

Regional Features of Long-Term Exposure to **PM_{2.5}** Air Quality over Asia under SSP scenarios

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PM_{2.5} concentration

$$= \text{BC} + \text{OC} + \text{NH}_4 + \text{SO}_4 + \text{NO}_3 + (0.1 \times \text{DU}) + (0.25 \times \text{SS})$$

5 SSP scenarios

- SSP126, SSP245, SSP370, SSP370-lowNTCF, SSP585

WHO air quality index (AQI)

	Index	PM _{2.5} (µg/m ³)	Basis for the Selected Level [57]
5	Significantly over target (ST)	53-	Defined as a concentration that exceeds 150% of the interim target-1 level.
4	Over target (OT)	35-53	Defined as a concentration higher than the interim target and less than 150% of the interim target-1 level.
3	Interim target 1 (IT-1)	25-35	Approximately 15% higher long-term mortality risk relative to the air-quality guideline level.
2	Interim target 2 (IT-2)	15-25	These levels lower the risk of premature mortality by approximately 6% relative to the IT-1 level.
1	Interim target 3 (IT-3)	10-15	These levels reduce the mortality risk by approximately 6% relative to the IT-2 level.
0	Air-Quality Guideline (AQG)	0-10	Lower end of the range of significant effects on survival in response to long-term exposure to PM _{2.5} . [58]

Study area

- subregional domain from CMIP6



Evaluation of CMIP6 in the PD period

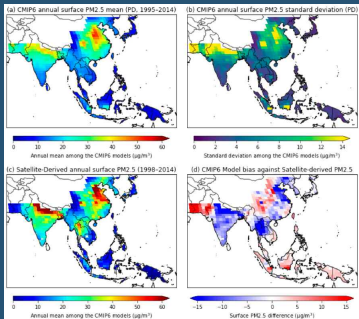
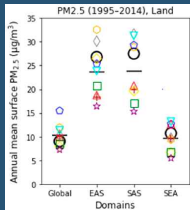
Multi-Model ensembles

- 9 CMIP6 models
- available data

Model Name	Historical	SSP1-2.6	SSP2-4.5	SSP3-7.0	SSP3-7.0-lowNTCF	SSP5-8.5
UKESM1-0-LL [44]	○	○	○	○	○	○
GFDL-ESM4 [45]	○	○	○	○	○	○
NorESM2-LM [46]	○	○	○	○	○	○
GISS-E2-1-G [47]	○	○	○	○	○	○
MIROC-ES2L [48]	○	○	○	○	○	○
MRI-ESM2-0 [49]	○	○	○	○	○	○
CESM2-WACCM [50]	○	○	○	○	○	○
BCC-ESM1 [51]	○	○	○	○	○	○
MPI-ESM1.2-HAM [52]	○	○	○	○	○	○
Total number of models	9	5	5	7	7	5

Reasonable estimation

- underestimated in EAS, SAS
- highest value in industrialized and highly population



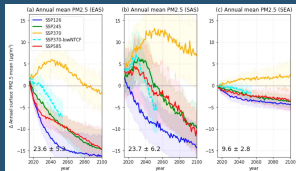
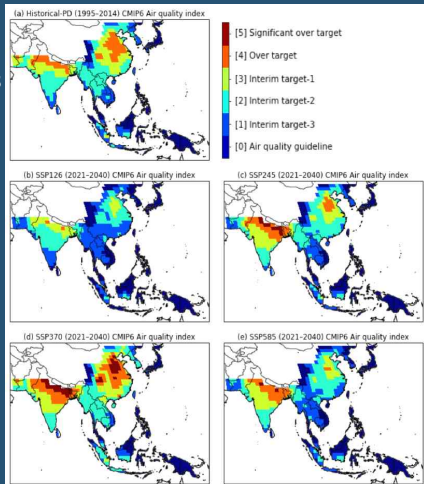
Air quality Index

Historical

- AQG in Korea, Japan
- Lv 4 around Mega Cities

Near future

- improved in SSP126
- $585 < 245 < 370$ due to SSP pathways



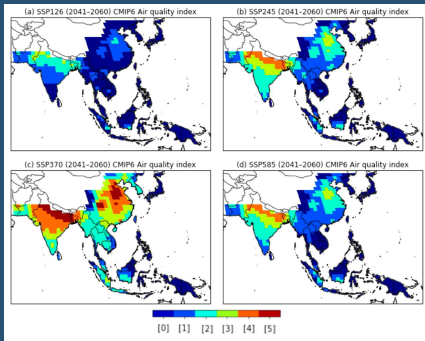
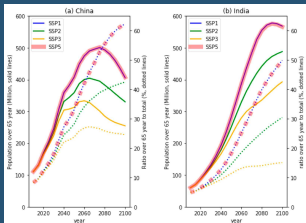
Air quality Index in Mid future

Mid future

- improved overall region in SSP 126 scenario
- 'weak' air quality controls in SSP370 lead higher level of AQI

Considering population change

- Rapid population ageing coupled with AQI level may increase the risk in SSP370 scenario



dotted line indicate the ratio over 65 years to total

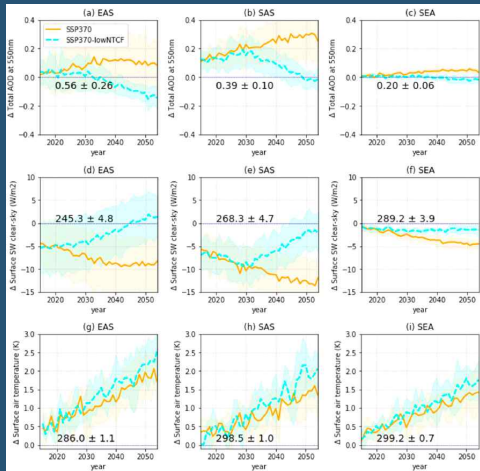
Impact of air quality controls

SSP370 vs SSP370-lowNTCF

- implementation of strong air quality controls contributes to regional warming

Regional response

- SAS > EAS > SEA



Conclusion

'Weak' air quality controls in SSP370

- the level of AQI is expected to increase significantly
 - > the risk of premature mortality from long-term exposure to PM2.5 could significantly increase in China and India due to the rapid population ageing in the future

Response of aerosol reduction

- An additional finding of this study is the potential acceleration of global warming in Asia with future decreases in anthropogenic aerosol emissions reducing the radiative cooling effect of aerosols
- understanding the effects of fine particulate matter on human health and climate interactions have become critical to regional policymakers

Thanks you for
your attention to our study