绍

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1

Project background

项目背景

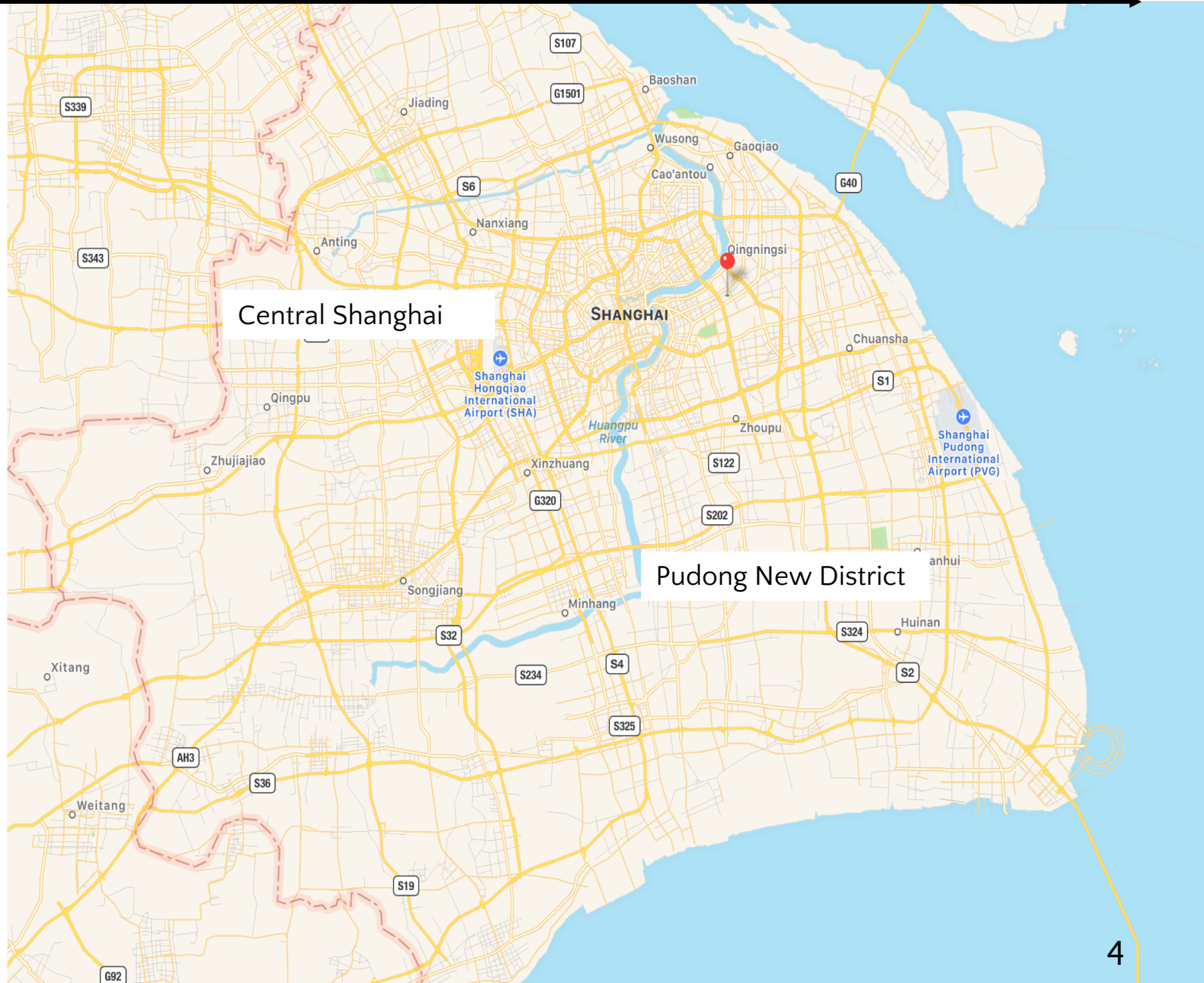


Project Site – Pudong New District of Shanghai 浦东新区

The metropolitan area to the east of Huang Pu River of Shanghai, with the following main features:

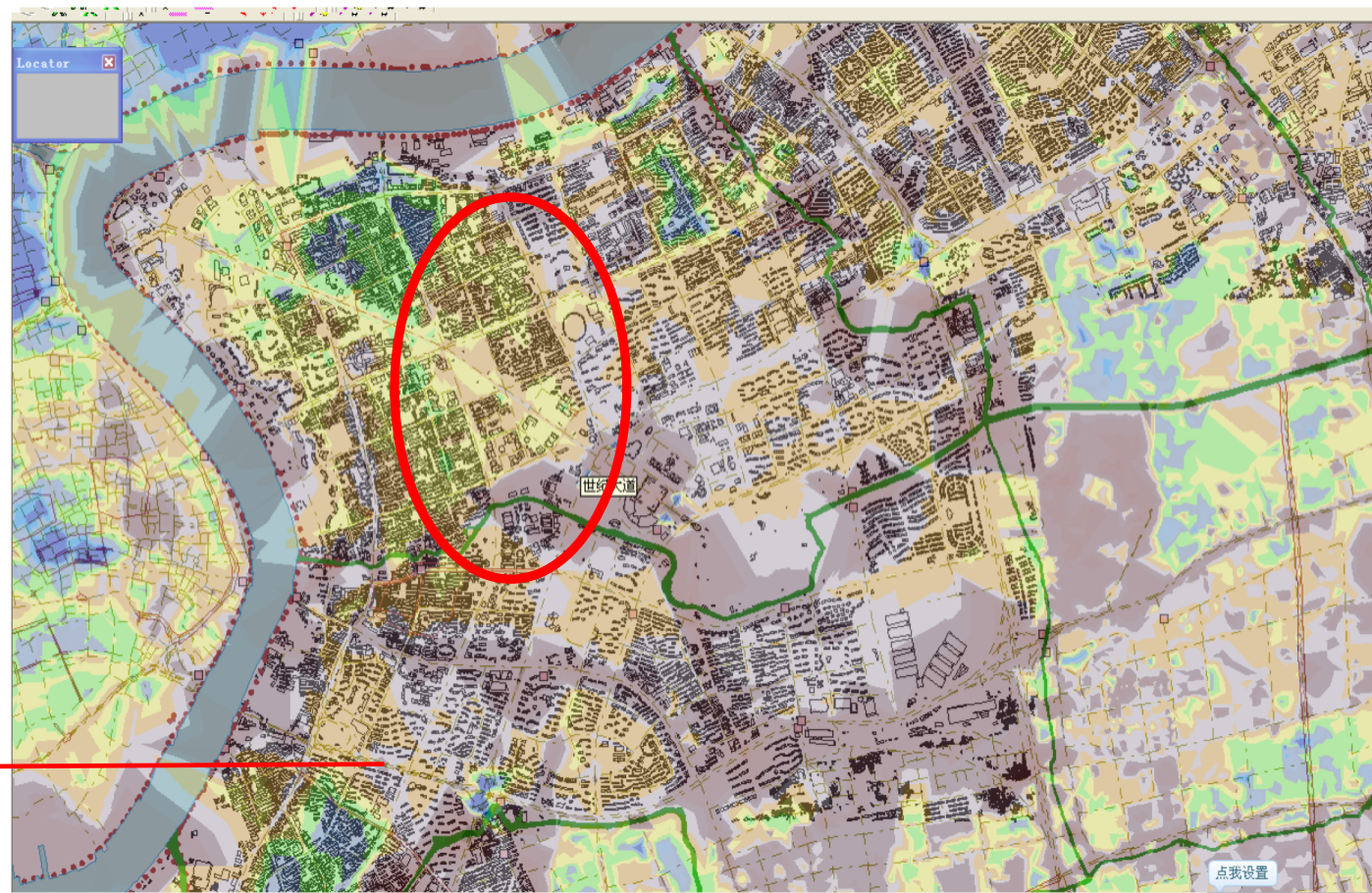
该都市圈位于黄浦江以东，河网密集，流域面积约1400平方公里。常住人口约600万人，地面高程仅仅3-4米，区内海岸线长46千米

- 1400km²
- 6m people
- Under rapid development
- Terrain (3.0~4.5m)
- Costal line 46km
- Dense of River network



Flat terrain, locked by the major Huangpu River and coastal line, leads to increasing threats in dealing with extreme weather conditions, storm surge, as well as climate change.

浦东地区为平原地带，由于紧沿黄浦江且濒临东海，导致在应对极端天气条件，风暴潮以及气候变化方面的威胁日益增加。



Rapid urbanization causing stormwater risks

城市的高速发展带来雨洪压力

- **Very Complicated drainage network servicing rapidly developing city.** 排水管网复杂，城市高速发展，城市水文、用地条件的改变和气候变化，带来较大的雨洪压力。
- **Challenges to be consistent with Smart City and Urban Security.** 城市的排水系统如何与城市形象协调，建立智慧排水城市，面临不少挑战。
- **Major infrastructures play important role in system operation optimization.** 泵、闸、河网的合理调度在排水系统中起着重要作用。

Infrastructures are aging and getting more complicated

系统逐渐老化复杂

- **Urban expansion, limited drainage pipeline construction space, high construction and maintenance cost, especially in central city, the improvement of drainage system capacity will depend more on operation and optimal scheduling.** 城市不断向周边扩展，排水管道的建设空间极其有限，建设养护成本很高，尤其在中心城区，排水系统能力的提升将更多依赖于运行与优化调度。

Time to maximize the value of assets by means of IT

信息系统价值发挥富有潜力

- **ICT essential to maximize the value of information, understanding the data owned** 充分挖掘信息价值，掌握系统状况信息
- **Capability to process and operate Big data analysis, to improve quality of decision making.** 应用标准化模型技术，改进调度决策系统
- **Intelligent drainage network model to analyze and predict system performance with real time data becomes essential.** 有必要建立适合本地特征的标准排水系统模型，利用实测数据评估和预测系统表现





2

Objectives and System Design

目标与设计



- Hot topics on Smart City/ Big data/Intelligent water Management in China.

智慧城市/大数据/智慧水务管理已成为中国热点话题

- Telemetry Systems are well developed, huge amount of data available.

发达的遥感监测系统, 海量监测数据

- The central CBD and a number towns were flooded twice in 2015, but struggled to use the data efficiently , and to help make good decisions.

2015年上海中心城区和一些城镇遭受两次洪水, 然后在有效利用数据和做出正确决策方面仍有困难

- Time to develop a good framework to integrate all available data and intelligent solutions.

构建良好框架, 整合海量数据和智能解决方案

- Improve the quality of technical outputs for decision making

提升决策支持技术质量

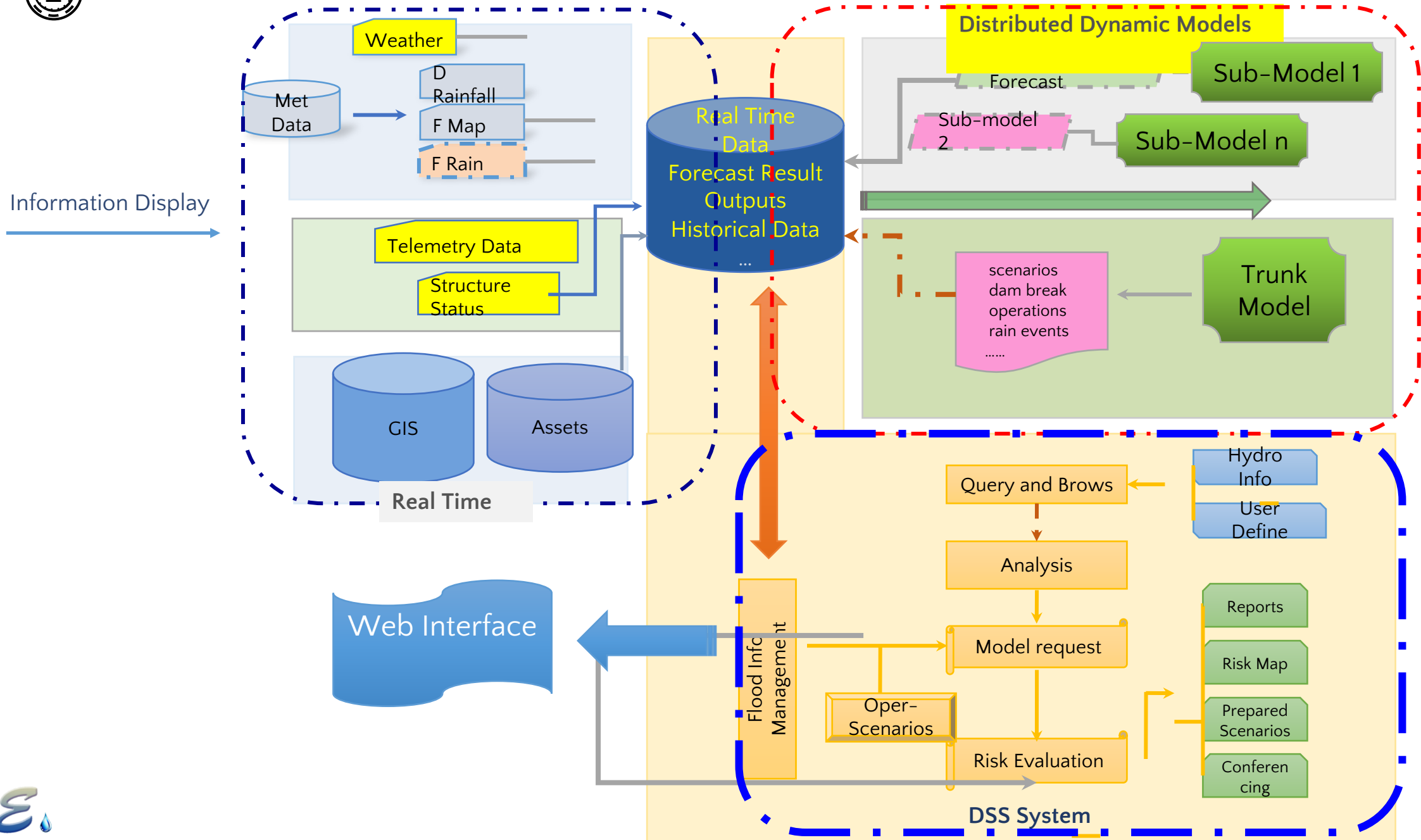
- **Develop applications with FEWS was considered the right choice**

正确解决方案：利用荷兰Delft- FEWS平台, 开发相关业务系统

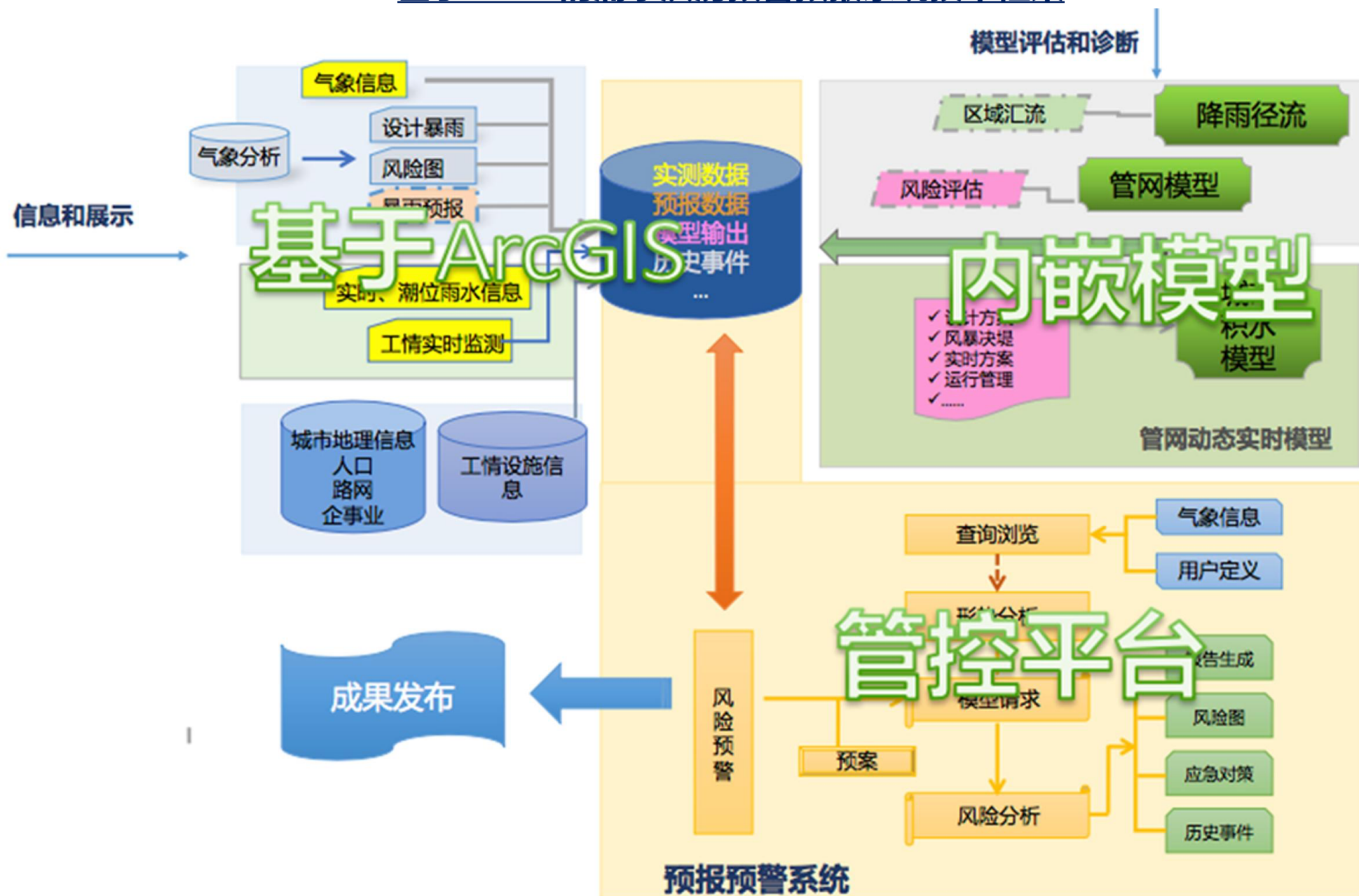


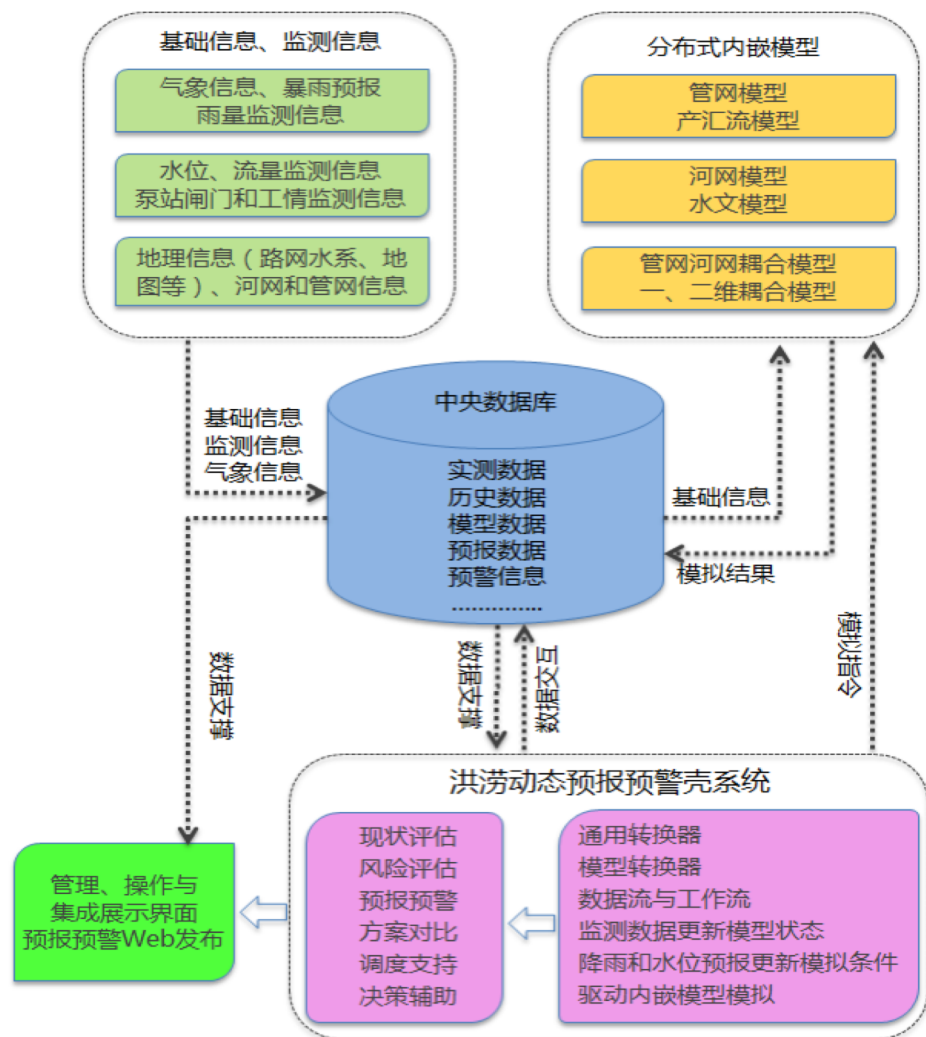
- Framework, functionality design 构建整体框架和系统功能
- Data Integration of meteorology, river& tide level, Pumps and gates
集成气象、河道水位、潮位以及泵闸站等监测数据
- Conversion and quality check 数据转化和质量检查
- Existing Mike model conversion to Sobek
MIKE模型到SOBEK模型的转化
- Urban SW 1D+2D model development 开发Urban 雨水一二维耦合模型
- Model calibration 模型校正
- Development, operational testing 开发、运行测试
- Installation and training and support 系统安装、人员培训、售后支持

Pudong Urban FEWS System Conceptual Framework



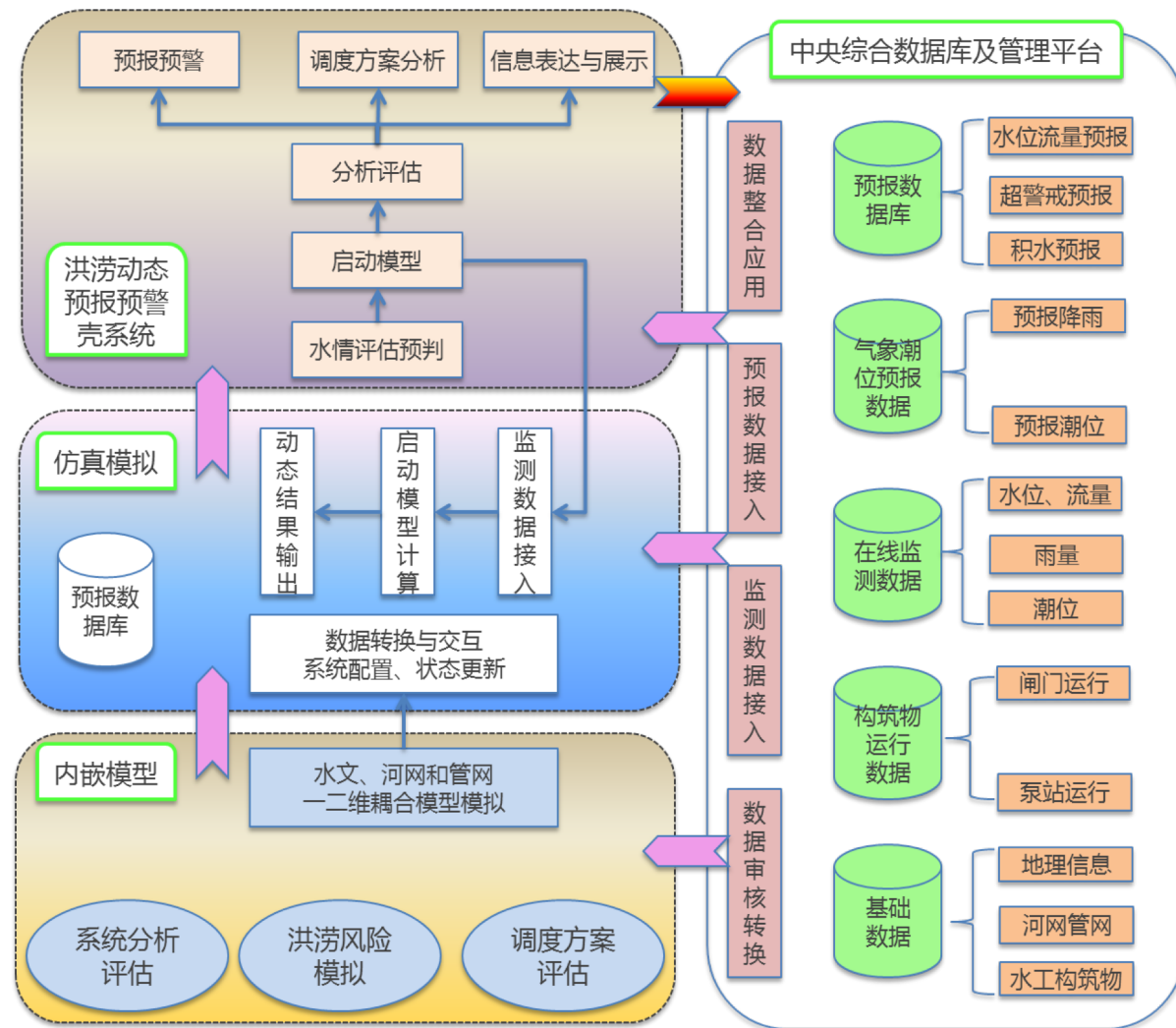
基于FEWS的浦东洪涝预警预报系统技术框架





Internal data flow design

系统内部数据流设计



Forecasting and early warning workflow design

系统预报预警 workflow 设计

Normal

正常模式

Information query, conditional query, statistics, reports 信息查询、组合查询、统计、报表

Real-time infographic presentation 实时信息图表展示

Dynamic presentation of contour lines 等值线动态展示

Facility status display 设施状态展示

Critical

警戒模式

Forecast of rainfall trend and development trend 降雨趋势和发展趋势预测

Forecast of storm surge trend and development trend 风暴潮趋势和发展趋势预测

Current trends vs plans 当前趋势与预案比较

Current trends vs historical events 当前趋势与历史事件比较

Possible extent, scope and risk assessment 可能发生的影响程度、范围和风险评估

Emergency

应急模式

Prepare and export data for storm forecasting and models 准备和输出暴雨预报和模型需要的资料

Prepare and export data for pump station, sluice and scheduling 准备和输出泵站、水闸等状态和调度预案资料

Start real-time simulation 启动实时模拟

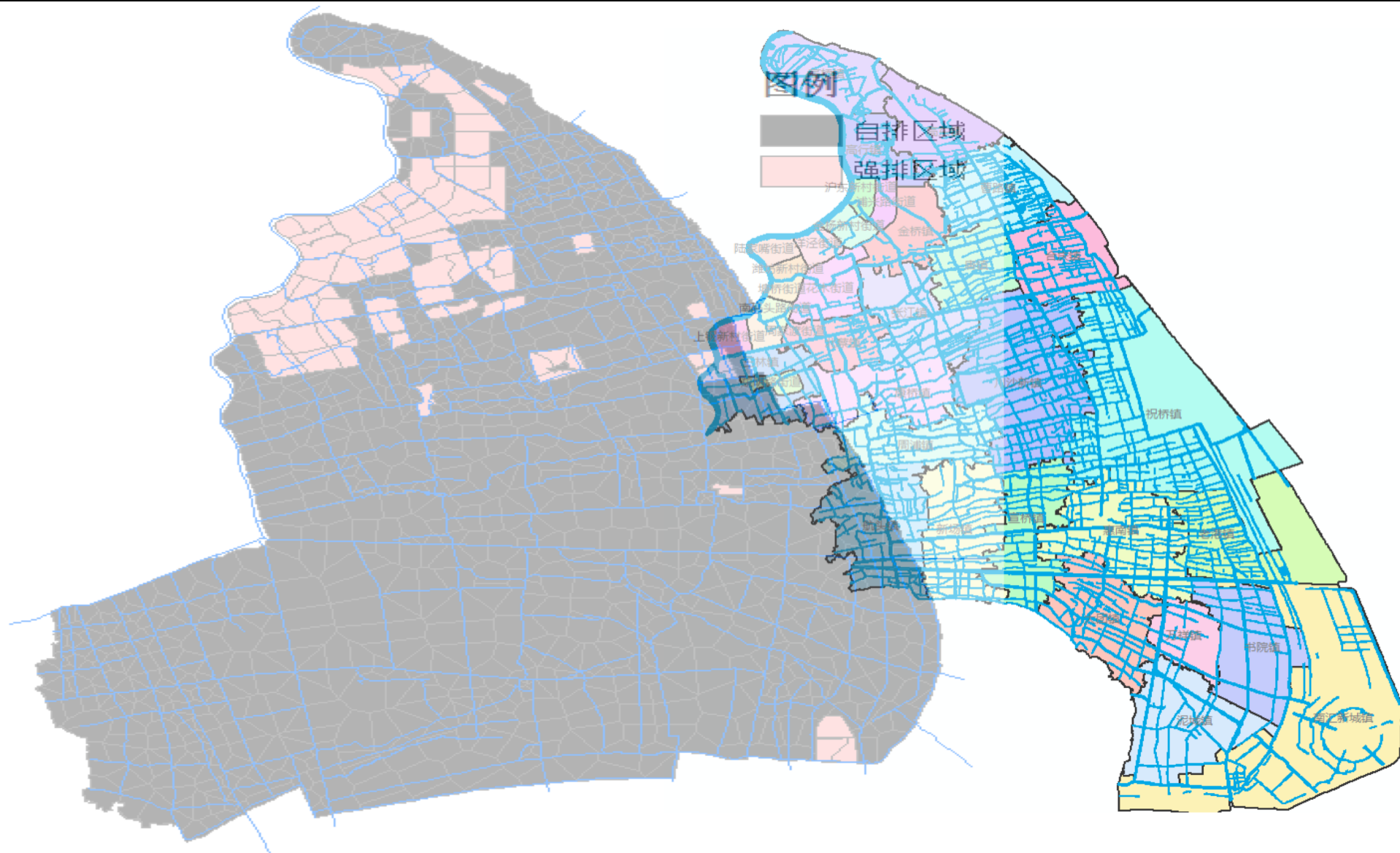
Read and process forecast results 读取和处理模型预报结果

Dynamic risk assessment and display; impact/flooding area 动态风险评估、展示；影响/淹没范围

Impacted facilities/Units and water depth 影响设施/单位和水深

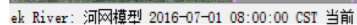
Demonstration point/water depth forecasting of point of interest/water level process and water depth 代表点/关注点预测积水/水位过程，积水深度





Integration of real time measured data 实时监测数据整合

- 120+ Rain gauges
120+雨量站
- 15 Wind stations
15个风力测站
- 18 tidal sites
18个潮位站
- 56 river level site
56个水位测站
- 14 flow sites
14个流量测站
- 300+sites of interests
300个关注点



- Whole Pudong plus fengxian and minhang together(2200km²)

涉及整个浦东水利片（包含浦东新区、奉贤区、闵行区浦江镇等），概化面积约2200km²

- 884 Rivers with 8173 cross sections

河道884条（段）

- 1673 catchments including 77 pumps drainage sub

个子流域，包括77个雨水强排系统

- 58 pumps and gates

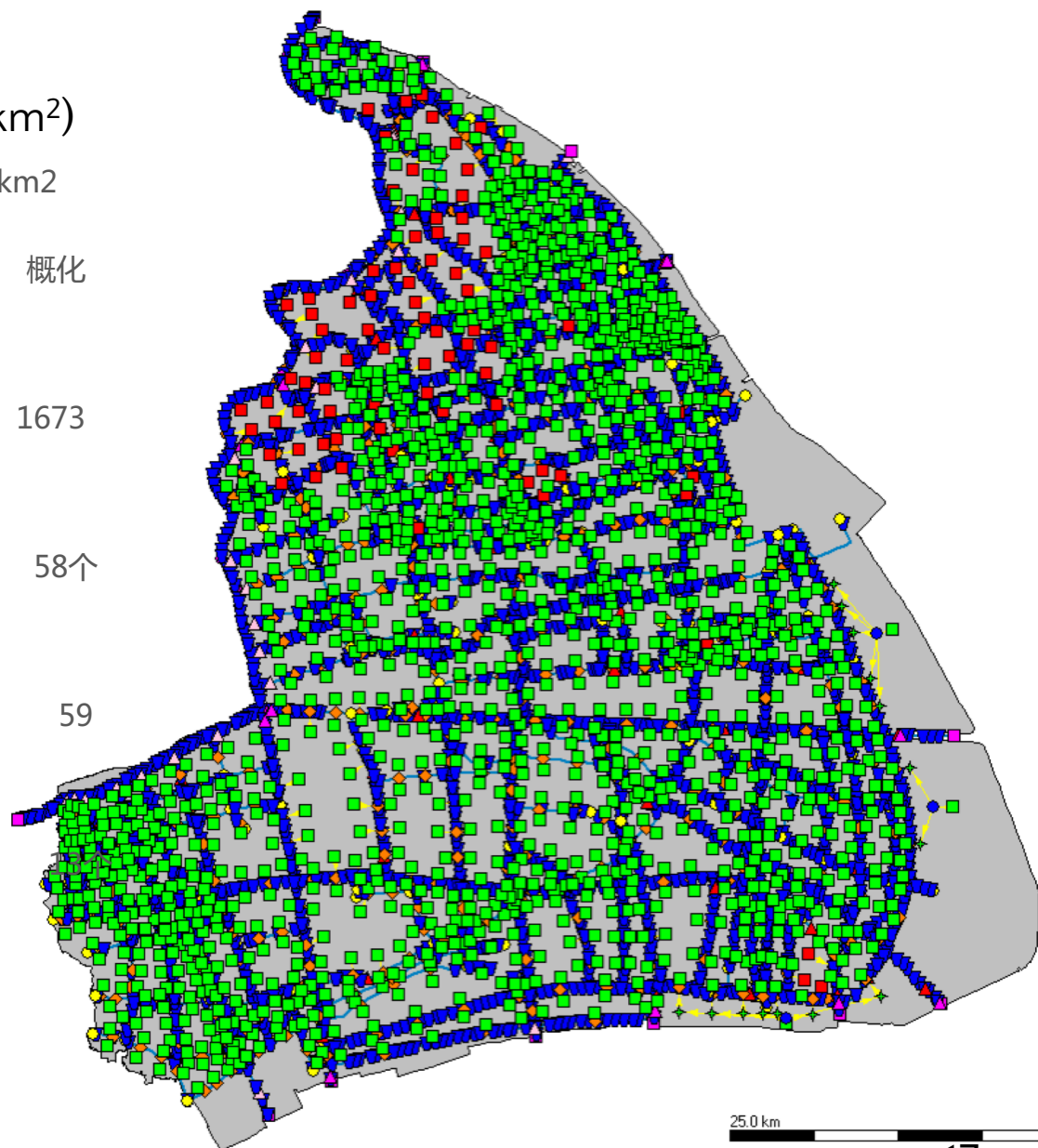
泵闸站

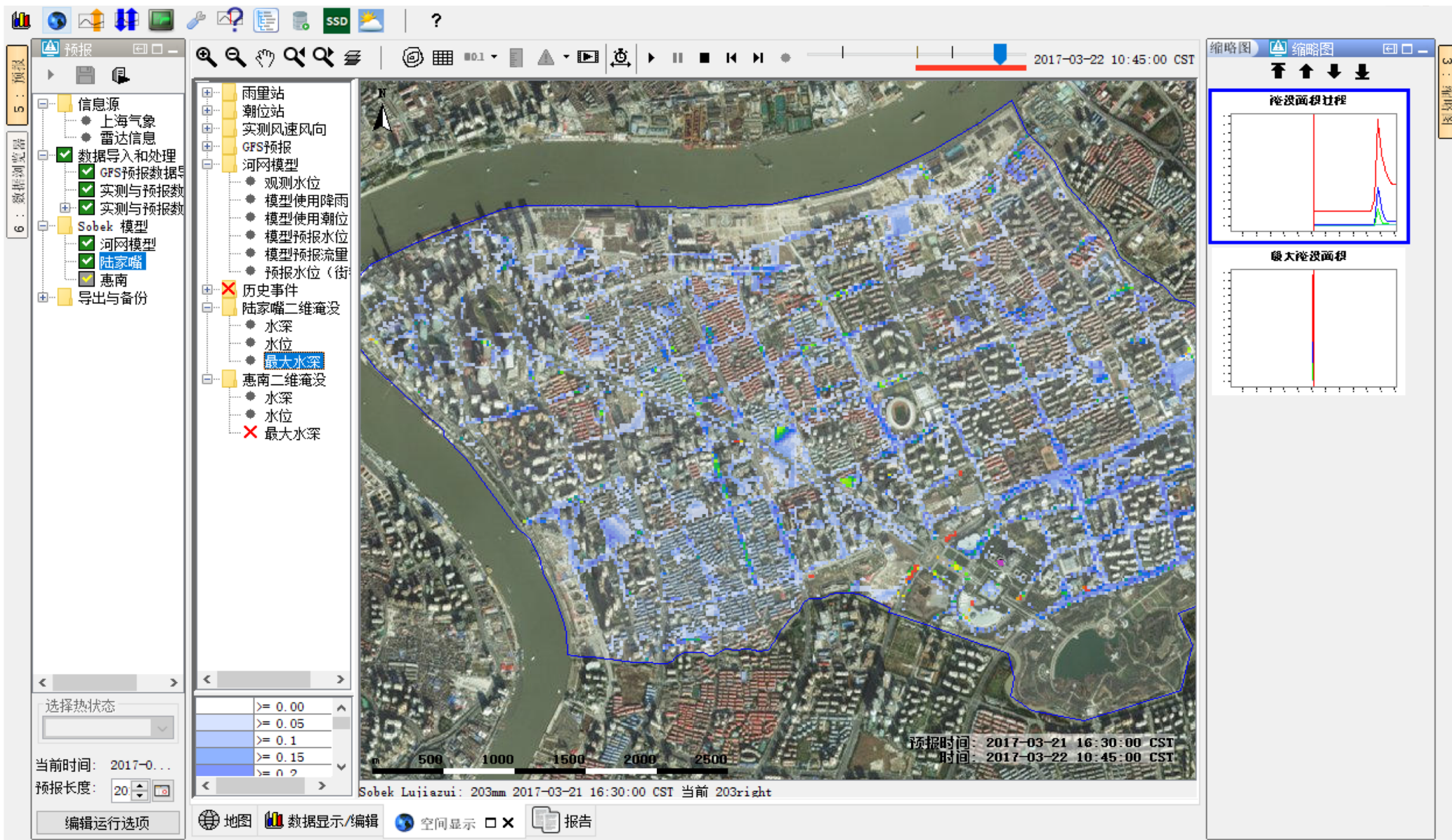
- 59 rainfall stations

个雨量站点

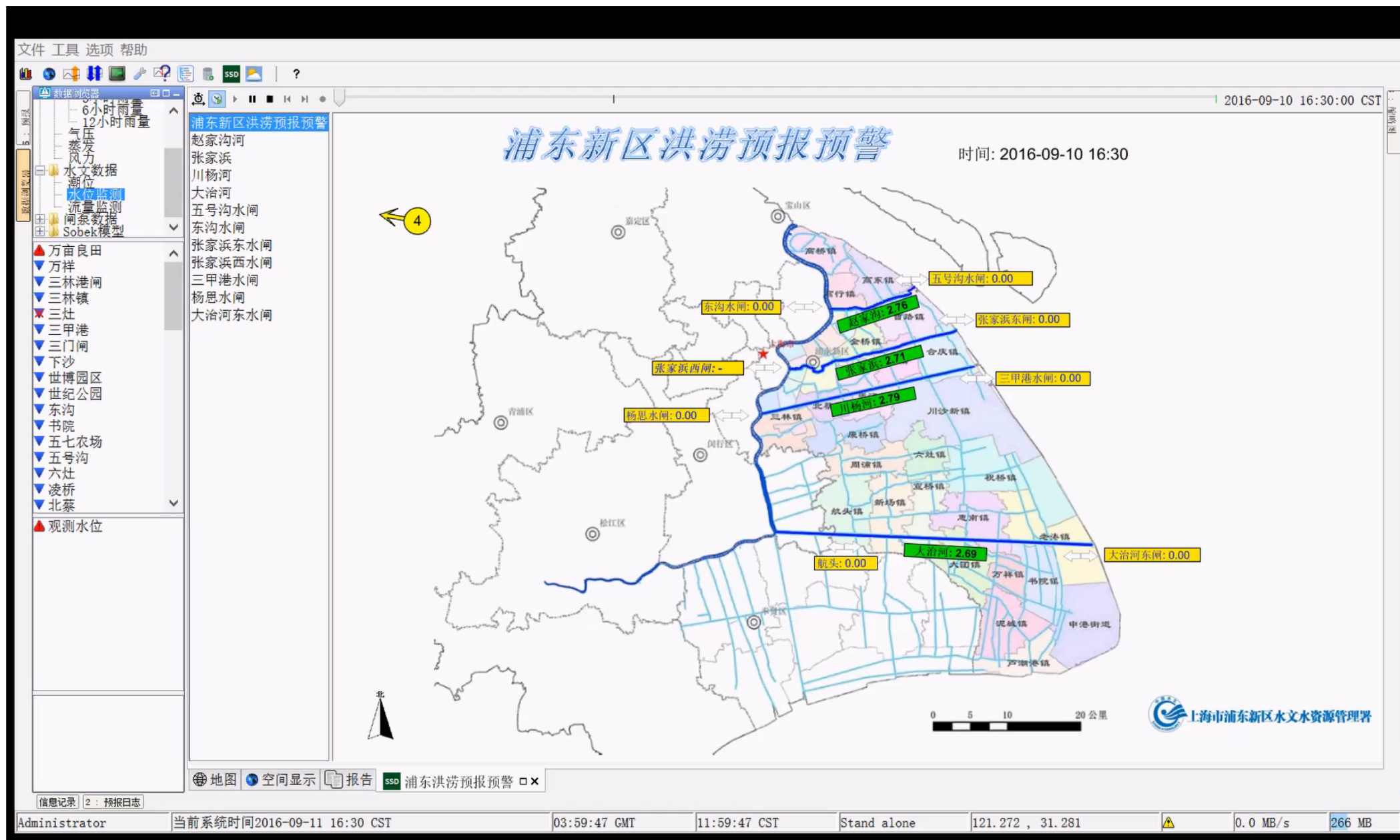
- 13 tide sites

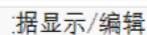
潮位站

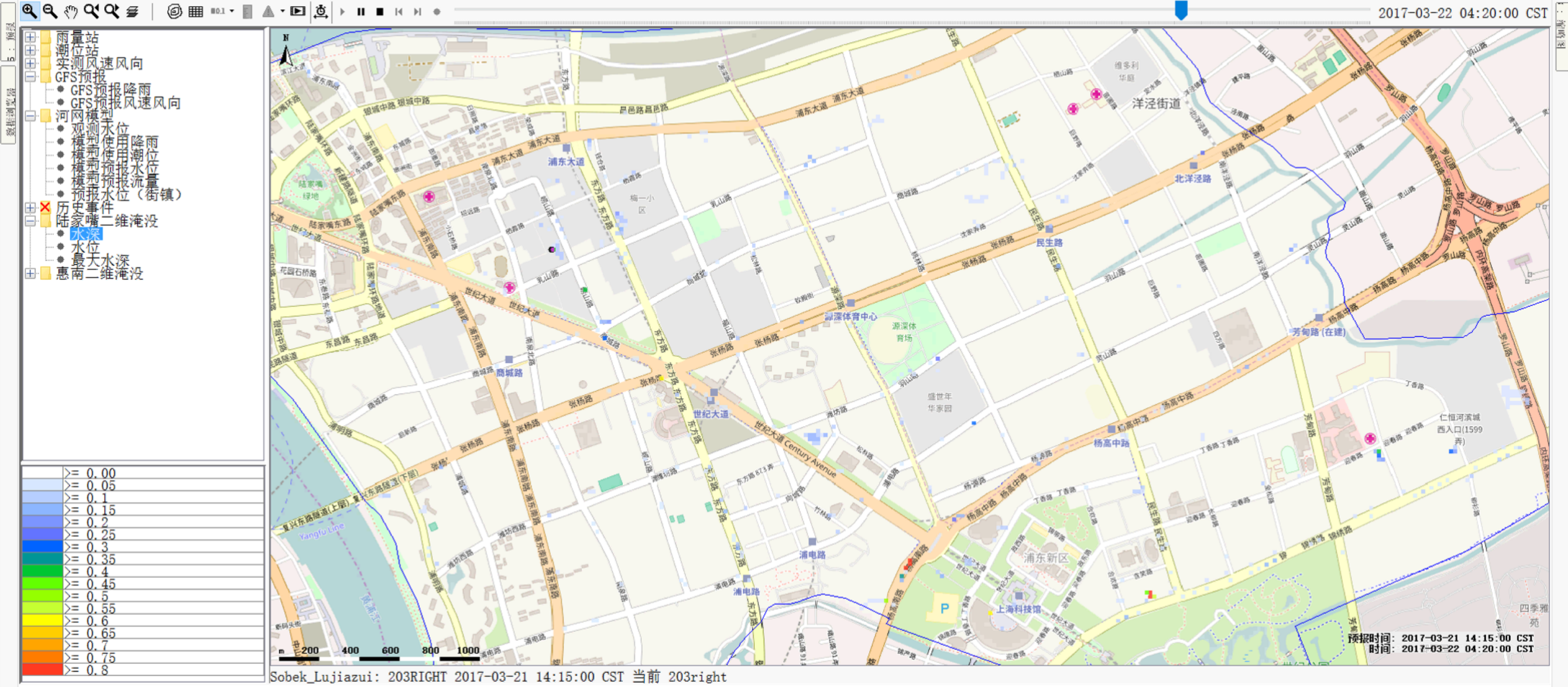












- Connection to Telemetry data through WISKI 通过WISKI连接遥测数据
- Connection with Met Services Forecast 连接气象预报系统
- 2200 km² river model 2200 km² 河网模型
- 2 Urban SW 1D&2D models 城市1&2维雨洪模型
- Various decision support tools produced by information integration technologies 利用信息集成技术建立决策支持工具



4

Future development

未来开发



- The system is regularly launched to train operational staff, collect model error samples for big data analysis 定期培训操作人员，收集模型错误样本进行大数据分析
- Model calibration has been continuously improved 不断改进模型校准
- Further analysis on system performance to produce knowledge for planning and operational decisions 进一步分析系统性能，为规划运行提供决策支持技术
- Improvements on Result presentation and functionalities on Information dissemination with mobile apps 通过移动app进行信息传播，改进成果展示和功能



THANK YOU

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