Membrane Technology
ISSN (online): 1873-4049

Research on the Regional Flood Disaster Prevention Path Based on the Multi-Source Flow Membrane Model

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Abstract:
It had occurred frequently to the flood disasters in recent years, and the scope of influence has been expanding, causing serious casualties and economic losses to the global climate change. It introduces the multi-source flow model in order to analyze the factors of the flood and the waterlogging prevention and control and the degree of synergy. According to the coupling relationship between the flood and the waterlogging prevention and the multi-source flow model, it is divided into the factors of the flood and waterlogging disaster to the water flow, the information flow, the facility flow, etc. According to the synergistic relationship of the influencing factors, it is constructed to the multi-source flow model of flood and waterlogging prevention and control. At the same time, it is established an evaluation index system of three categories, 10 categories and 21 categories of flood and waterlogging prevention and control synergy. Through the calculation of the degree of synergy, Clarify the problems in flood disaster prevention and control, and propose the path of "the water flow, the information flow, and the facility flow" for the flood disaster prevention and control. The proposed path of the regional flood disaster prevention and control based on the multi-source flow model can't only control the flood disaster from multiple aspects, but also ensure the synchronization of flood disaster prevention and control elements, and achieve the combination of disaster prevention social construction and flood prevention and control during disasters, It will provide new methods and technical support for the flood disaster prevention and control in China and the world, and ensure the sustainable development of cities and society.

Keywords: the multi-source flow model; the flood disaster; regional synergy; prevention and control path; membrane technologies.

INTRODUCTION

With the change of the global climate and environment, it occurs once in a century or even hundreds of years to the heavy rainfall, and it is frequent to the phenomenon of "looking at the sea" in cities. it has made many cities turn pale when talking about rain to "7.21 Zhengzhou Rainstorm". The original green space and rivers have been occupied, the hardened area has increased, the surface runoff and drainage zoning have changed, extensive urban construction has also led to incomplete construction of drainage pipe networks in many areas, low construction standards of drainage pipe networks, more dead end pipe networks and pipe network empty areas, and a large amount of rainwater can't be drained out of the city due to the large-scale urban development. They are built along the river to the most cities in China, but there is only one regional river, and the rivers are not systematic inside the city. it rises sharply to the river water level during heavy rainfall and causes difficulties in urban drainage and back irrigation, leading to floods too. In view of frequent urban floods, it proposed the best management method for floods [1] and the concept of low impact development to the United States [2], it proposed the method of sustainable urban drainage system according to its own situation to the United Kingdom [3], Australia also proposed the concept of water sensitive city [4]. However, these methods only study the urban drainage network, water storage space, etc., and lack the construction and control of sluice and other facilities, which can't fundamentally solve the drainage problem when the region has heavy rainfall at the same time. In order to solve the problem of urban drainage, China has proposed a sponge city low impact rainwater development system [5], giving full play to the advantages of rivers and lakes [6], restoring or rebuilding the catchment channel, and improving the flood discharge capacity of the river [7]. As the city is a complex system, all elements are closely related [8]. The occurrence of flood disaster is the result of multiple factors and is greatly affected by the region. The solution to a single problem in a single city can't fundamentally solve the urban flood problem. The multi-source flow theory regards the city as a part of the region, and uses complex networks to deal with problems. Domestic scholars, starting from the multi-source flow framework, apply it to public policy analysis, covering politics, economy, society, education, science, technology, culture, health and other fields. As flood disaster prevention and control is a part of urban society and politics, and has a certain impact on social development [9,10], Therefore, the multi-source flow model can also be used for flood disaster prevention and control. The formation of urban flood disaster is affected by water body, information, facilities and other factors, and its constituent elements are strongly coupled with the multi-source flow model. Therefore, the flood disaster prevention and control are carried out from the water body, information, facilities and other aspects to realize the construction of the self-organized system for urban flood control and drainage, which not only solves the problem of rainfall prediction, but also transforms and constructs the water storage and seepage space, drainage pipe network, etc. within the city, and proposes the construction of river sluice and other control facilities, At the same time, through the application of information technology, it is built to intelligently control the city and regional departments and facilities to a regional flood control platform, increase the urban rainwater infiltration and storage capacity, and achieve regional drainage in different periods, so as to achieve the combination of rainwater drainage and storage and reduce river flood peaks, so as to avoid urban flood disasters.

THE MULTI-SOURCE FLOW MODEL AND ITS COMPOSITION

It is the American political scientist put forward to the multi-source flow model by John W· Kingdon that he believed that the policies for solving most problems in modern society were not formulated by government organizations and plans, but they were completed by the public policy subsystem, which was a multivariate collection [11]. it believes that "problem solving is the result of the joint action of many factors, not one of them" to John W· Kingdon [12]. There are independent the problem flows, the policy flows and the political flows in the policy system. The three flows are usually parallel to each other [13]. When a problem occurs, it will cross converge under the impetus of possible accidental factors, open the policy window, and the problem can be solved, However, this possibility depends not only on the triggering of this specific event, but also on the development of the three major sources [14]. When problems arise, despite the intersection of the political flow (strong voice of public opinion) and the problem flow (clear problem), the policy flow (solution) continues to be parallel, unable to converge, and the policy window cannot be opened. The "policy advocates" need to seize the opportunity to "soften" the opponents of the problem proposal. If the "softening" is successful, the purpose of the convergence of the three streams is achieved, the policy window opens, and the problems enter the policy agenda, and begin to formulate policy plans, implement problem solving [15] (**Figure 1**).

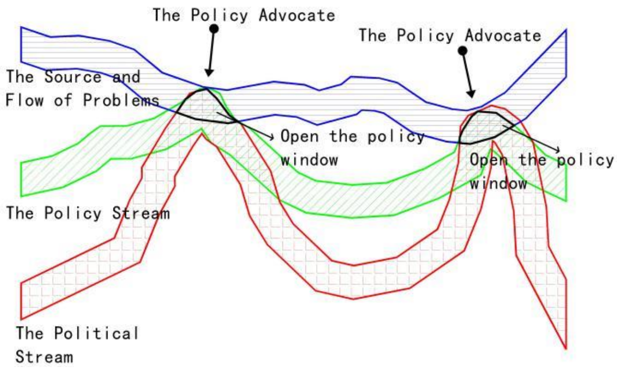

Figure 1. The multi-source flow model

It explains the comprehensive role of multiple elements in solving a problem to the "multi-source flow" model effectively, which is also the reason why many problems in China cannot be solved in a consistent way due to multiple elements, that is, the "policy window" period has not yet arrived, some or more elements have not reached the peak, there is no intersection between them, and various source flow elements cannot converge, leading to the lack of coordination and unity between elements.

THE COUPLING RELATIONSHIP BETWEEN MULTI-SOURCE FLOW AND FLOOD DISASTER PREVENTION AND CONTROL AND CONSTRUCTION OF COORDINATION MODEL

Coupling Relationship between Multi-source Flow Model and Flood Disaster Prevention

Coupling of multi-source flow model and flood disaster prevention

The formation of urban flood is affected by many factors due to the complex urban environment. Although different elements have different contributions to the formation of the flood, each element basically accounts for an average proportion. it is not only the infiltration of rainwater during heavy rainfall and the lack of storage space to the reason for urban flood, but also the insufficient drainage capacity of rainwater pipe network and the imperfect pipe network, resulting in a large number of ponding, which is also caused by heavy rainfall, Cities discharge a large amount of water to regional rivers at the same time, resulting in the sudden rise of regional river water level [16-18]. In addition to the large rainfall, insufficient rainwater infiltration and drainage capacity, the urban flood is closely related to water management, rainfall prediction and facility management. Since the IBM put forward the vision of the smart city construction in 2010, the Internet of Things, cloud computing, and the Internet have been widely used in urban construction and vigorously promoted, but it rarely used in flood disaster prevention. As it is closely related to the control of relevant facilities to the occurrence of flood, especially the lack of water flow control facilities at the river intersection, resulting in the sudden rise of rivers during heavy rainfall, causing the floods. The flood control should not only pay attention to water flow, but also pay attention to the application of information technology and the management of various facilities. Each element of flood prevention and control corresponds to the element of multi-source flow model. As the driver of disasters, heavy rainfall can only reasonably control the flow of water, and build management platforms and smart control facilities to use smart technology, solve the problem from the aspect of information flow, and build and improve facilities. Each facility is both an independent individual and a part of the system, which is like the political flow, Therefore, there is a strong coupling relationship between the flood control and the multi-source flow model (**Figure 2**).

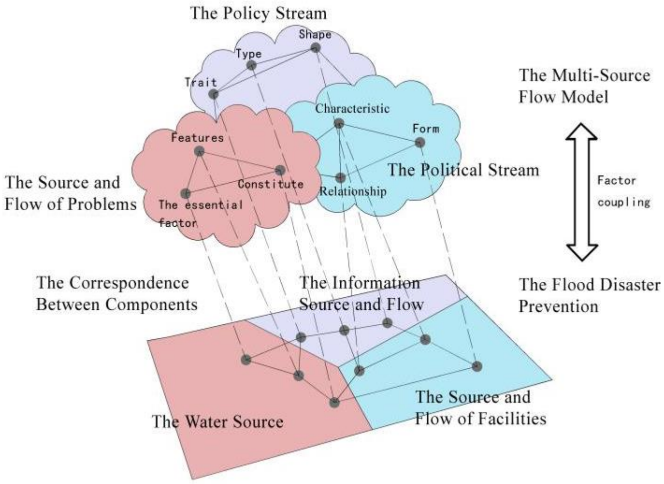

Figure 2. Coupling diagram of flood and daterlogging drevention elements and multivariate flow model

Correspondence between multi-source flow model elements and flood disaster prevention elements

(1) The problem flow and the water flow

As the main cause of the event, the problem flow is closely related to urban water space and drainage, and the water flow is the main problem of flood disaster. It is not only caused by heavy rainfall, but also caused by the rapid development of urbanization to the flood disaster, which leads to the expansion of construction land scale, the increase of hardened area, the occupation of ecological space, and the reduction of rainwater infiltration and storage capacity caused by river cover plates and landfills, all of which are obviously related to water bodies. The construction density is high, the construction of various facilities is early, the construction standard of rainwater pipe network is low, and there is a drainage gap in some areas in some areas of China, especially the old urban areas; In the newly developed areas, due to the large-scale expansion of cities, the urban drainage zoning has changed greatly. However, the extensive urban construction has made the construction of rainwater pipe network unable to keep up with the speed of urban development. In some built-up areas, there is no rainwater pipe network. The new rainwater pipe network is connected to the original drainage pipe network, and there are problems such as the wrong connection of rainwater pipe network, which makes it impossible to drain rainwater quickly, resulting in waterlogging. At the same time, due to the lack of comprehensive meteorological control and accurate prediction in the city, rainfall prediction is not accurate, enough water storage space is not reserved before heavy rainfall, and during heavy rainfall, all regions discharge a large amount of water to regional rivers at the same time, coupled with flood discharge from upstream reservoirs, resulting in a sudden rise of river water level, causing water backflow and drainage difficulties, and causing urban flooding.

(2) The policy flow and the information flow

As a policy community composed of policy participants, the policy flow makes suggestions, propositions and discussions on policies, and tries to make policy suggestions accepted by the policy community through various ways. As a policy source in the multi-source flow model, the information source flow has relatively similar characteristics in its nature, element composition and content performance, and plays an important role in flood disaster prevention, It has also become an important part of the multi-source flow model for flood disaster prevention [19]. As an important part of the current social development, information is also an integral part of smart city construction. The construction of the Internet of Things, the Internet and 5G network is also gradually changing the original lifestyle of residents and gradually being accepted by residents, especially the filling, scanning and online shopping of various kinds of information in the use of smart phones, which are also gradually accepted by residents, especially the online ticket buying of the railway system Popularization of mobile phone scanning during the normalization of epidemic situation. Due to the development of network technology and the rapidity and accuracy of information transmission, it is also required in the process of flood disaster prevention to the application of information technology, especially the transmission of information between different departments and between the government and the public, which requires the use of information technology to achieve disaster prevention, treatment and personnel transfer.

(3) The political flow and the facility flow

The political flow refers to the decisions and propositions put forward by policy related personnel. The occurrence of urban flood disaster is also due to the unreasonable number and location of flood control facilities and the need to achieve coordination between them. At the same time, there are many similarities between various facilities and relevant personnel in the policy source stream. The facilities are coordinated with each other only by ensuring, can they be consistent before, during and after heavy rainfall, the flood disaster can be controlled only by comprehensive control of river flow and regional drainage. It not only include sluice gates, drainage pump stations, meteorological monitoring facilities, flood forecasting and early warning facilities, sponge facilities and water monitoring facilities to the flood control facilities, but also must be combined with the actual situation, rainfall, drainage, river width, flow rate, etc. in flood disaster control to ensure that sufficient rainwater storage space is reserved before heavy rainfall occurs, Avoid flood caused by large amount of upstream drainage and downstream river jacking during heavy rainfall.

Construction of Multi-source Flow Model for Flood Disaster Prevention

Construction idea of multi-source flow model for flood disaster prevention

The flood disaster is caused by many factors in social development. The prevention and control of urban flood disaster also requires comprehensive control of many factors. The control of a single factor cannot meet the demand. The only way to achieve this is to control from the source and comprehensively analyze the urban precipitation, drainage, ponding, etc., so as to realize reasonable storage, infiltration and discharge of rainwater, and make the amount of water discharged into the river not exceed the river drainage and river water carrying capacity. In order to avoid the sudden rise of river water level and reverse irrigation, it is necessary not only to use intelligent means to monitor regional precipitation, drainage and ponding, but also to control the river and all drainage facilities, so as to achieve reasonable drainage in each region. Therefore, it is necessary to coordinate the water flow and information flow, so that each region can timely adjust the drainage method and drainage volume according to the ponding situation and precipitation situation, so as to avoid the sudden rise of downstream water level due to massive drainage in the upstream, This also requires collaboration between information flow and facility flow. The urban internal ponding and river drainage are mainly controlled by river sluice, drainage pump station and other facilities, which requires the mutual connection between facility flow and water flow for reasonable drainage control [20]. As a means of collaboration, water flow needs the support of information flow and facility flow. At the same time, information flow, as a link of collaboration, shows the effect of informatization through facility flow and water flow. As the basis of collaboration, facility flow is the most important content of water flow control, and also the support for the realization of information flow (**Figure 3**). As long as the three cooperate, flood disaster prevention and control can be achieved [21]. Because there is obvious synergy between the three streams, but in the process of urban development, there are large differences in urban construction level, management ability, facility construction level, information utilization degree and intelligent control of facilities. When the differences between them are large and cannot be balanced, flood disaster will occur. Therefore, it is necessary to study the synergy of various elements, analyze the synergy, and improve according to the differences of elements, Ensure the coordination among the three streams.

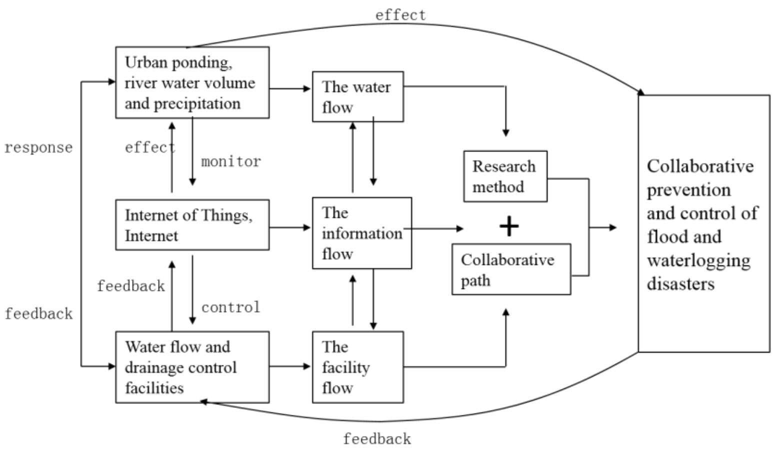

Figure 3. Multi-source flow model construction for flood disaster prevention

The multi source flow model for flood disaster prevention

Because it is affected to the formation of flood by many factors, and it is a process in which a little makes a lot to the formation of flood. When there is water in the water prone points, the water cannot be removed, leading to urban flood disasters. When there is a large amount of water in the city, unreasonable control of various facilities, poor information transmission, etc., regional flood may occur [22-23]. The flooding occurs not only in the local waterlogging at the micro level, but also in the urban level, as well as in the regional flooding at the macro level. Therefore, when building the multi-source flow coordination model for flood disaster prevention, we should take the system granularity as the starting point, and analyze from the micro, meso and macro levels to achieve flood control [24-25]. The construction of multi-source flow collaborative model needs to seek the relationship among water flow, information flow and facility flow, and act on different factors of flood formation. Flood and waterlogging are mostly caused by urban ponding. The appearance of ponding is not only affected by rainfall, but also by drainage facilities and information transmission speed. Rainwater drainage facilities have a strong control over the formation of ponding. At the same time, information transmission and intelligent systems have a strong control over sluice, drainage pump station and other facilities. Only reasonable facility control can ensure rapid drainage and infiltration of rainwater, the requires the collection and transmission of information on water conditions of each layer to ensure the reasonable control of facilities. Therefore, water flow determines whether flood can be formed and occurred. Facility flow has a strong control over water flow, and information flow also controls facility flow to ensure rapid drainage. There is a strong mutual feedback relationship between information flow and water flow [26-27]. It is released and fed back for information through ponding, flood and other situations, Realize comprehensive control of ponding to avoid flood (**Figure 4**).

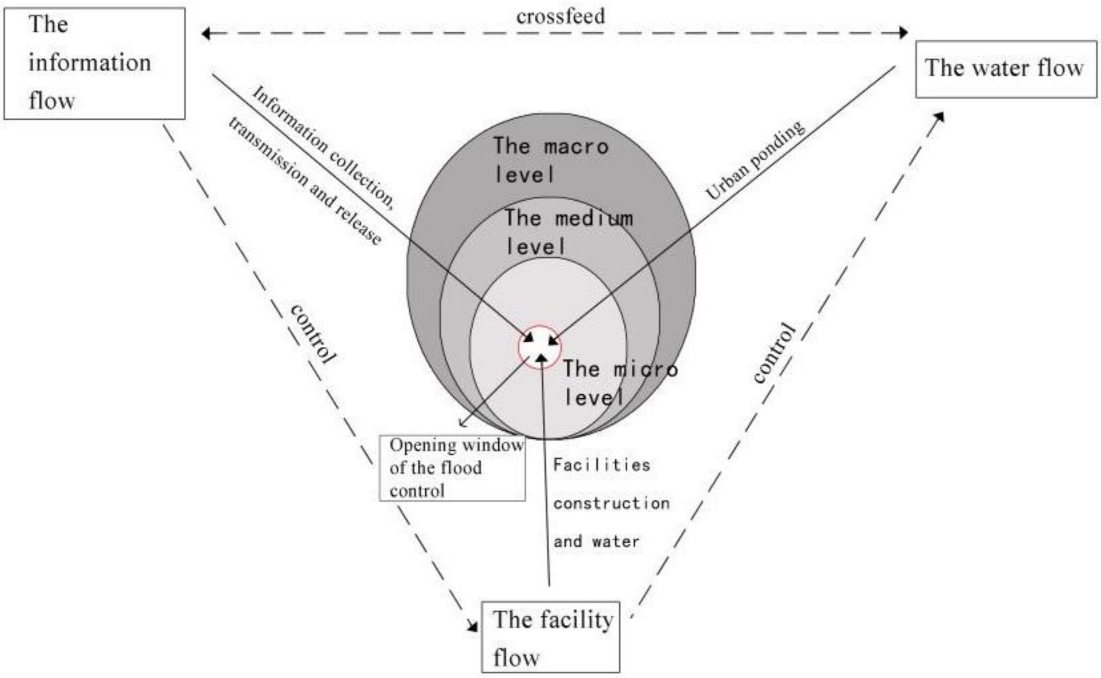

Figure 4. The multi-source flow model for flood disaster prevention

Collaborative research method of multi-source flow model

(1) Calculation method of multi-source flow synergy degree of flood disaster

In order to analyze the synergetic degree of multi-source flow elements in flood disaster prevention and control, a synergetic analysis model is built and a method for calculating the synergetic degree is proposed. During the construction of the synergetic model, the water flow, facility flow and information flow are taken as three axes, in which the water flow $\mu 1$ indicates that the information flow is represented by $\mu 2$ indicates that the facility flow is $\mu 3$ means that when the three elements intersect at the Q point, they will achieve synergy and flood disaster can be effectively prevented and controlled (**Figure 5**). For example, when it is located to *Q1* or *Q2* inside the interface, because a certain element is a short plate, there is no synergy between the three, and *Q1* or *Q2* is an arbitrary point in space, causing regional flooding [28].

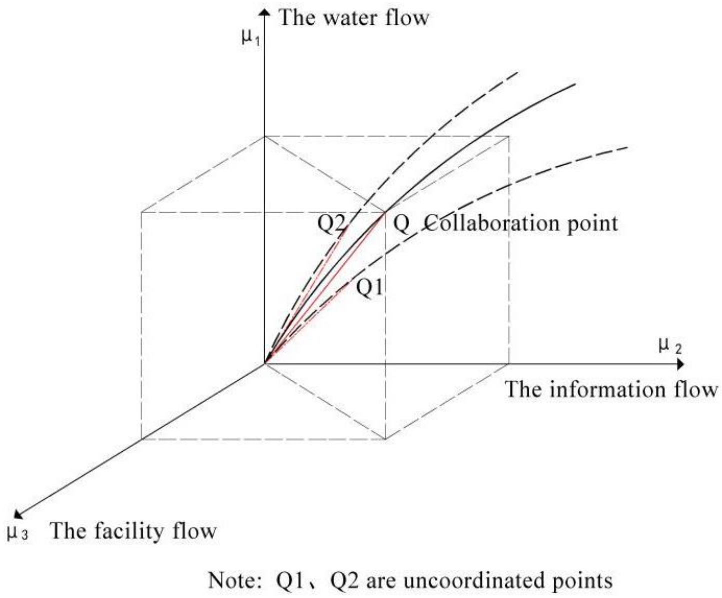

Figure 5. Analysis model of multi-source flow synergy for flood disaster prevention

The prevention and control of flood and waterlogging is greatly affected by the level of social and economic development and urban construction, and the degree of coordination between different periods and different cities is also quite different, which makes the methods and means of flood and waterlogging prevention and control quite different. The degree of coordination not only reflects the strength of connection between various elements, but also reflects the level of coordinated development. The degree of coordination among the three streams is between 0-1. When they are properly coordinated and mutually promoted for all the elements, the degree of coordination is high, which indicates that the more consistent the development of the three elements is, the more appropriate the coordination of all flows is, and the flood disaster prevention can be achieved.

When measuring the degree of synergy, the calculation formula is as follows:

$$Q=\sqrt{M*N} \tag{1}$$

$$M=\{\mu_{1i}*\mu_{2i}*\mu_{3i}/[(\mu_{1i}+\mu_{2i}+\mu_{3i})/3]^3\}^{1/3} \tag{2}$$

$$N=\alpha\mu_{1i}+\beta\mu_{2i}+\delta\mu_{3i} \tag{3}$$

Q: the degree of collaboration; *M* means $\mu 1i$, $\mu 2i$, $\mu 3i$, $\mu 1i$ represents the water flow, $\mu 2i$ represents the information flow, $\mu 3i$ represents the information flow of the i period area; *N* represents the comprehensive coordination index among the three; α, β, δ refers to the importance, that is, the weight. The value is generally *1/3*, depending on the social development.

(2) Comprehensive index system of the multi-source flow synergy degree of flood disaster

The flood control receiving water flow $\mu 1$. Information flow $\mu 2$ and Facility Flow $\mu 3$ Comprehensive impact. Water flow is determined by urban construction, ponding and water body conditions; The information flow is determined by the construction of smart cities, the construction of integrated service facility platforms, and the intelligent construction of facilities; Facility flow is determined by the construction of river sluice, rainwater pump station, river monitoring facilities and sponge facilities. In order to calculate the comprehensive score M of multi-source flow synergy, 10 middle class and 21 sub class indicators (**Table 1**) that have a great impact on flood disaster prevention and control are selected with reference to relevant literature to build a comprehensive indicator system of multi-source flow synergy for flood disaster prevention and control.

Table 1. Comprehensive indicator system of multi-source flow synergy degree for flood disaster prevention

Level I	Level II	Level III
The water flow	The urban construction	Urban hardening coverage
		Urban green space ratio
		Urban internal water body and wetland area
		Coverage of rainwater pipe network
		Rainwater drainage standard
	Water accumulation	Ponding depth
		Area of water prone area
		Number of ponding points
	Water body	Water capacity of river
		Number of rivers
		River drainage
The information flow	The Smart City Construction	Ranking of smart city construction in the province
	Construction of comprehensive service platform	Proportion of government service facilities included in departments
	Intelligent utilization of facilities	Proportion of smart facilities
The facility flow	Construction of river sluice	Number of sluice construction
	Construction of rainwater pump station	Number of rainwater pump stations
		Service area of rainwater pump station
	Construction of river monitoring facilities	River water volume monitoring facilities
		River water flow monitoring facilities
	Construction of sponge facilities	Construction scale of sponge facilities
		Storage area of sponge facilities

FLOOD AND WATERLOGGING DISASTER PREVENTION PATH BASED ON MULTI-SOURCE FLOW MODEL ELEMENTS

The Water Flow: Coordinated Management of Regional Water System to Improve Water Infiltration and Energy Storage

As a means of coordinated prevention and control of flood and waterlogging disasters, water flow can only reduce the occurrence of flood and waterlogging disasters by controlling water flow. Therefore, coordination is required from the macro, meso and micro levels (**Figure 6**). At the macro level, we will increase green space, wetlands and other ecological spaces, transform regional rivers, build perfect water storage and drainage spaces, reduce rainwater runoff, clean up regional rivers, strengthen regional river connections, and form a perfect regional drainage system. They will be built to wetland, green land and other ecological flood storage and detention areas on both sides of regional rivers. They will be built to vegetation buffer zones and ecological revetments on the shoreline of rivers and lakes and the surrounding space to improve the water carrying capacity of rivers, restore the infiltration function, and realize the joint commissioning, joint control and integrated control of regional rivers. Build water storage space such as ecological wetland in the upper reaches of the city, and increase drainage channels around the city to avoid the impact of a single regional river on other cities in the basin. At the urban level, divide different drainage circles, control the drainage around the city, prevent the rainwater in the peripheral areas from outside the drainage circle, ensure the safety in the drainage circle during heavy rainfall and prevent the peripheral rainwater from entering the drainage circle. For it easy to accumulate water the areas in the drainage circle, a deep tunnel drainage pipe network shall be built to directly drain rainwater into the regional rivers through pipes. In order to reasonably control urban drainage, rainwater drainage is divided according to terrain, urban construction, surrounding rivers and internal water system facilities, and drainage pipe network is improved to avoid long-distance and large-scale drainage to achieve "high water drainage, high water drainage, low water drainage". In order to increase the urban rainwater infiltration capacity, green space, squares and roads shall be reconstructed to reduce the hardened area and raised green space, and sponge facilities connected at the "community level, neighborhood level and city level" shall be built to increase rainwater infiltration capacity and reduce rainwater discharge (**Figure 7**).

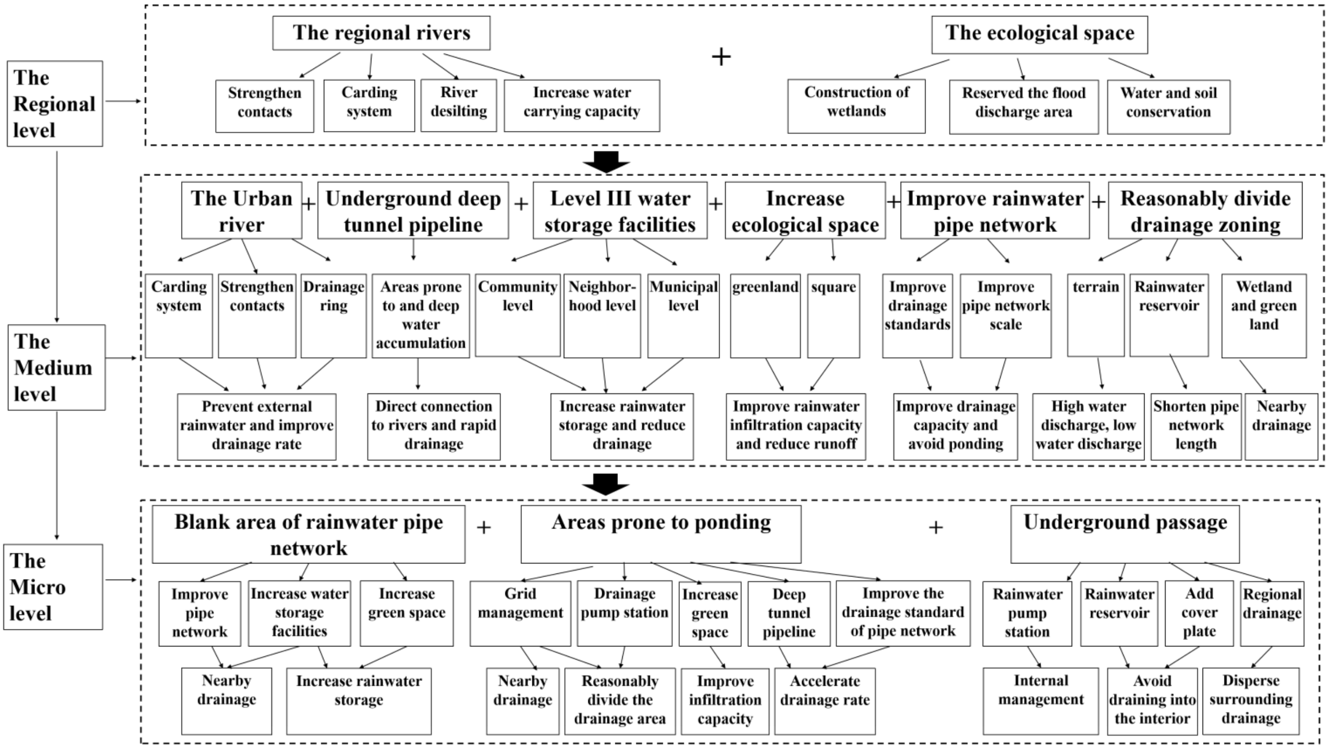

Figure 6. Three level collaborative road of water flow

At the micro level, in combination with sponge city construction and old city reconstruction, underground rainwater reservoirs and drainage pump stations will be built after building demolition or in combination with green spaces, squares, school playgrounds, etc. to drain the surrounding rainwater into the reservoirs for decentralized and short distance drainage. They shall be reconstructed to the underground passage by adding a water baffle or an underground reservoir at its entrance. The rainwater shall flow into the underground reservoir through a grid gutter inlet. The rainwater near the underground passage shall be intercepted and drained to prevent the surrounding rainwater from entering the underground passage. In order to control the rainwater entering the underpass, the upper part of the underpass is closed, and the current open drainage mode is changed, so that rainwater can be diverted to both sides to avoid rainwater entering the underpass. In order to ensure the safety of the underpass, a drainage pump station is built in the underpass. When water accumulates, it is timely drained (**Figure 8**).

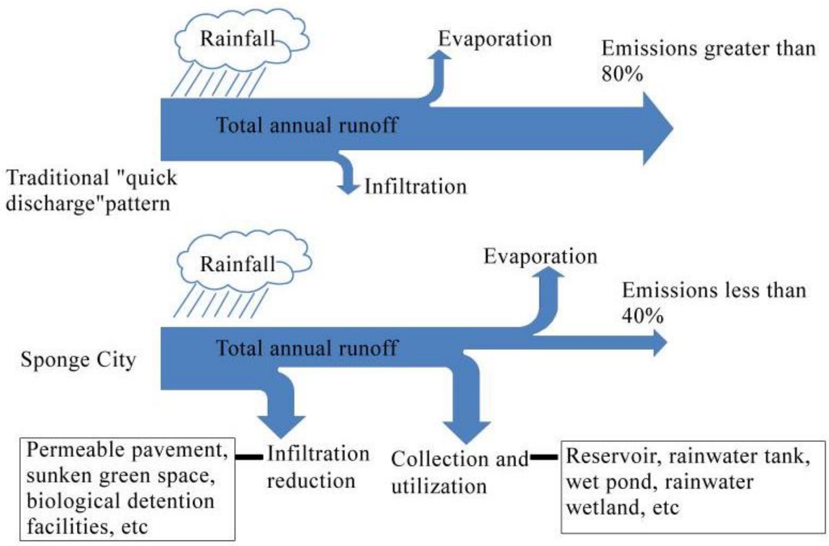

Figure 7. Comparison of urban rainwater before and after sponge facilities construction

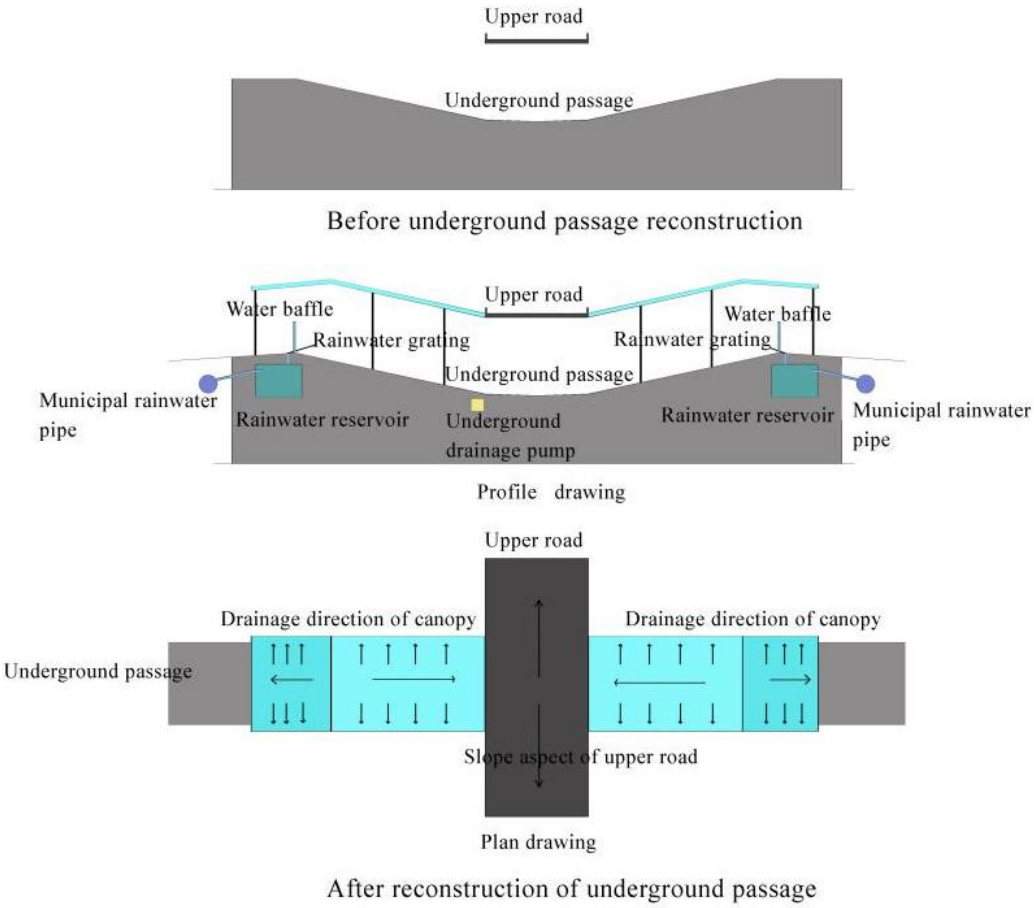

Figure 8. Underground passage reconstruction method

The Information Flow: Regional Information Sharing Platform Construction, Multi Department and Regional Integrated Management

As the link of flood disaster prevention, information flow is not only related to rainwater storage and drainage, but also related to regional drainage. As long as the use of information technology is strengthened, flood disaster prevention can be achieved. Therefore, we should take advantage of the opportunity of smart city construction to monitor rainfall and rainfall conditions and give early warning in advance. At the same time, we should speed up the control of relevant facilities and information transmission for flood, and build a comprehensive control platform, Flood and waterlogging related departments shall be taken as a whole for the integrated management. As the flood disaster is closely related not only to the management and information transmission of relevant departments, but also to the control and management of relevant facilities, in order to ensure the rapid and safe transmission of information on flood disaster prevention and control and facility control, a comprehensive flood control platform is built to manage the municipal, water conservancy, transportation, civil affairs, urban construction and other relevant departments, as well as the sluice, river monitoring, rainwater inlet, rainwater pipe network and other facilities on the same platform.

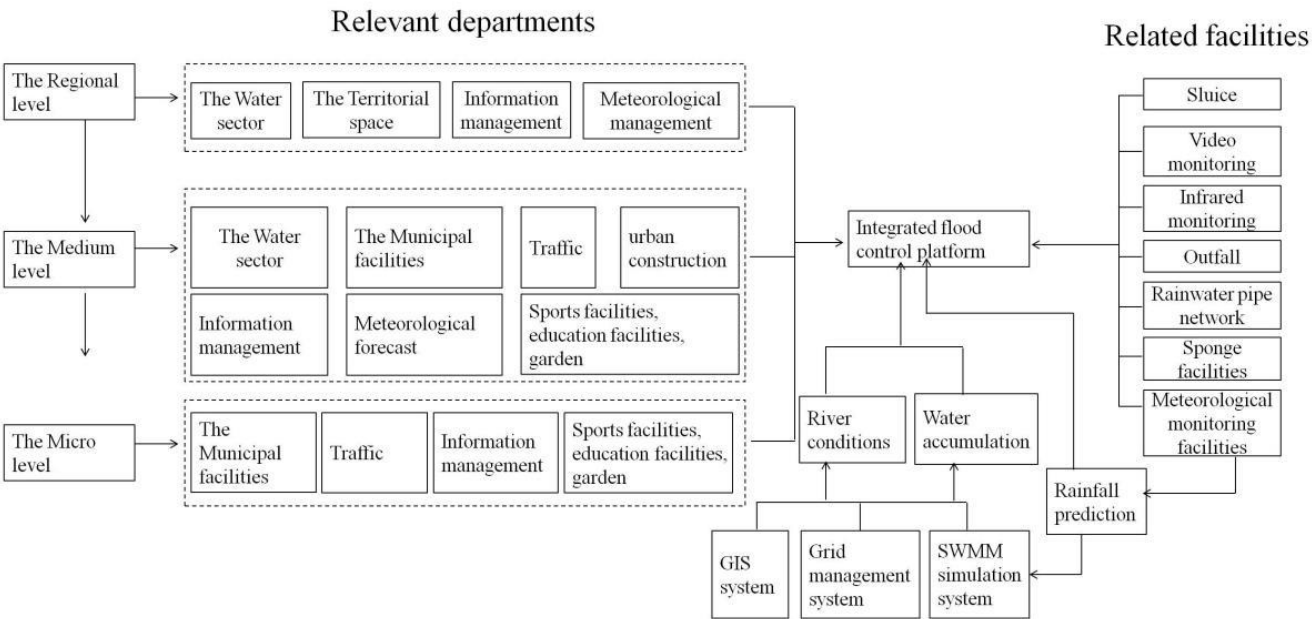

Figure 9. The information flow assimilation path

In order to avoid floods, high-precision meteorological monitoring facilities and refined meteorological prediction platform should be built to improve the accuracy of meteorological monitoring and rainfall prediction. At the same time, SWMM simulation platform, grid management system and GIS system should be used to simulate and analyze rainfall intensity, rainfall duration, ponding point location, ponding range, ponding depth, river water volume, water flow, water level, etc., and release information on the platform, Relevant departments shall monitor and reasonably control various facilities according to rainfall and flood forecast to avoid ponding caused by untimely opening and closing of facilities. It is not only caused to the occurrence of urban flood disaster by the rainfall in the city, but also may be caused by the sudden rise of river water level during the period of heavy rainfall in the region, resulting in difficulties in irrigation and drainage. Therefore, it is also necessary to manage all regions of regional rivers on a unified platform within the platform to achieve unified regional management. During the construction of the regional flood management platform, in order to achieve unified management and information sharing among various departments, the relevant departments are divided into micro, meso and macro levels according to the causes of flood disasters, and unified management interfaces are used to take various departments and facilities in different regions as one of the modules (**Figure 9**).

The Facility Flow: Coordinated Construction and Management of Regional Facilities to Form Water Discharge in Different Periods

As an important means of flood disaster prevention and control, control facilities are also an indispensable part of the collaborative path and an important part of the application of information flow. The application of information technology has greatly improved the ability of flood disaster management, but the use of information technology is inseparable from the construction of facilities. Only the intelligent control of facilities can ensure the reasonable storage and drainage management of rainwater. Therefore, firstly build drainage gates at the intersection of regional rivers and urban rivers, and build infrared monitoring facilities, water level monitoring facilities and automatic lifting facilities for drainage gates. They shall be built on both sides of the river to prevent the impact of the river water level surge to water level and water flow monitoring facilities on the region. The water inlet and drainage control facilities and water level monitoring facilities shall be built in the tertiary reservoir and wetland to reasonably regulate the water level and volume of the reservoir during heavy rainfall, and prevent the flood caused by the overflow of the reservoir water level when continuous rainy weather occurs [28]. They will be built to the Flood monitoring facilities and automatic opening and closing drainage pump stations in areas prone to water logging, especially in the underground passage. Infrared and video monitoring and alarm facilities will be built. When water logging occurs in the underground passage, the platform will give an alarm. When the water logging reaches a certain depth, the rainwater pump station will automatically open and give an alarm, control the surrounding traffic lights, and prohibit people and vehicles from entering. When the underground passage gives an alarm, all the surrounding traffic lights will be turned to red, and the traffic and municipal departments will assign special personnel to manage them.

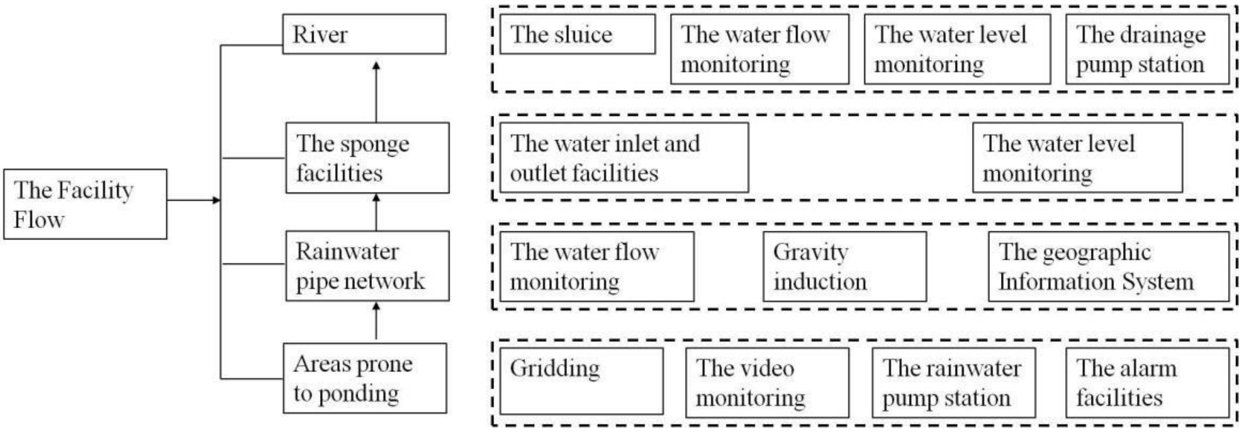

Figure 10. Implementation path of the facility flow assimilation

The flood disaster prevention and control not only requires reasonable rainwater infiltration and storage, but also reasonable rainwater drainage. Therefore, it is necessary to build a perfect rainwater pipe network system and install water flow monitoring facilities, gravity sensing facilities, etc. in the gutter inlet and rainwater pipe network. Through the monitoring of water flow, pipeline filling, etc., when the pipeline and gutter inlet are blocked, timely clean them up, improve the drainage flow rate of the pipe network, and achieve rapid drainage. In order to avoid massive drainage of regional rivers and urban interior at the same time during heavy rainfall, according to the meteorological monitoring, clear the storage capacity of reservoirs and rivers in advance to provide enough rainwater storage space (**Figure 10**). Due to reserving storage capacity before rainfall, each area will discharge water in different periods according to precipitation, ponding, and water volume of rivers and reservoirs during heavy rainfall to avoid reverse irrigation and drainage difficulties caused by river flood peaks. However, it is short of water resources, especially in the northern of China region. They have been built to drainage gates at the intersections of rivers at all levels, and monitoring facilities such as water level and water flow have been built on both sides of the river. Therefore, the sluice can be controlled according to the water level of each river, and the discharge to regional rivers can be strictly controlled. This not only effectively controls the river water level surge, but also enables the river water volume to be controlled at a certain depth for use as landscape water and municipal water, Avoid waste of water resources.

CONCLUSION

It is affected by many factors to the formation of flood and waterlogging. In order to achieve the prevention and control of flood and waterlogging, according to its formation factors, it is introduced to study the water flow, information flow, and facility flow to a multi-source flow model formed by the flood and waterlogging, and a multi-source flow model for flood and waterlogging prevention is built. In order to analyze the synergy of flood and waterlogging prevention and control, it built an evaluation index system of three categories, 10 categories, and 21 subcategories, and also proposes a method to measure the synergy degree of flood disaster prevention and control, clarifies the medium and short board of flood disaster prevention and control, cooperatively controls the regional water system from the "macro meso micro" level, builds three-level connected sponge water storage facilities, improves rainwater infiltration and storage capacity, uses the Internet of Things, the Internet and other means to build an information flow path for flood disaster prevention and control, builds a regional information sharing platform, and conducts multi sector Integrated management of multiple facilities and regions in the basin. At the same time, the flow path of facilities such as storage and drainage control facilities proposed, and the regional flood is reasonably controlled through flood simulation analysis. The application of multi-source flow model and the establishment of prevention and control path not only provide new methods for flood and waterlogging disaster prevention and control in China, greatly improving the scientific degree of flood and waterlogging disaster prevention and control, but also enable some cities to carry out more targeted construction, making flood and waterlogging disaster prevention and control more scientific and reasonable. However, the selection of elements is relatively narrow, and the selection of elements still can't meet all needs due to the large dislocation between flood and waterlogging prevention and control elements, in future, the more scientific and perfect flood control elements and scientific and reasonable calculation methods will be proposed.

ACKNOWLEDGEMENT

Henan Archives Science and Technology Project Plan (2022-B-001); Nanyang Institute of Technology Doctoral Research Initiation Fund Project (NGBJ-2022-38); Henan University Humanities and Social Sciences General Project (2022-ZDJH-662).

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