3rd WGHS, Korea

# Progress of Water resource assessment theme

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**WORKPLAN: Water Resource Assessment** **GAO Ge and Hwirin KIM**

| Activities | Actions | Outputs | Resources | Milestones | Linkages | Progress |
|---|---|---|---|---|---|---|
| 1. Assessment of basin-wide water resources availability, including use of climate predictions (3.3.2) | • Prepare assessment and outlook of basin-wide availability water surplus and deficits on a national level in a regional context including the use of climate scenarios. (Priority C) | | • RA II | | • RA II<br>• CHy | |
| 2. Assessment of basin-wide water resources availability, including use of climate predictions (3.3.2) | • Set up knowledge base to adapt to changes in water resources availability (trends, outlook) (Priority A) | • Report related to the case studies | • RA II<br>• Research documents | • Develop new system by Dec 2015<br>• Collection case studies by July 2016<br>• Evaluate model performance by Sept 2016<br>• Final report on new model in Nov 2016 | • RA II<br>• AWG | • Case studies being collected<br>• Use made of KICT CAT (Catchment Hydrologic Cycle Assessment Tool) |
| 3. Implementation of Water Resources Assessment (WRA) (3.3.3) | • Provide guidance materials for WRA linking to Climate extended range prediction<br>- Downscaling<br>- monthly and seasonally prediction WRA models<br>- WRA (Priority B) | • Guidance for WRA | • China<br>• Korea | • Provide draft technical report in Nov 2016 | • RAII<br>• CHy | |
| 4. Development of national and regional capacity building programmes and related training activities for hydrological services (3.3.4) | • Provide training material for a training course related to the advances in WRA:<br>- Downscaling methods for extended range prediction<br>- Data collection<br>- WRA methods<br>- WRA Information system (Priority B or C) | • Training Course | • WMO Regional Training Center in Nanjing | • Training Course in Jun 2016 | | |

# Activity 2

- **Activity:** Assessment of basin-wide water resources availability, including use of climate predictions (3.3.2)
- **Action:** Set up knowledge base to adapt to changes in water resources availability (trends, outlook) (Priority A)
- **Milestones:** Collect case studies by July 2016.
- **Achievements:**
  - 2015-2016: collect some case studies in different basins on adapt to changes in water resources availability.

- **Case study 1: Evaluate to water resources vulnerability using SWAT-WEAP Model in Tributary of Xi Liaohe River.**

- **Method:**

- **Coupling SWAT and Water Evaluation and Planning System for simulating water demand and supply under potential future climate change scenarios based on the framework of climate change-water resources- environment-society and economy.**
- **The unmet water demand was applied to the Vulnerability Index to quantitatively analyze water vulnerability.**
- **Problems  and adaption suggestions.**

**Evaluate to Water Resources Vulnerability Using SWAT-WEAP Model in Tributary of Xiliaohe River**

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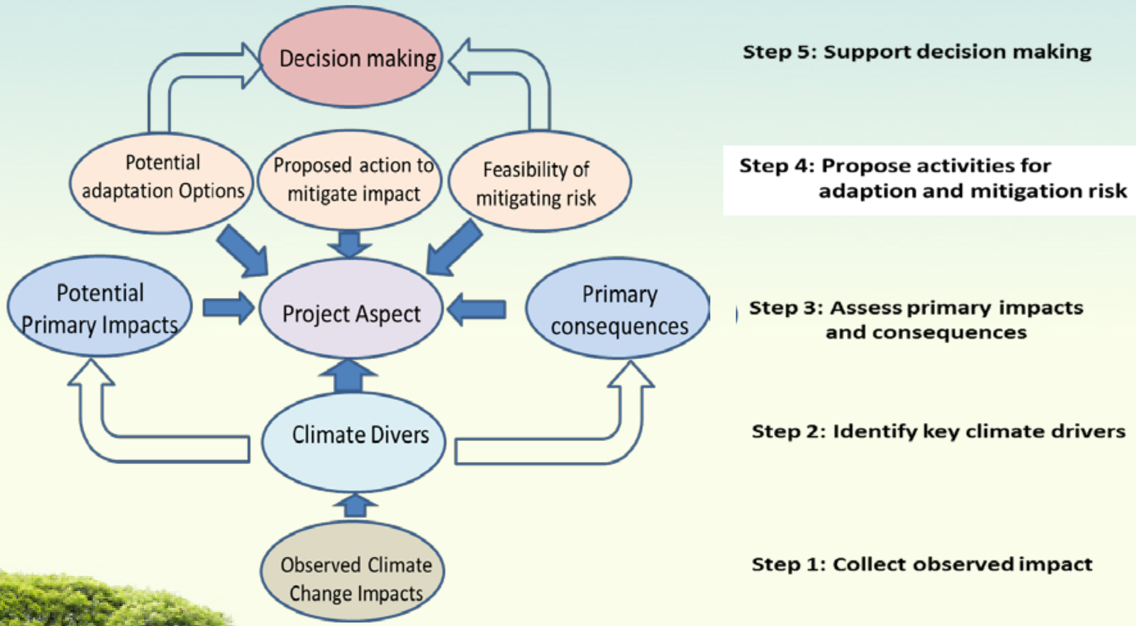
**Abstract**: The impact of climate change and human activities on the water cycle and water security are the new areas of research directions and a topical issue within international hydrological science in the 21st century. Laohahe River Basin (LRB) was selected as the research area. Used the coupling hydrological model method (SWAT-WEAP), the hydrology simulated by the Soil and Water Assessment Tool (SWAT) was used to drive Water Evaluation and Planning System (WEAP) for simulating water demand and supply under potential future climate change scenarios based on the framework of "climate change-water resources-environment-society and economy". Water vulnerability is the degree to which a water system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes. Water vulnerability is a function of the character, magnitude and rate of climate variation to which a water system is exposed, its sensitivity, and its adaptive capacity. The unmet water demand was applied to the vulnerability index (VI) to quantitatively analyze the water vulnerability to the climate and human activities change. The results show that: 1) predicted temperature increase 2 ℃ together with a 10% reduction in precipitation has a disproportionately greater impact on the vulnerability of water resources, that is, warm and dry weather increased significantly the vulnerability of water resources in LRB. 2) The impact of climate change on irrigation water shortage is greater than on domestic and industrial water shortage. 3) The main problem in the area is caused by number of identified water uses in agriculture sector, which is the driving force in the area. Over irrigation is a strong constraint to the integrated water resource management. The main problem is not the shortage of water but the management of the lake. To develop animal husbandry, change planting structure, and increase the efficiency of water-saving irrigation are the most effective measures to adapt to climate change. 4) In most scenarios, warm and dry climate intensifies and aggravates the impact of human activities on water resources vulnerability. Reservoir can effectively reduce the vulnerability of water resources. However, the effectiveness of such conventional supply-oriented measures weakens due to limited water supply source in dry and warm climate. In short, the impact of climate change on water resources not only depends on the river runoff and groundwater recharge volume, changes in the allocation of time, but also depends on the characteristics of the water system, the pressure changes of water system, and what kind of system management and measures are in place to adapt to climate change. Non-climate change factor may have a greater impact than climate change factor on water resources vulnerability.

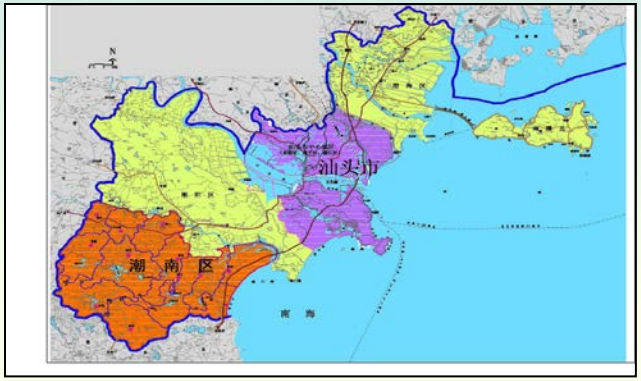
**Key words**: Laohahe River Basin; SWAT-WEAP; unmet water demand; human activities; dry and warm climate

# Climate Change Risk Assessment for Water Related Project

## Case study 2:

- Guangdong Chaonan Water Resources Development and Protection Demonstration Project
- It is the first project that involved climate change risk assessment in ADB (Asia Development Bank) project
- NCC/CMA provide Climate Change Risk Assessment Report to ADB to supporting decision making
- Climate change impacts and risks assessment became a key component for ADB project since Apr. 2013

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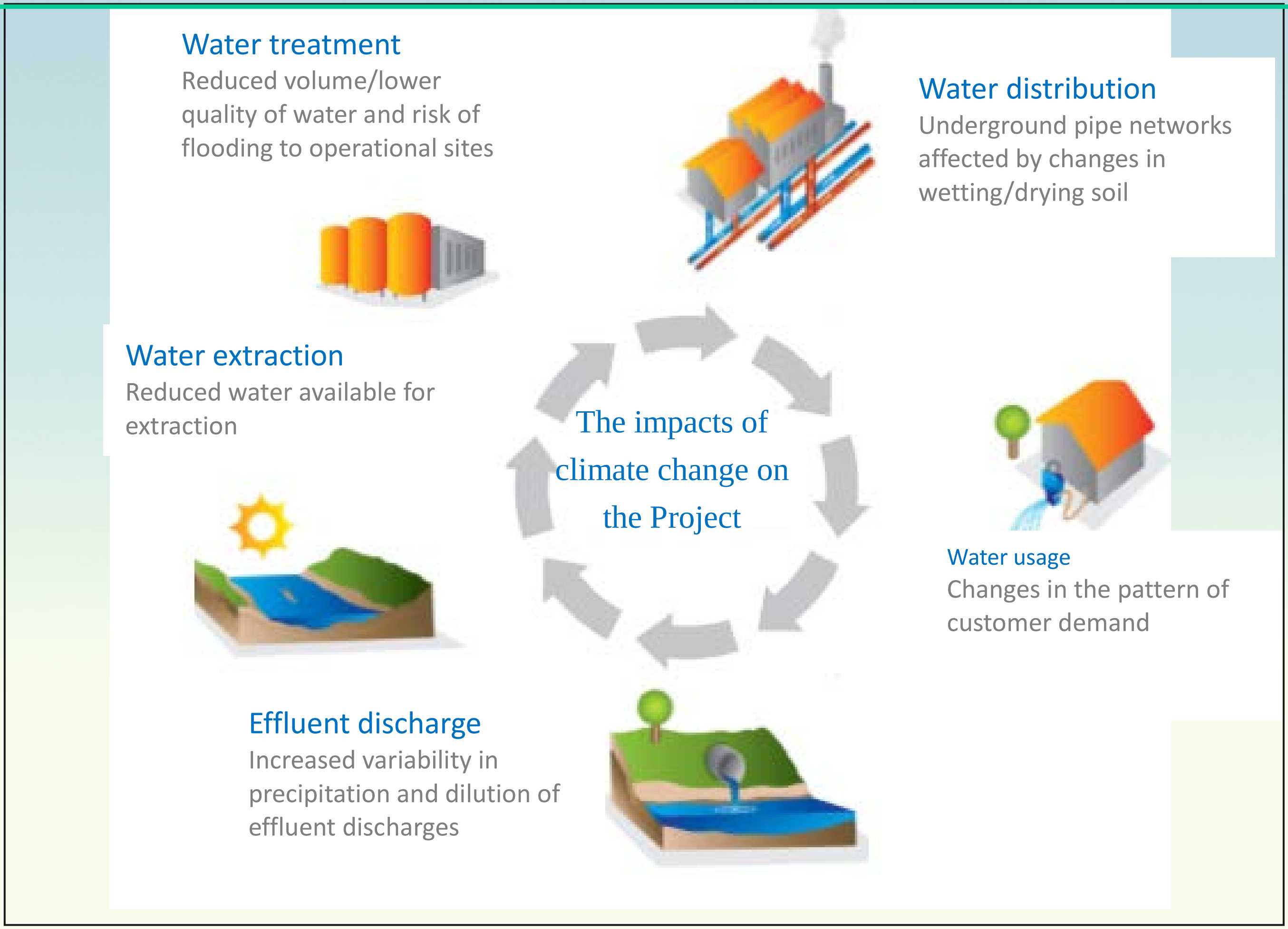
# Climate Change Risk Assessment for Water Related Project




**Concept Diagram of Climate Change Risk Assessment for Water Related Project**

# Activity 3

- **Activity:** Implementation of Water Resources Assessment (WRA) (3.3.3)
- **Actions:**
  - Provide guidance materials for WRA linking to Climate extended range prediction
    - ✓Downscaling
    - ✓monthly and seasonally prediction WRA models
    - ✓WRA (Priority B)
- **Milestones:**

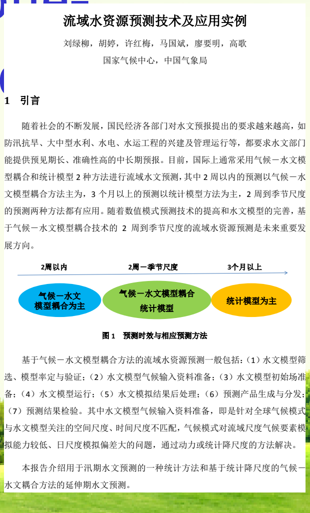
  provide draft technical report in Nov 2016

# Achievements:

– Apr.2015-Sep.2016, technique report draft of water resources prediction on basin scale and case studies is finished in Chinese.

# Outline:

- Introduction
- Hydrological prediction in flood season based on statistics method
- Extended range hydrological prediction based on one-way coupling between climate and hydrological mo
  - Statistic downscaling(Data, Methods, Test)
  - Hydrological model (HBV and SWAT, Yellow River , Validation and verification)



**流域水资源预测技术及应用实例**

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**1　引言**

随着社会的不断发展，国民经济各部门对水文预报提出的要求越来越高，如防汛抗旱、大中型水利、水电、水运工程的兴建及管理运行等，都要求水文部门能提供预见期长、准确性高的中长期预报。目前，国际上通常采用气候－水文模型耦合和统计模型 2 种方法进行流域水文预测，其中 2 周以内的预测以气候－水文模型耦合方法主为，3 个月以上的预测以统计模型方法为主，2 周到季节尺度的预测两种方法都有应用。随着数值模式预测技术的提高和水文模型的完善，基于气候－水文模型耦合技术的 2 周到季节尺度的流域水资源预测是未来重要发展方向。



**图 1　预测时效与相应预测方法**

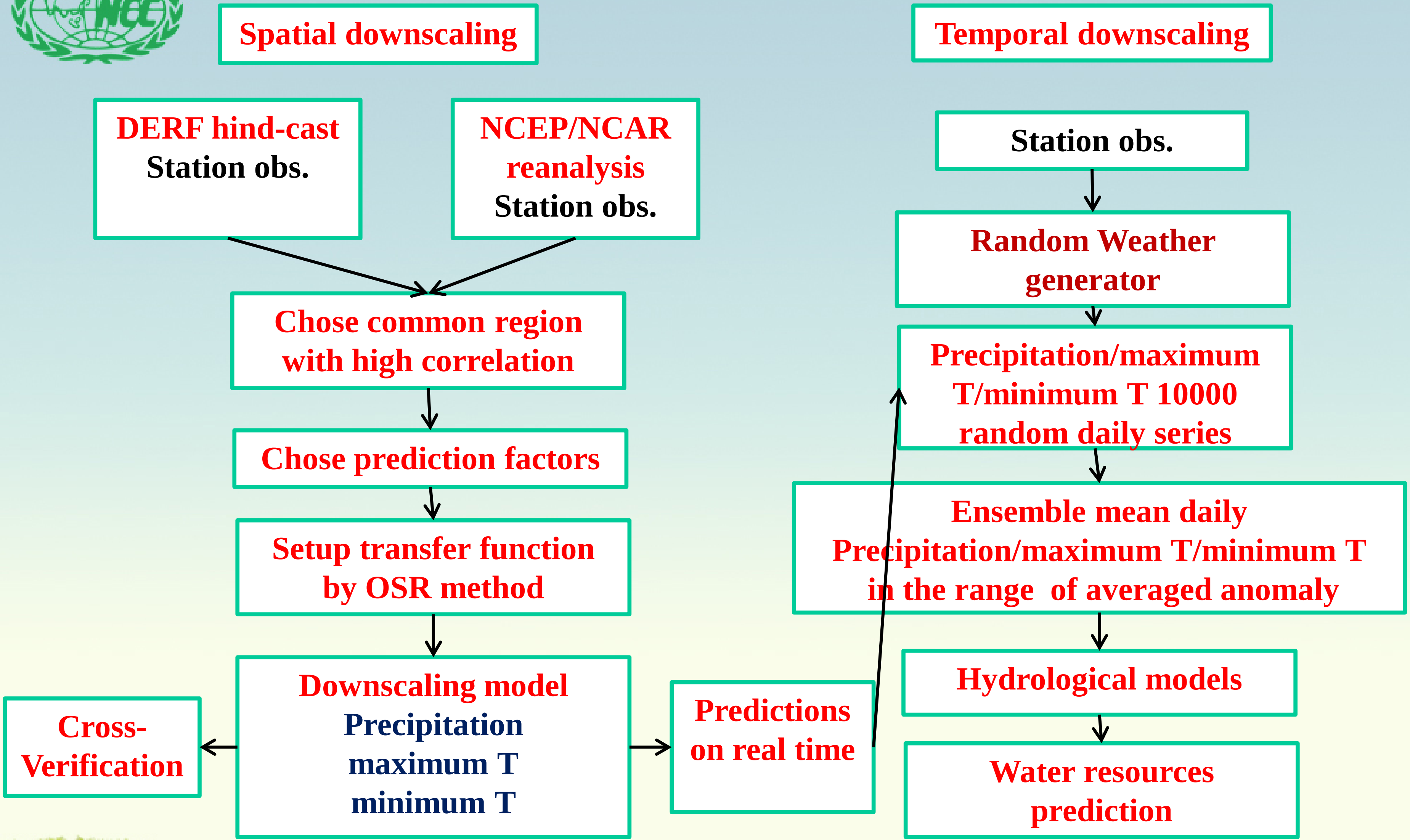
基于气候－水文模型耦合方法的流域水资源预测一般包括：（1）水文模型筛选、模型率定与验证；（2）水文模型气候输入资料准备；（3）水文模型初始场准备；（4）水文模型运行；（5）水文模拟结果后处理；（6）预测产品生成与分发；（7）预测结果检验。其中水文模型气候输入资料准备，即是针对全球气候模式与水文模型关注的空间尺度、时间尺度不匹配，气候模式对流域尺度气候要素模拟能力较低、日尺度模拟偏差大的问题，通过动力或统计降尺度的方法解决。

本报告介绍用于汛期水文预测的一种统计方法和基于统计降尺度的气候－水文耦合方法的延伸期水文预测。

- Tool of Water resources assessment of some basins in China
    - Main functions\Data input

    Products:
    - Prediction of water resources in Flood season
    - Water resources assessment during the past many years
    - Extend period water resources assessment and degrees assessment of water abundant and lack
- Two case studies

**Liu LL，Hu T.,et al**



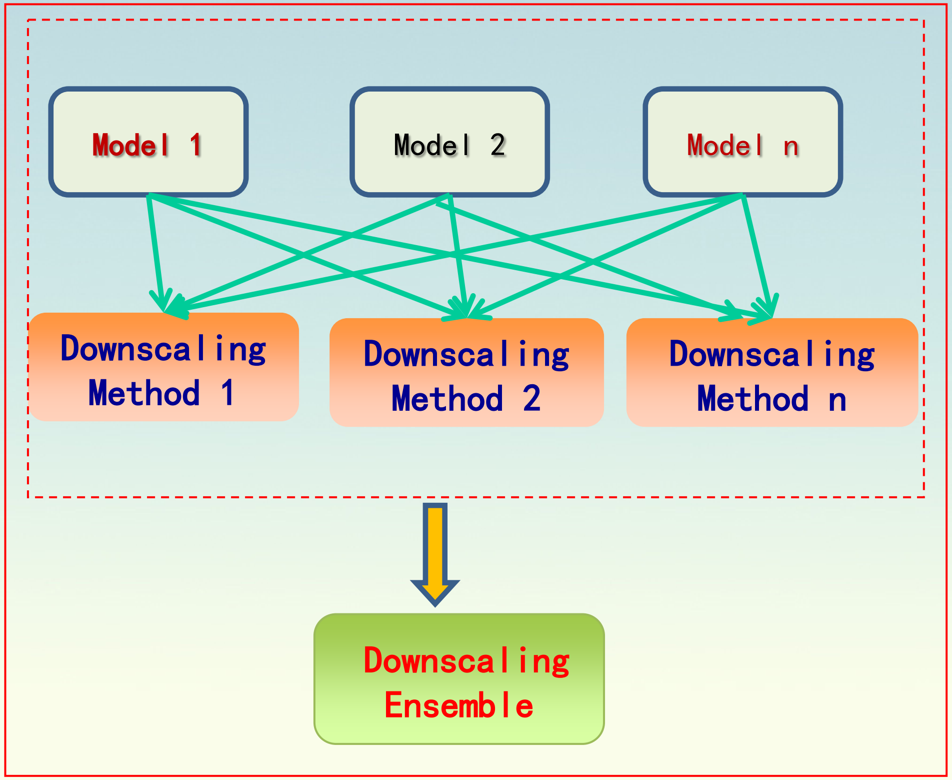

**Technique flow chart of dynamic extended range forecast and hydrological model coupling based on statistic downscaling**

# Multi-Model Downscaling Ensemble System (MODES, BCC/CMA)

| Issued Unit | Models |
|---|---|
| BCC | CSM1.1 |
| ECMWC | System4 |
| TCC | CPS2 |
| NCEP | Cfs2 |

## Downscaling Methods:

- BP-CCA(canonical coefficient analysis)
- OSR (optical subset regression)
- APCC - CPPM
- …




Products:

Elements:

- Precipitation
- Temperature

Temporal scale:

- Monthly
- Seasonal

MODES is a basic operational platform of climate prediction in BCC which is build in 2013 .

# Next Steps

- Finished the draft technique report in English.
- Achievements in activities 2, 3 set up a basis for activities 1,4.