Comparison of PM2.5 and Ozone Pollution in China

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Background

- Over **90% of the world's population** suffers toxic air and research is increasingly revealing the profound impacts on the health of people especially children.
- Air pollution is killing **7 million people** a year and harming billions more (WHO 2018).
- China is facing severe air pollution recently, which is bringing huge damage to China.
- This study aims to use CGE model combined with health module and GOES-Chem model to evaluate the impacts of PM2.5 and ozone in 30 Chinese provinces.
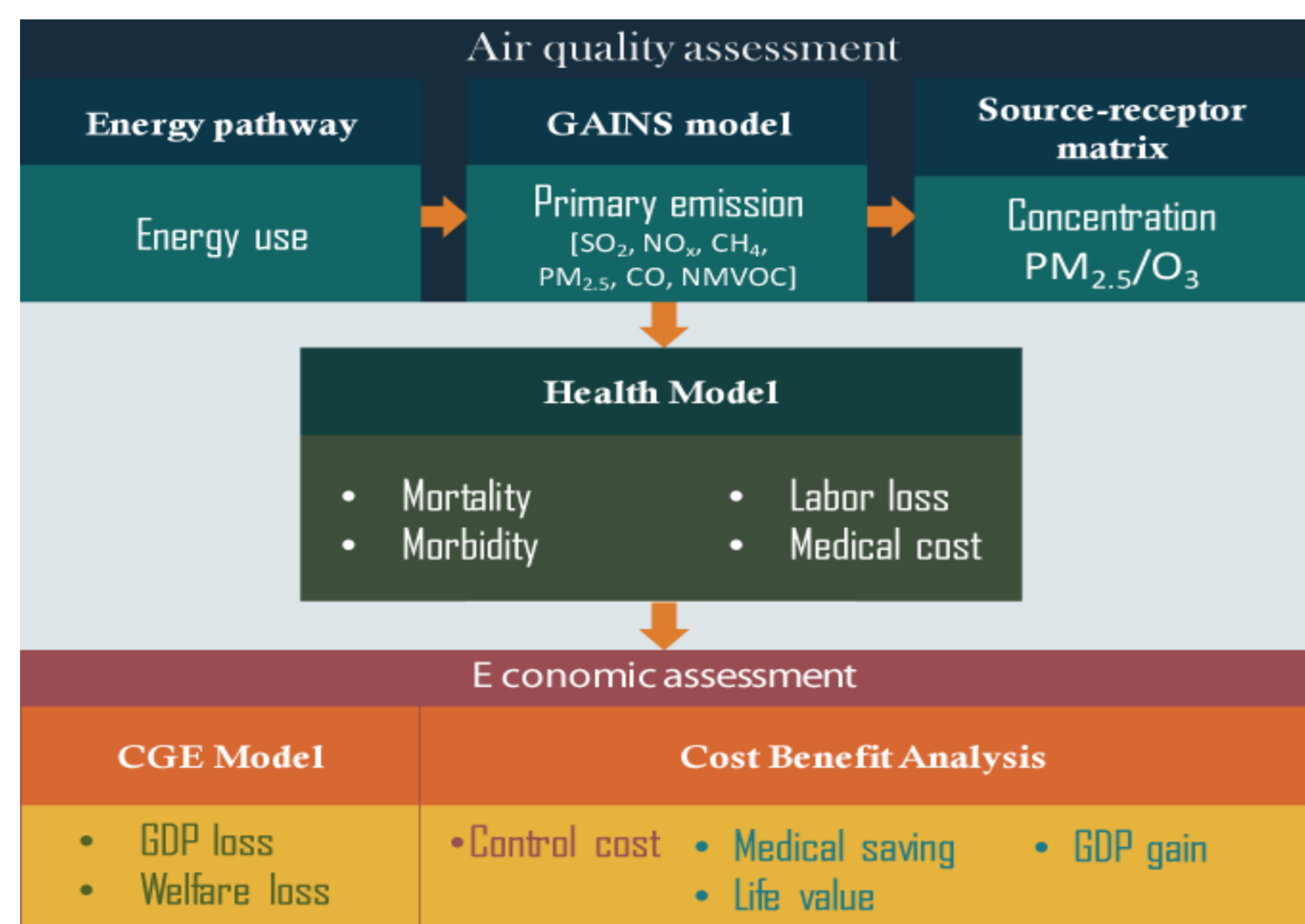

Fig. 1: Research framework

Methods

1. Models

- Combining **AIM/CGE**, Health impact assessment model, **GAINS** model and **GOES-Chem** model.
- **GAINS-China** model calculates air pollutants emissions and **GOES-Chem** model simulates PM2.5 annual average concentration in 30 provinces in China.
- Health impact assessment model quantifies the health impacts and converts to work time loss.
- **AIM/CGE** model evaluates economic benefit from air pollution control in China.

2. Scenario

- **WoPol:** penetration rate of mitigation technology remains the same as 2005 and additional emissions from energy combustion remain uncontrolled throughout the modeling period.

- **WPol:** reflects current air pollution policies in China, considering sectoral and provincial differences with respect to emission limit values and time of their introduction. WPol assumes the existence of intensive air-pollution-control technologies.
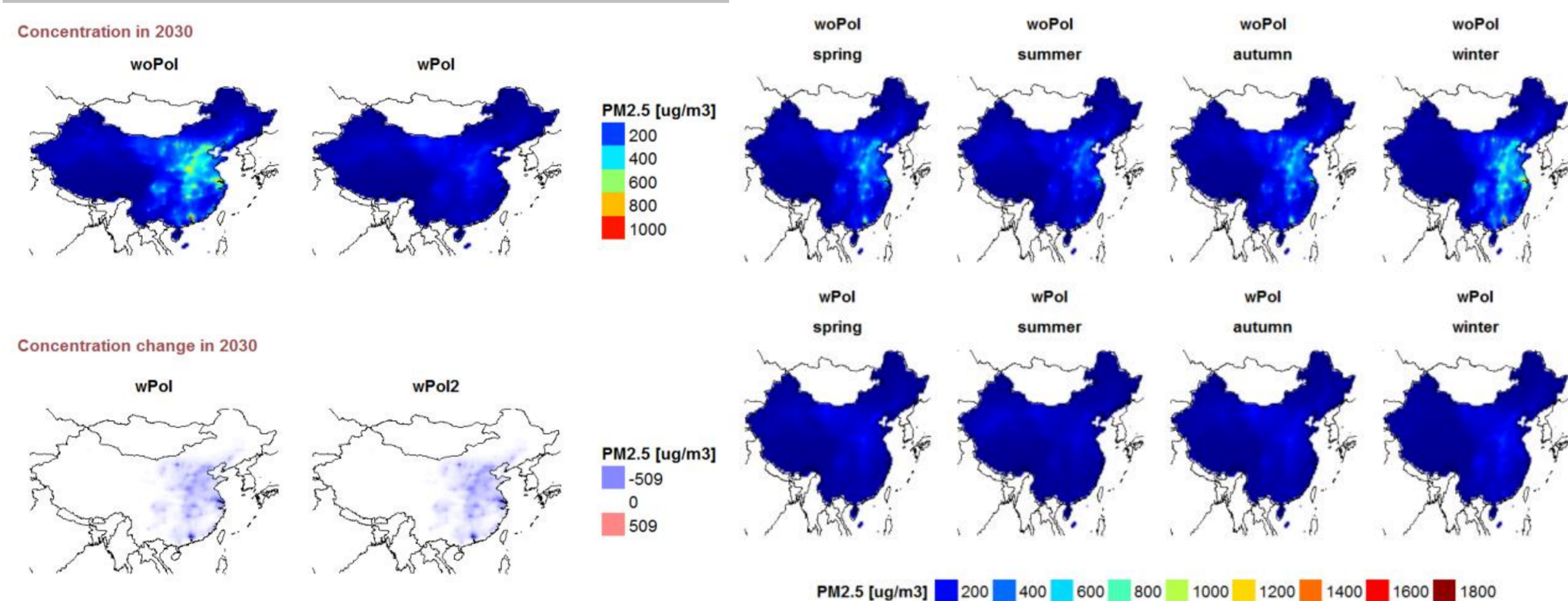
Results

PM2.5 concentration

Fig. 2: Annual average PM₂.₅ concentration

Fig. 3: Seasonal average PM₂.₅ concentration
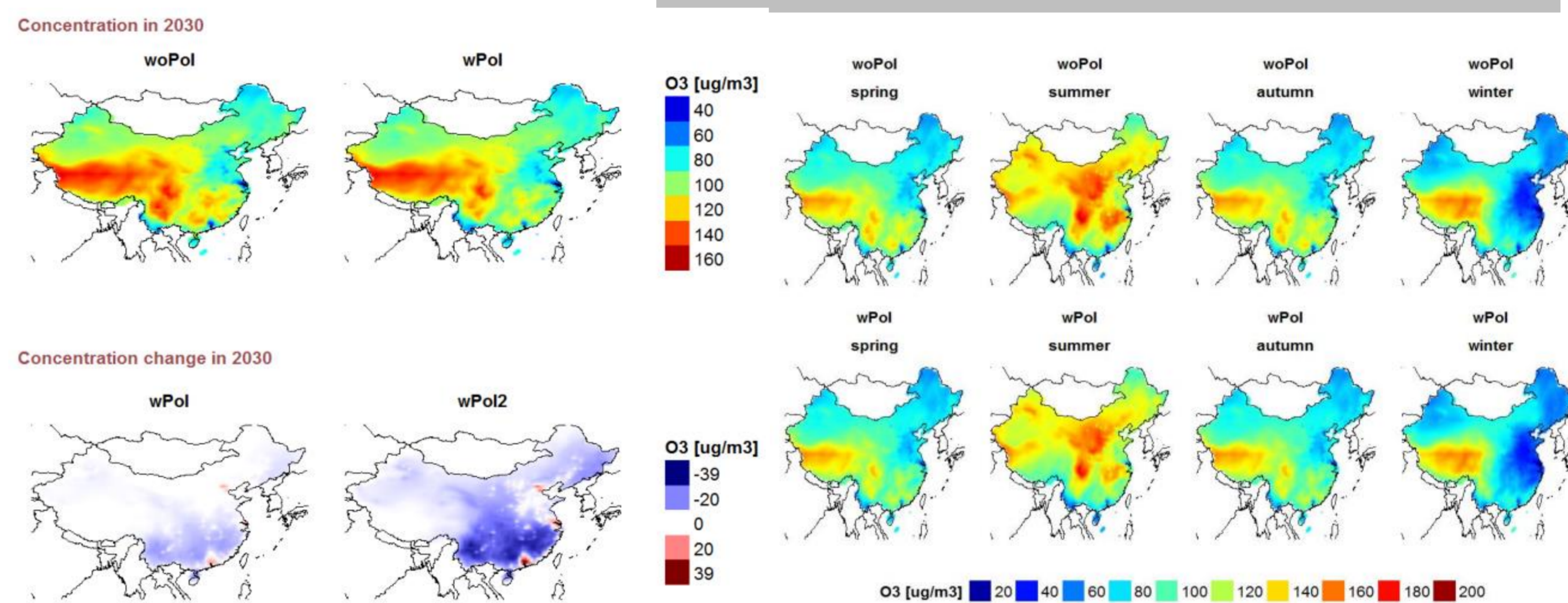
Ozone concentration

Fig. 4: Annual average ozone concentration

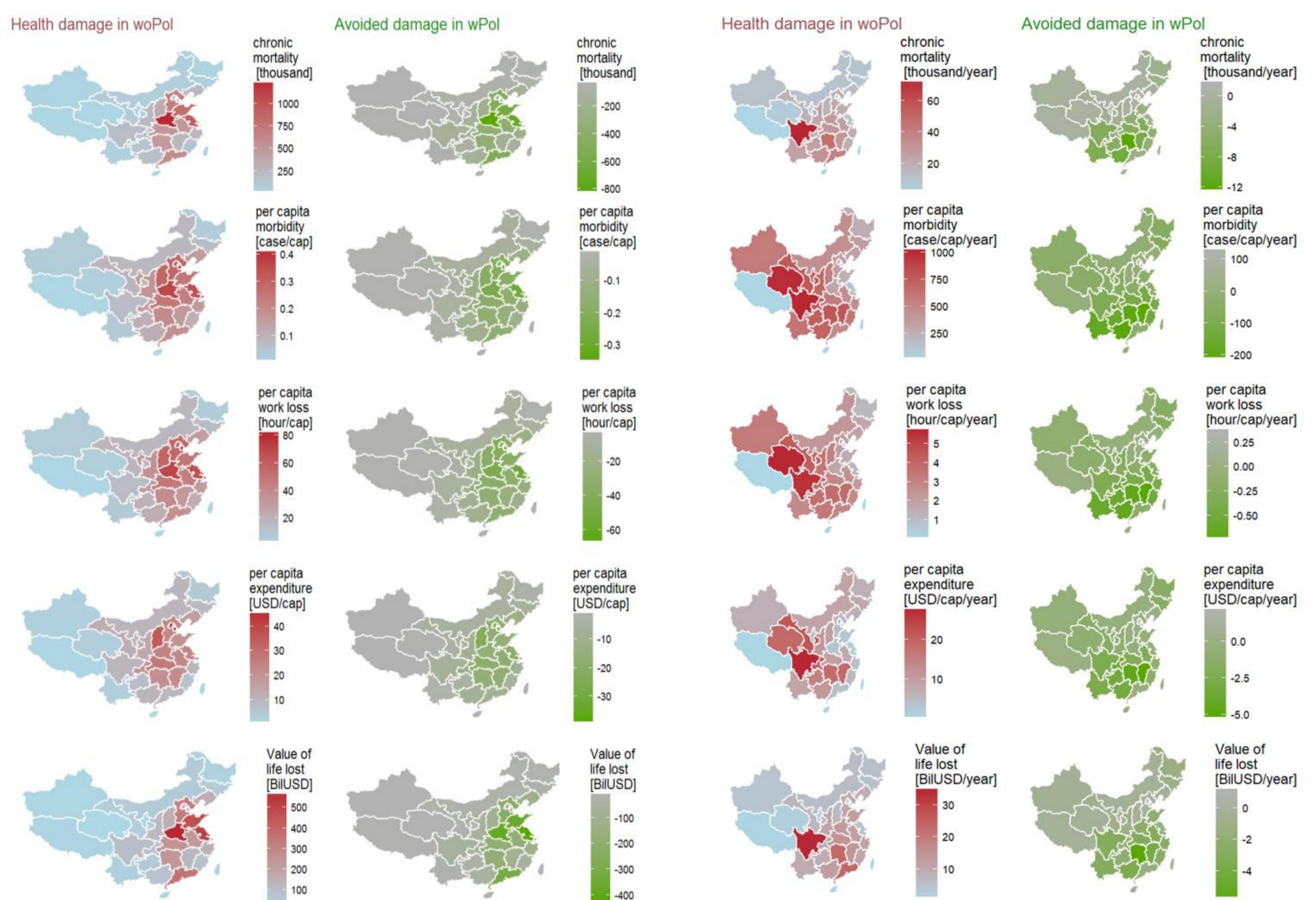*Fig. 5: Seasonal average ozone concentration*

Fig. 6: Health benefit of air pollution control: PM2.5(Right)/ Ozone (Left)
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PM2.5

- The mortality due to PM 2.5 pollution is 9.2 million and 2.3 million in WoPol and WPol scenario in 2030.
- Henan, Shandong, Jiangsu, Hebei and Sichuan provinces have larger amount of premature death.
- Air pollution control policy can reduce work time loss around 41 hours per capita in 2030.
- China experiences a 2.0% GDP loss and 2.7% welfare loss from PM 2.5 pollution in WoPol scenario.
- Air pollution control policy would lead to 1.2% GDP gain in 2030.

Ozone

- Air pollution control policy would reduce 92 thousand premature death in China in 2030.
- Sichuan, Gansu, Shaanxi and Hunan encounter most of the ozone-related mortality.
- The national average per capita work loss is 2.8 hours .
- About 4-5% population suffer from ozone pollution-related morbidity.
- The total health expenditure is 100 and 87 billion CNY (2002 constant price) in the woPol and wPol scenarios.
- China will experience a GDP loss of about 0.09% in 2030 in WoPol scenario.

Summary & Conclusion

- China is also suffering quite severe air pollution, especially PM 2.5 and ozone pollution. Air pollution in China has led to millions of mortality and morbidity every year and increased health expenditure. It is also a big burden on China's economy.
- The Chinese government is promoting series of air pollution control policies, which could improve air quality and bring positive impact on the people's health and the economy.
- Provinces with higher population density, worse air quality and higher development, have higher benefit from air pollution control technology.
- These provinces in undeveloped regions have less or negative impact on the economy from air pollution control policy. Air pollution control needs collaboration among provinces in China.