

Past and Future Changes In Extreme Weather Events In Hong Kong

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Background

- The Hong Kong Observatory (HKO) has been conducting meteorological observations continuously since 1885, except for a break during World War II (1940 - 1946). The meteorological data collected over the last 120 years or so serve as a basis for studying the climate change of Hong Kong.
- Against the background of global warming and local urbanization, significant changes in the climate of Hong Kong have been observed, including increased temperature, enhanced rainfall, raised sea level, etc.
- This poster presents results of the studies on the observed and projected changes of the extreme temperature and precipitation events in Hong Kong.

Observed trends of extreme weather events in Hong Kong

- The long term variations of the occurrence of extreme temperature and rainfall in Hong Kong from 1885 to 2010 using a suite of extreme indices adopted from the core indices of ETCCDMI* have been studied.
- There is a significant increase in the warm indices (TN90p and TX90p) and a significant decrease in the cold indices (TX10p and TN10p)

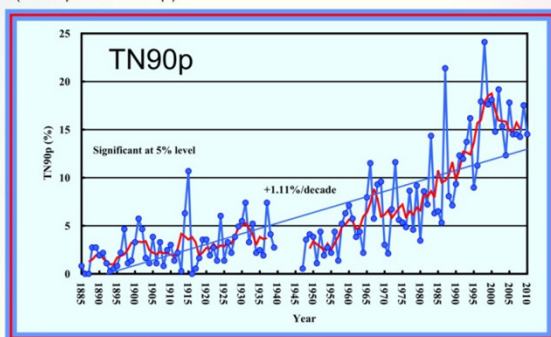


Figure 1. Time series of TN90p from 1885 to 2010 (linear trend and 5 year running mean)

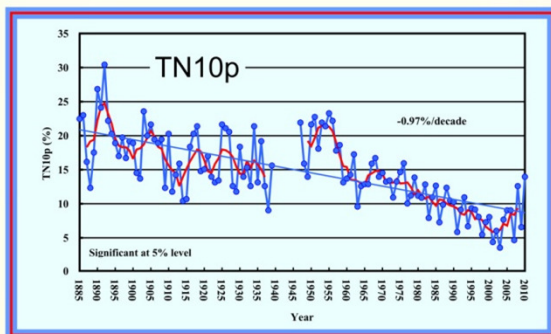


Figure 2. Time series of TN10p from 1885 to 2010 (linear trend and 5 year running mean)

- Daily rainfall intensity in wet days (SDII) and the contribution to the annual rainfall by events exceeding the daily 95 percentile of the climatological normal (R95p) have increased significantly.

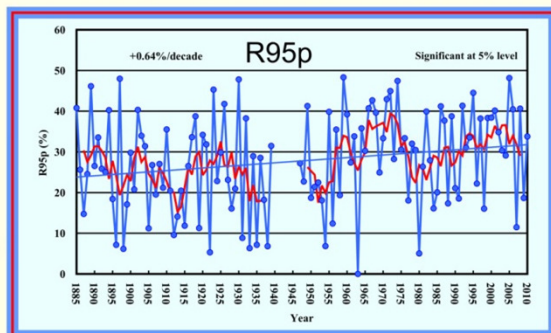


Figure 3. Time series of R95p from 1885 to 2010 (linear trend and 5 year running mean)

- The results of the time-dependent Generalized Extreme Value (GEV) Distribution analysis showed that the return periods for maximum temperature $\geq 35.0^{\circ}\text{C}$ and hourly rainfall of 100 millimetres or more have shortened significantly from 1900 to 2000, but the return period for minimum temperature $\leq 4.0^{\circ}\text{C}$ has lengthened significantly.

Table 1. Time dependent GEV analysis of the return period of extreme weather events in Hong Kong

Extreme event	Return period in 1900	Return period in 2000
Minimum Temperature $\leq 4^{\circ}\text{C}$	6 years	163 years
Maximum Temperature $\geq 35^{\circ}\text{C}$	32 years	4.5 years
Hourly rainfall $\geq 100\text{ mm}$	37 years	18 years

Future Projections

- The possible changes in the frequency of extreme temperature and rainfall events in Hong Kong in the 21st century have been investigated by statistically downscaling a number of daily global climate model projections of IPCC AR4 for 3 different GHG emission scenarios (A2, A1B and B1).
- The projections suggest that the trends in extreme temperatures that have been observed during the 20th century are expected to continue into the 21st century, i.e. more frequent extremely high temperature events and less extremely low temperature events.
- The rainfall in Hong Kong in the 21st century may become more extreme. The number of rain days is expected to decrease while the number of heavy rain day (daily rainfall $\geq 100\text{mm}$) will increase.
- There is still a large difference in the projections among different model/emission scenarios, reflecting large uncertainties in model simulations of future extreme weather events.

Table 2. Projections of extreme indices in Hong Kong (TN10p, TX10p, TN90p, TX90p, SDII and R95p) for the decades 2050-59 and 2090-99 as well as the average of the observed values in 1980-99

Extreme indices	1980 - 1999	2050 - 2059	2090 - 2099
TN10p (%)	9.4	1	0.3
TX10p (%)	10.8	2.1	0.8
TN90p (%)	11.6	53.4	74.2
TX90p (%)	8.9	35.5	57.6
SDII (mm per day)	22	29	33.6
R95p (%)	28.8	33.8	39.3

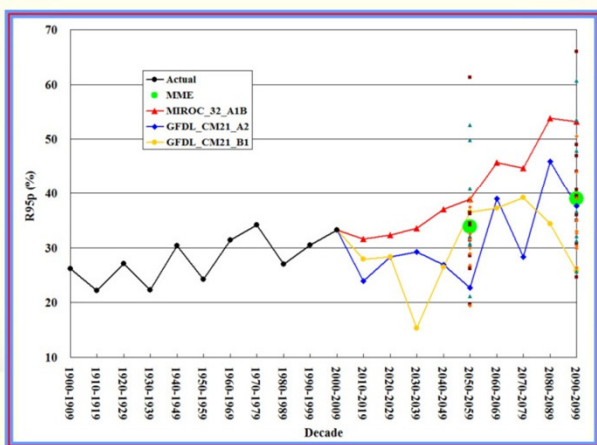


Figure 4. Projected R95p in Hong Kong for the 21st century given by GFDL_CM21 model (A2 and B1 scenarios) and MIROC3_2_HIRES model (A1B scenario) together with the spread of the projection of all the model-scenario combinations for the decades 2050-59 and 2090-99. Green dots show the multi-model ensemble mean.

References

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