# A Novel Integrated Hydro-Economic Model: Application to Water Stress Assessment and Mitigation in China



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## Research gap and question

Question

- Impacts of economic activities on water resources
- Relation of quantity and quality stress
- What are impacts of economic activities on water Research

Causes, impacts and solutions to mitigate water stress

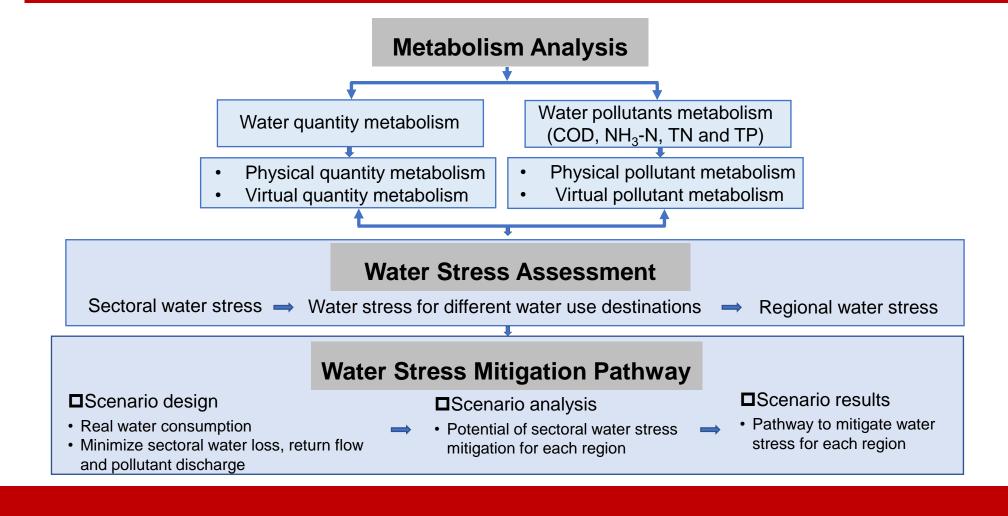
resources?

Research

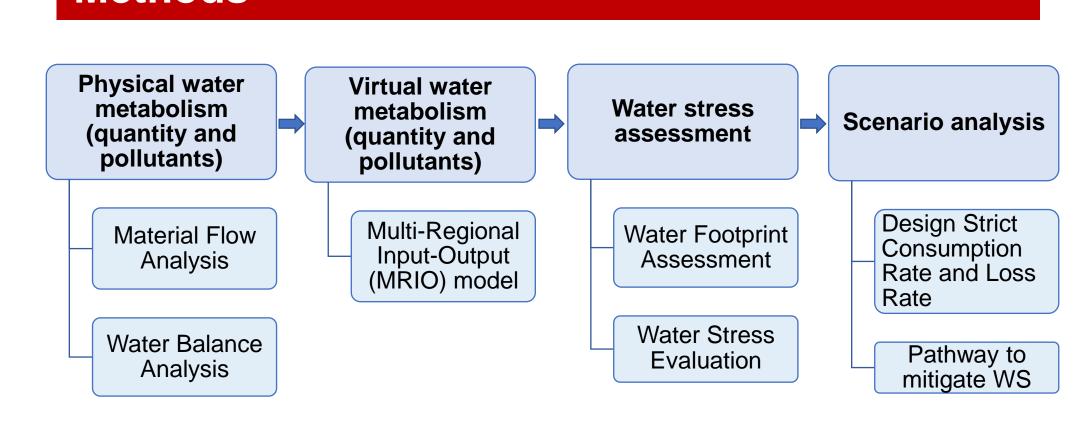
Contents

- Metabolism analysis
- Water stress assessment
- Pathways to reduce water stress
- Contributions
- **Hydro-economic model**
- Water stress mitigation

## Framework of hydro-economic model



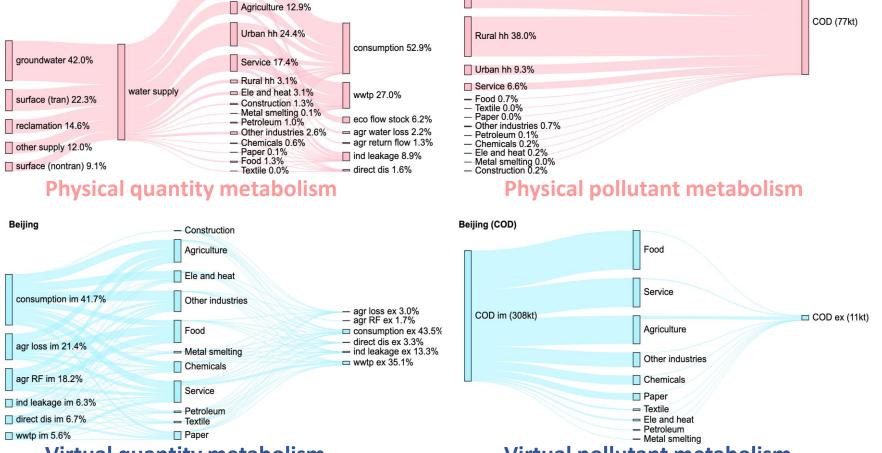
### Methods



#### Results

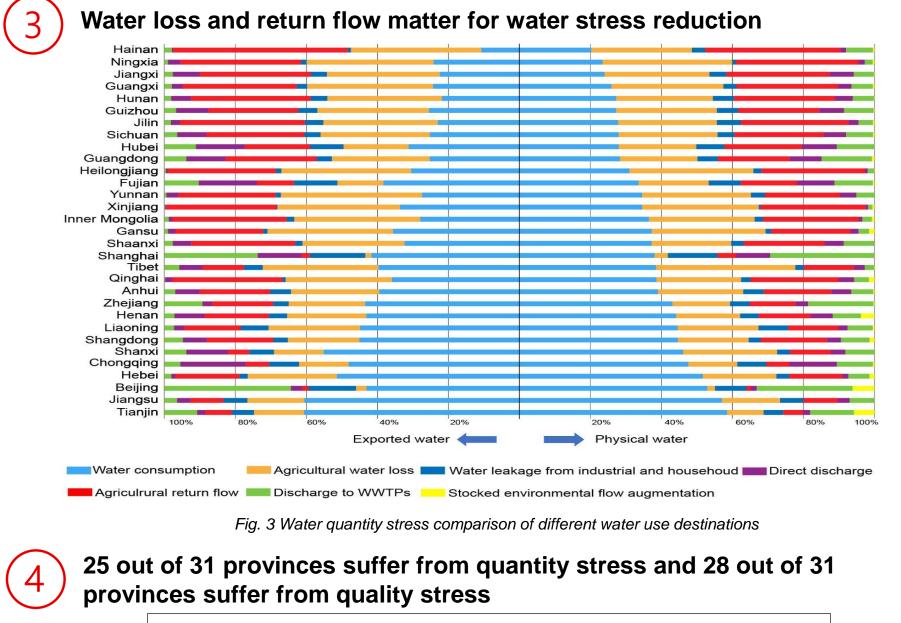
Research gap

- Four types of metabolism analysis in 31 regions
- 36-79% of water use is returned to environment
- 39-89% of virtual water export is water loss and return flow
- Agriculture and households are top pollution sources
- Major export or import sectors vary for different regions



Virtual quantity metabolism Virtual pollutant metabolism Fig. 1 Four types of metabolism analysis in Beijing (an example of 31 regions in China) Agriculture and households are main contributors to water stress

Agriculture 🚾 Electric power and heat power 🤍 Other industries 🦰 Construction 🔳 Service 📁 Environmental flow augmentation 📁 Urban HH 🗨 Rural HH Fig. 2 Sectoral water quantity and quality stress comparison

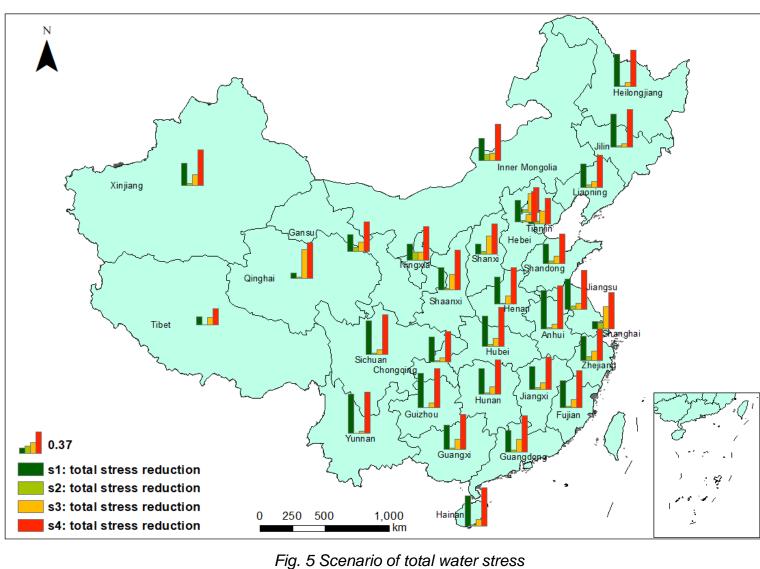


total water stress

Fig. 4 Regional water stress in China

#### No one-size-fits-all water stress mitigation strategy

- Agriculture is the most important sector for 23 provinces, as it has the largest potential to reduce total water stress by 34-67%.
- For Beijing and Qinghai, decreasing return flow and water loss of domestic water use could mitigate total water stress by 39% and 50%. For regions like Tianjin, Shanghai, Shaanxi Guangdong, it is necessary to reduce return flow and water loss of several sectors simultaneously to achieve reducing water stress largely.



#### Conclusions

- ☐ Hydro-economic model is a novel model to study quantity and quality metabolism
- ☐ Metabolism analysis is useful for water stress assessment and mitigation
- ☐ Most regions suffer from water quantity and quality stress simultaneously
- ☐ Water loss and return flow matter for water stress mitigation
- □ No one-size-fits-all water stress mitigation strategy
- □ Top 5 sectors could reduce total water stress by 28-74%