

# **Adaption of typhoon risk modeling to climate changes**

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# Overview

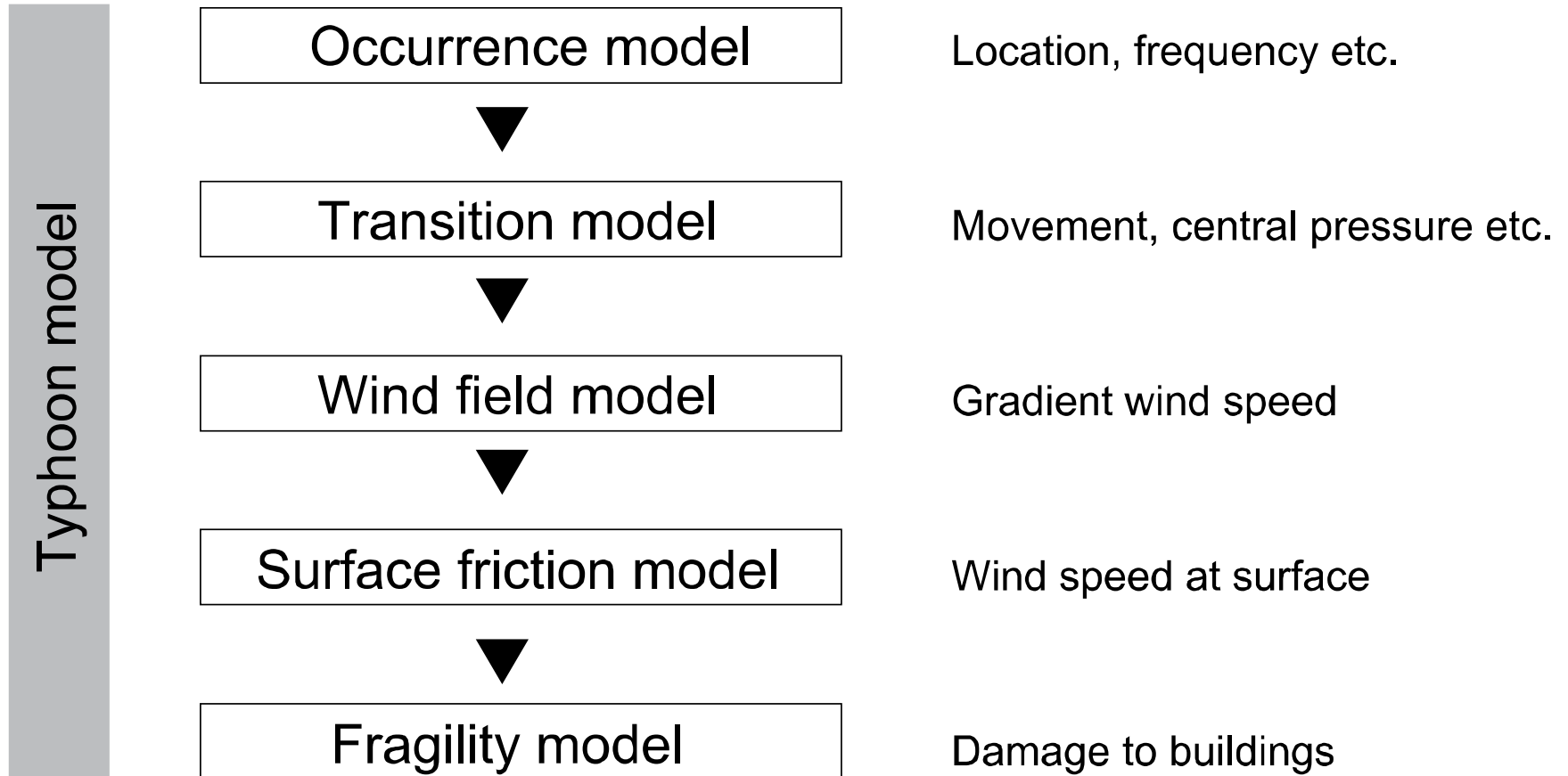
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2/17

- Introduction of the typhoon model utilized in the present study and its adaptation to possible climate changes.
- Influence of sea surface temperature (SST) change on the intensities of extreme wind speeds induced by typhoons.
- Consequences of the increased intensities of the extreme wind speeds to the performance of structures in terms of failure probability.
- An investigation on how the policies in regard to structural design may be adapted to the climate changes to maintain the structural reliability.

# Typhoon model

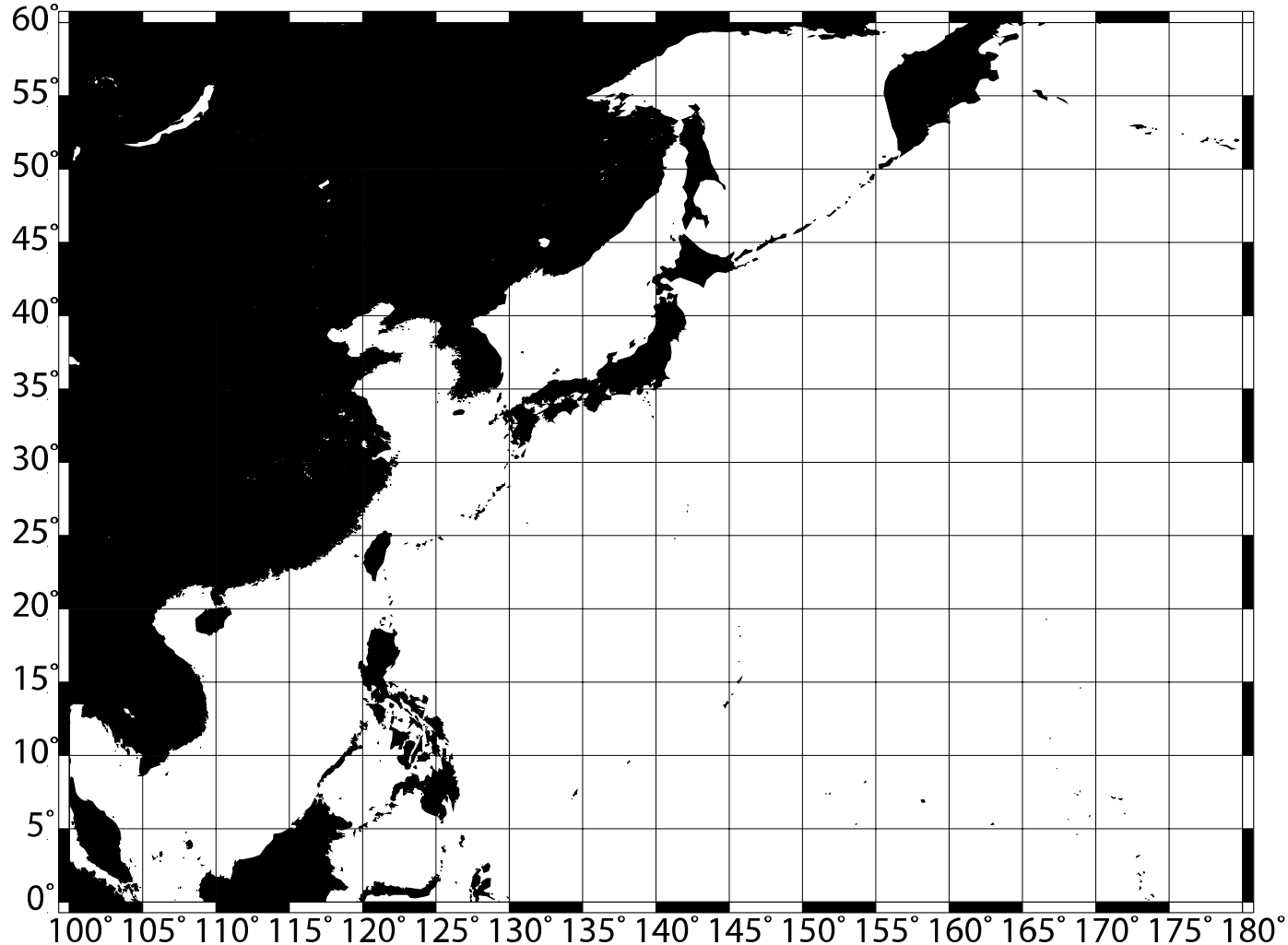
3/17



# Transition model

4/17

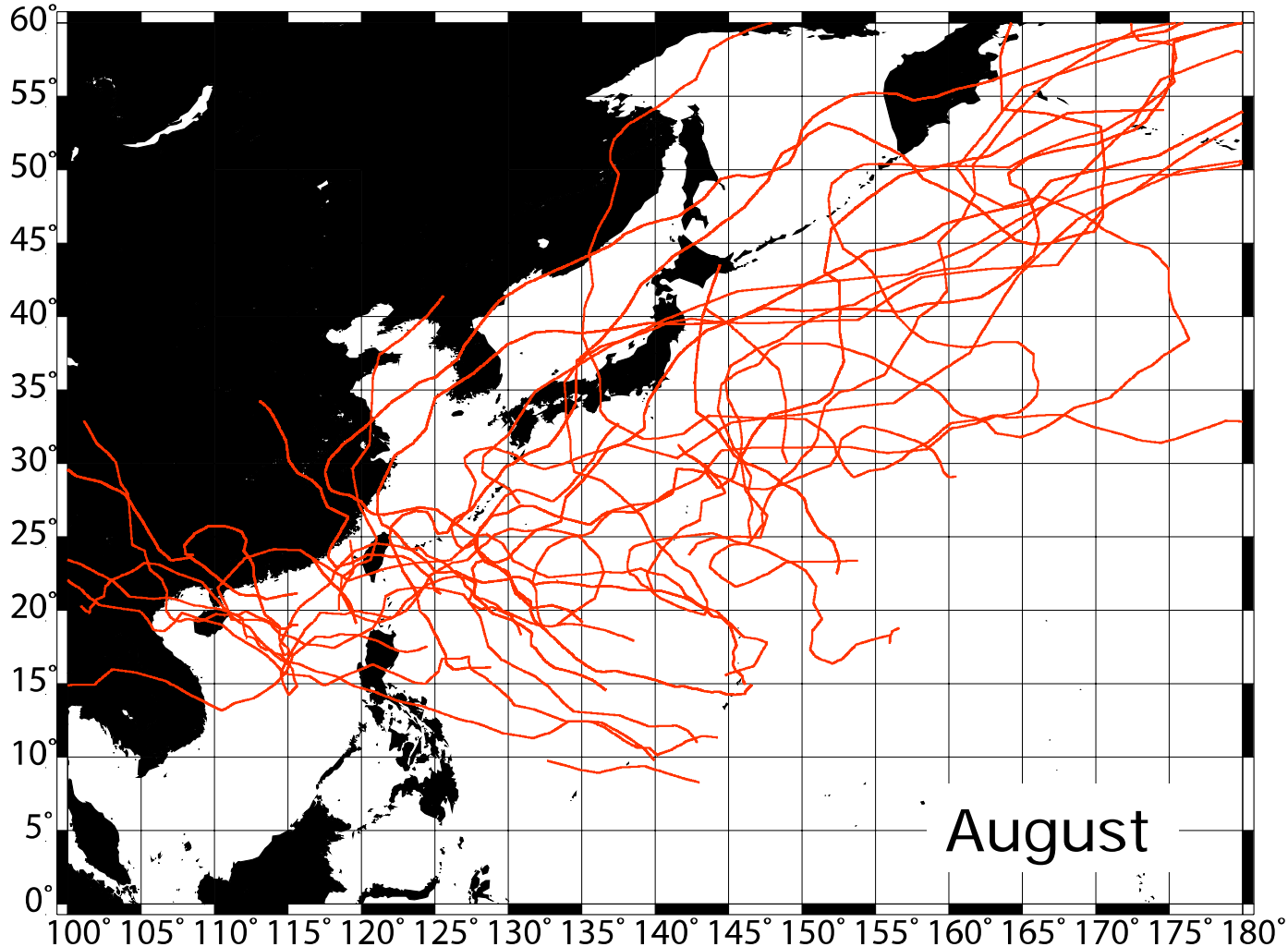
## Map of the northwest Pacific



# Transition model

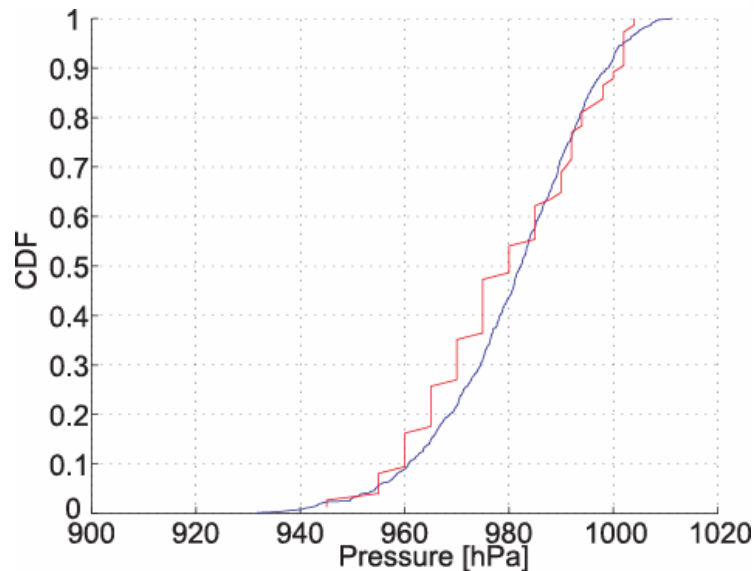
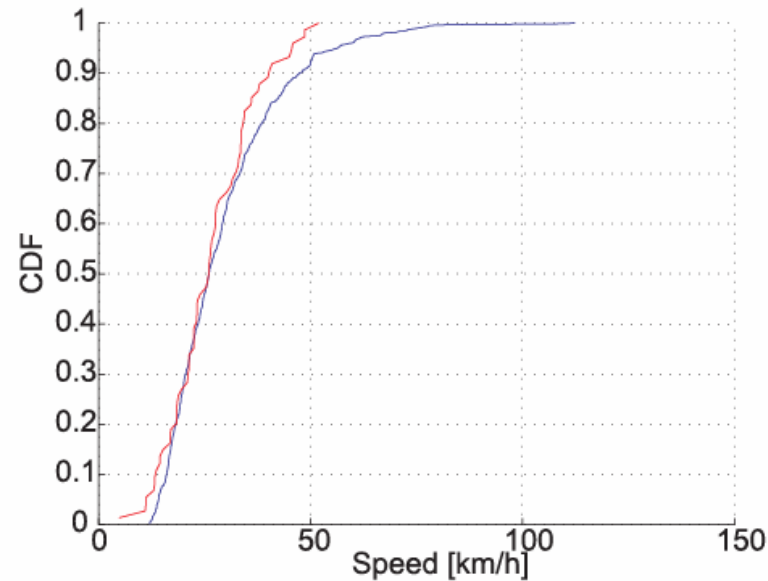
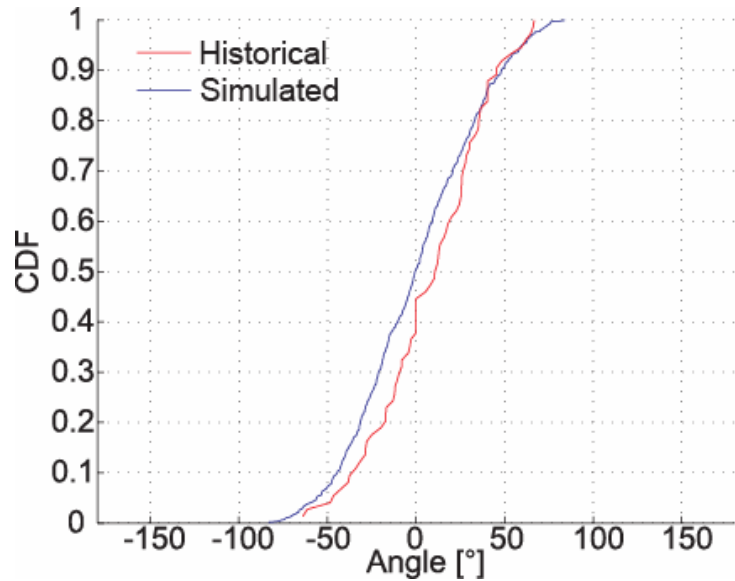
5/17

Map of the northwest Pacific with 30 typhoon tracks



# Transition model

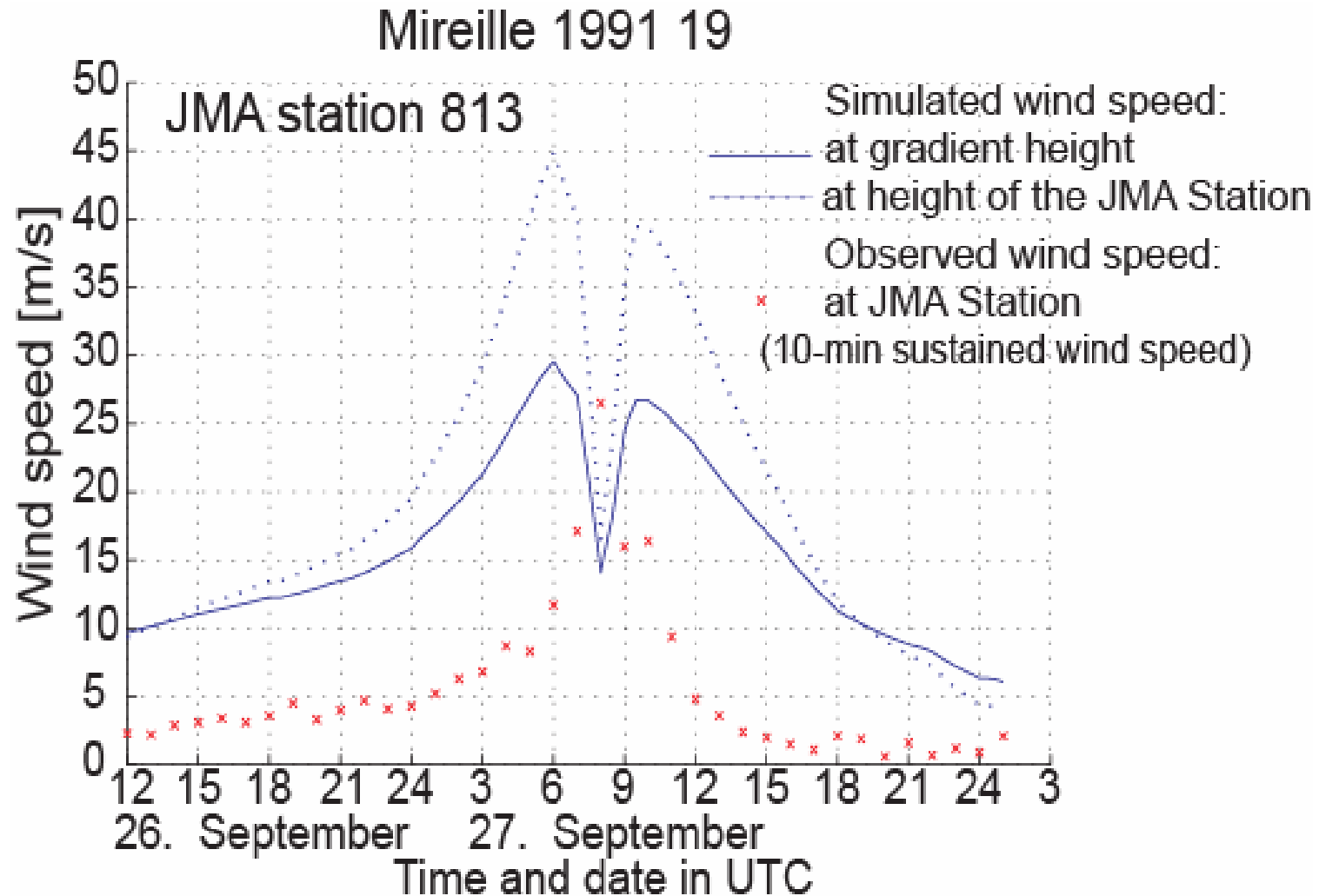
6/17



Comparison of historical and simulated data.  
August; latitude =  $32^\circ$ ;  
longitude =  $120^\circ$ - $160^\circ$

# Wind field and surface friction model

7/17



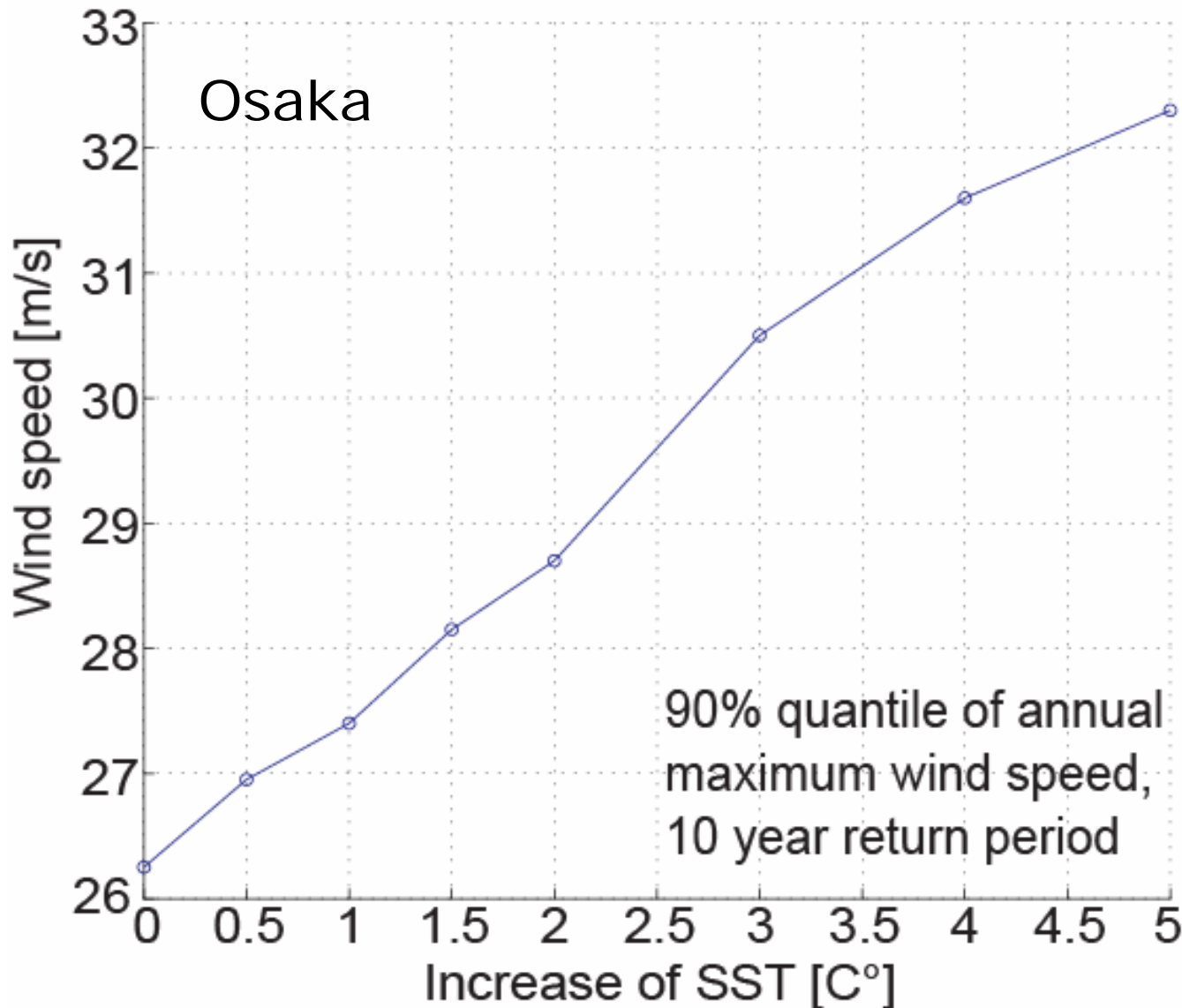
# Adapting typhoon model to climate changes

8/17

Change of the central pressure of typhoons at each time step is modeled as a function of SST.

The effect of climate changes on the intensities of typhoons is considered in terms of SST increase.

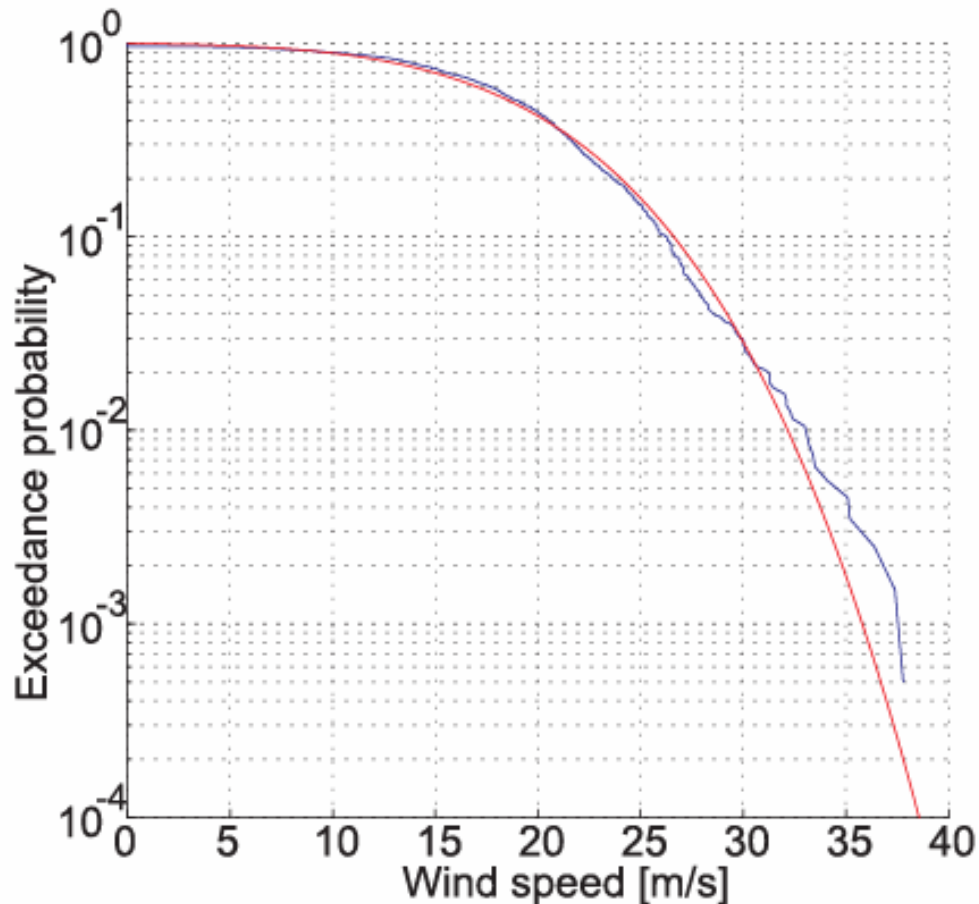
# Increased extreme wind speeds



# Annual maximum wind speed

10/17

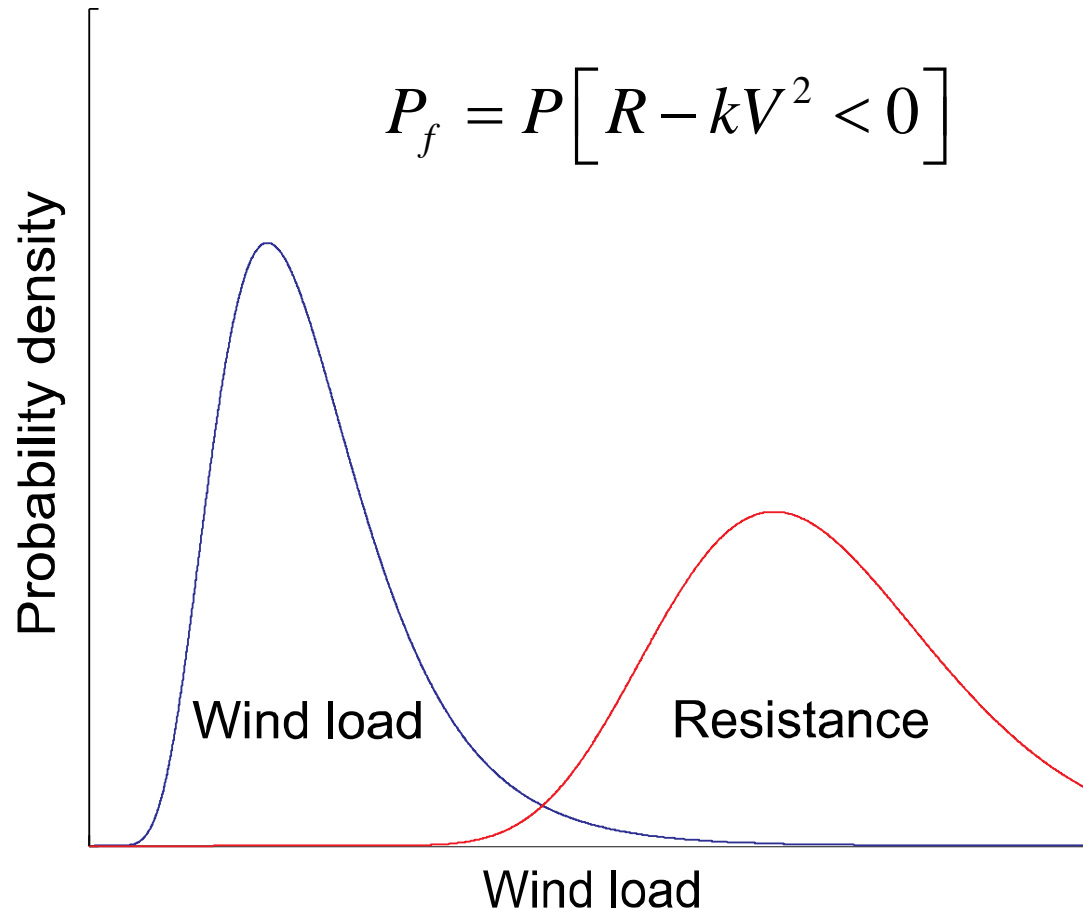
Fitting annual maximum wind speeds to a shifted Weibull distribution



# Probability of failure

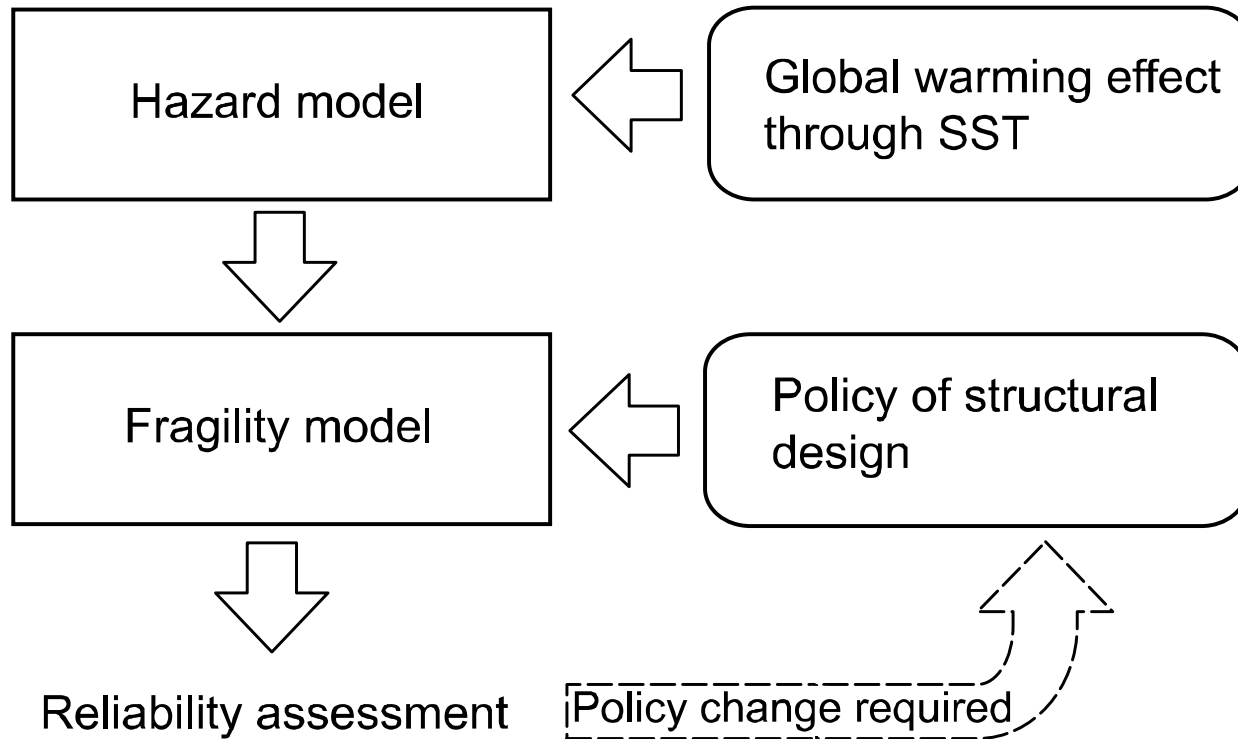
11/17

Target probability of failure:  $p_F \approx 10^{-5} [1/year]$   
(JCSS Probabilistic Model Code)



# Adapting the structural design

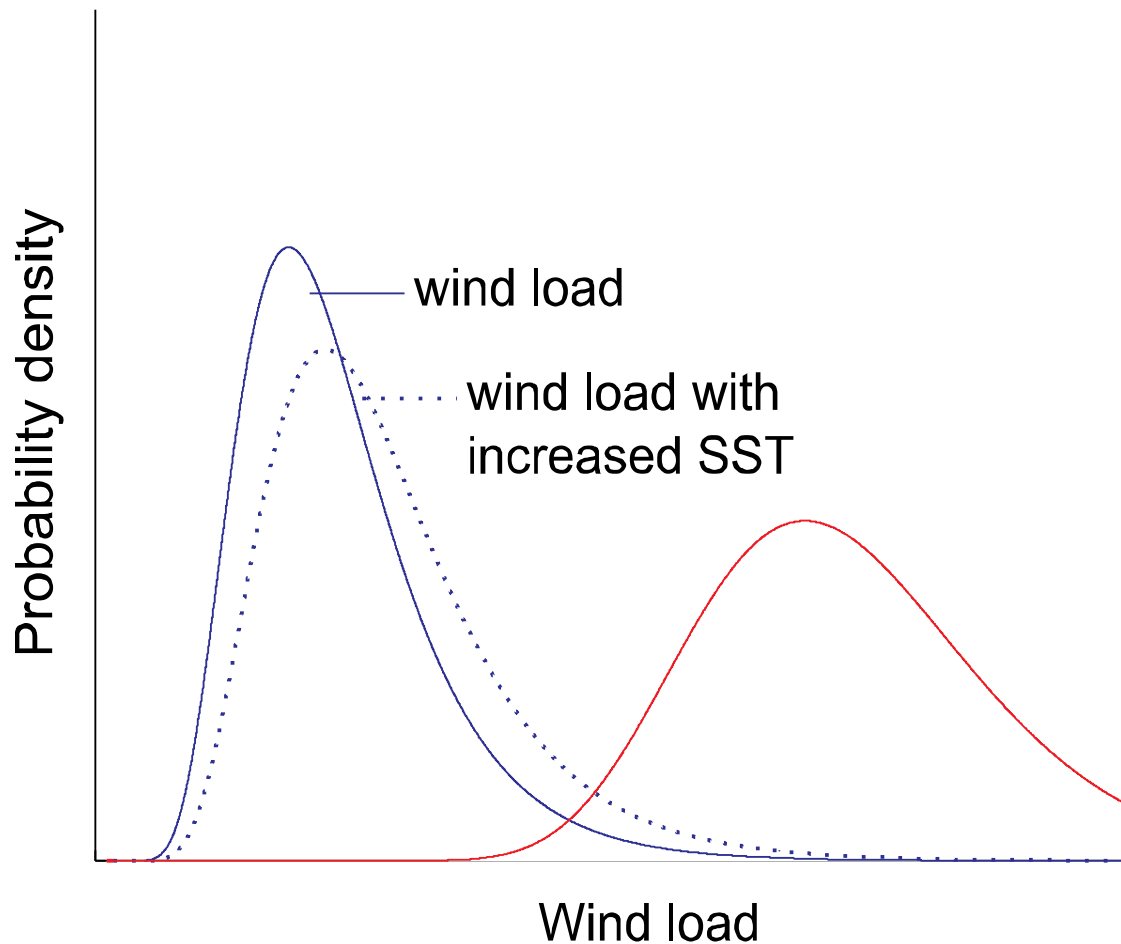
12/17



1. Increase of failure probability due to climate change
2. Adjusting the resistance to maintain failure probability

# Increased probability of failure

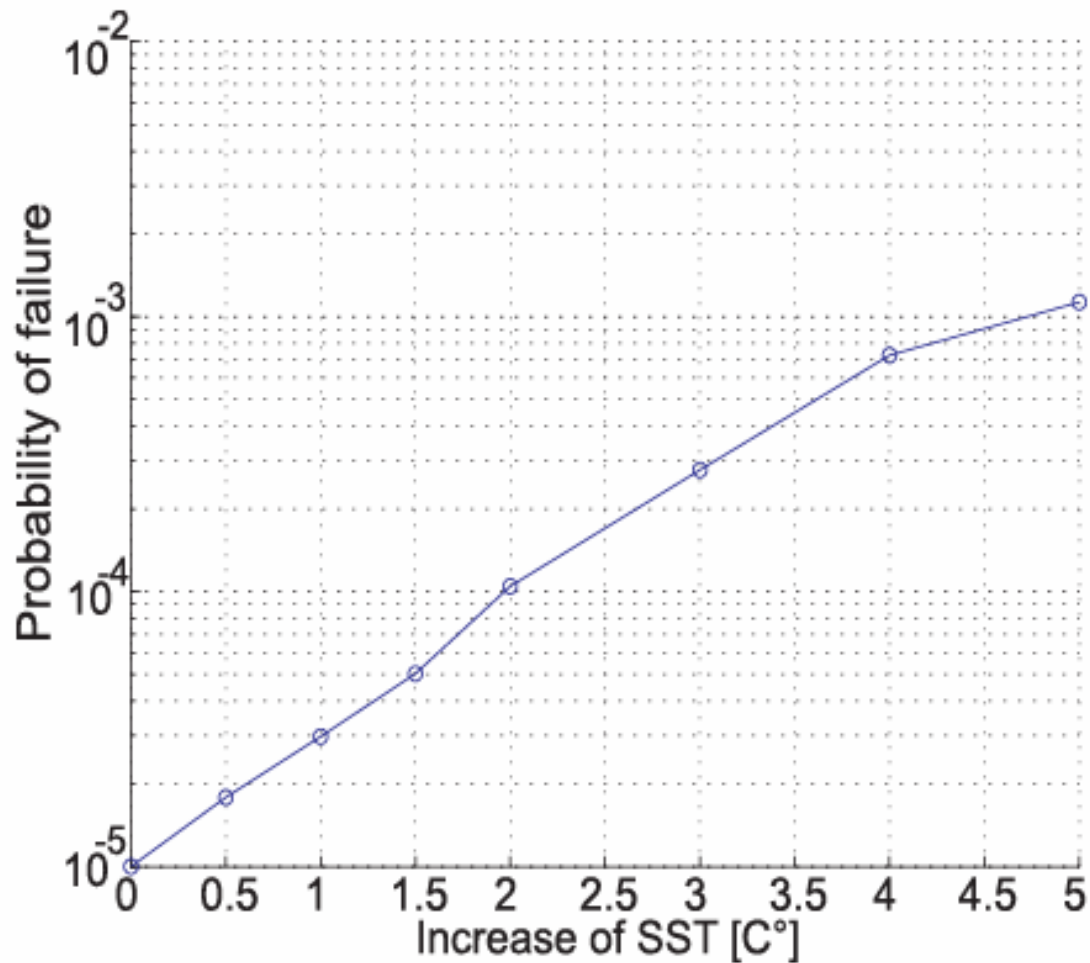
13/17



Changes of the wind loads due to SST increases can lead to the increase of the probability of failure.

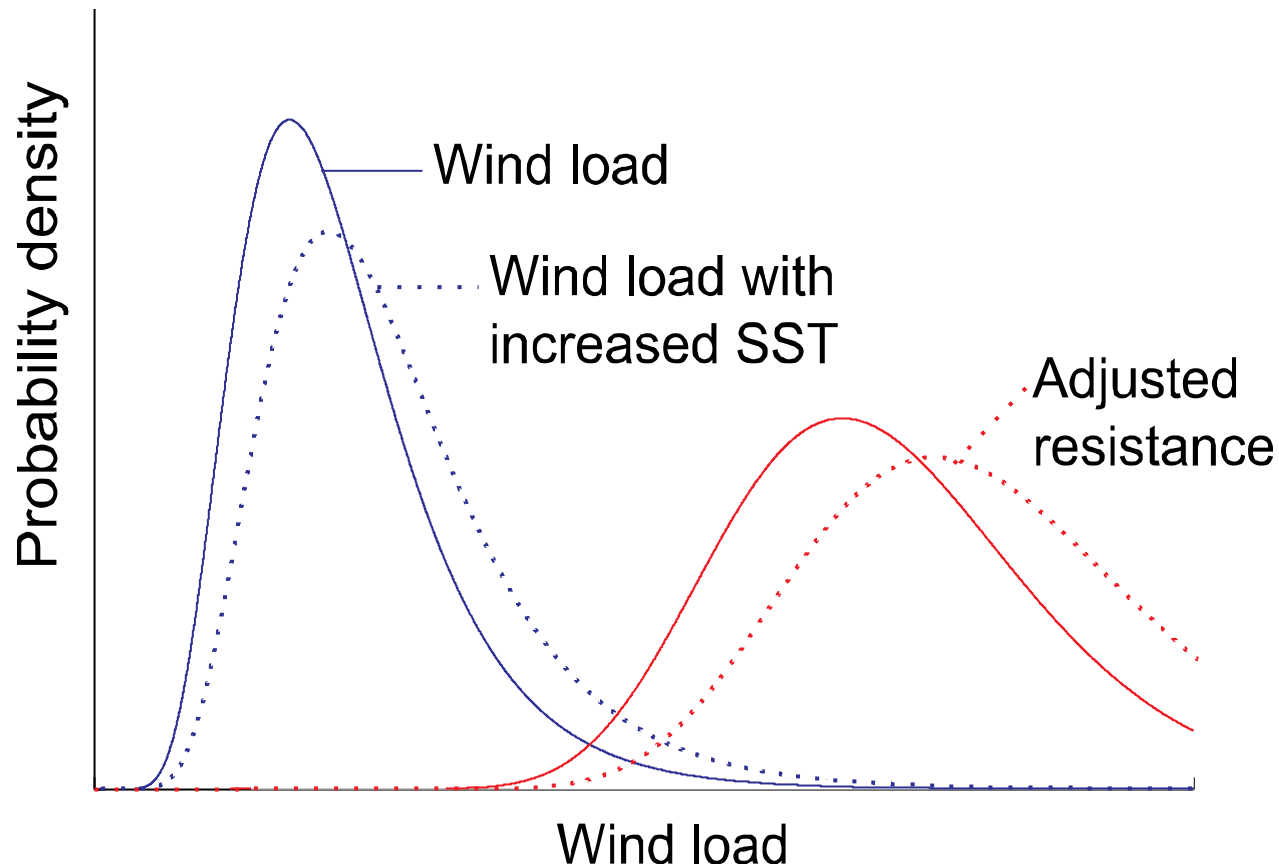
# Increased probability of failure

14/17



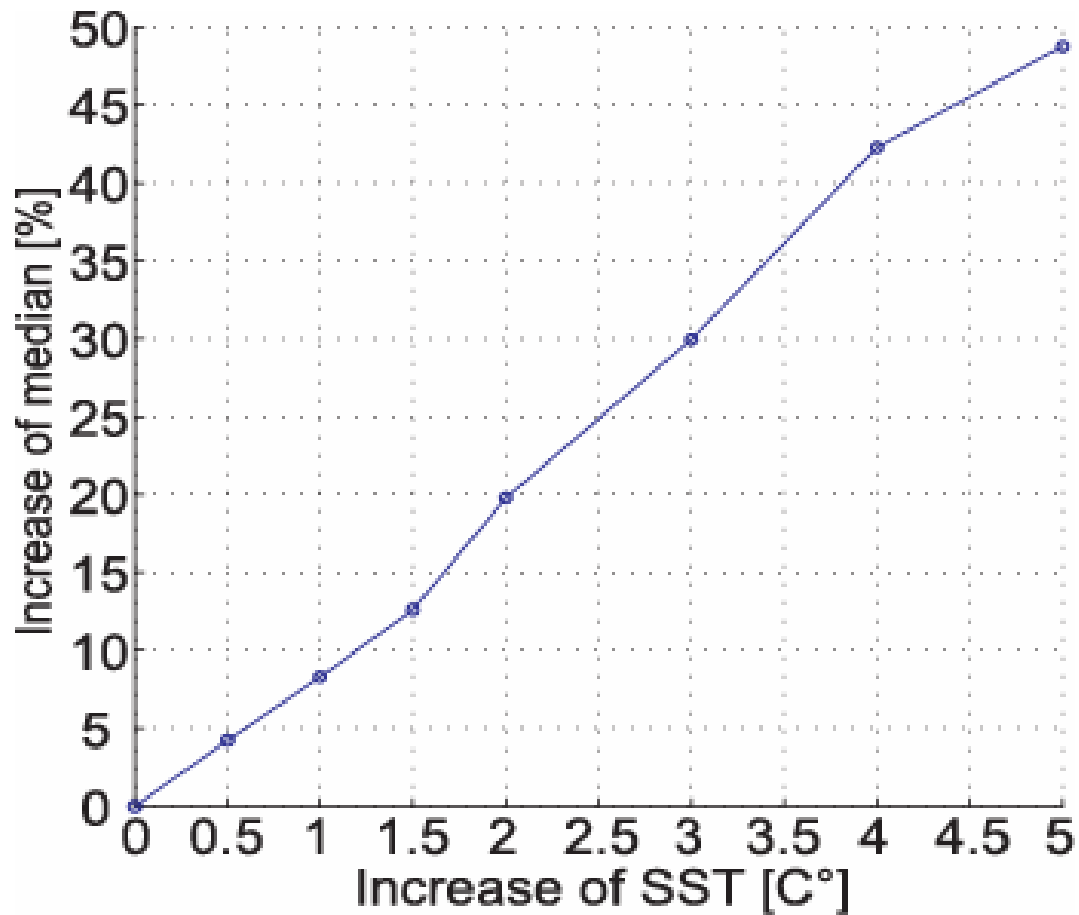
# Adapting the structural design

15/17



Policy change in regard to structural design may be required to maintain structural reliability.

# Adapting the structural design



# Conclusions

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17/17

- Approach to adapt a typhoon model to climate changes is presented.
- Changes of the intensities of extreme wind speeds induced by typhoons due to SST increases are investigated.
- Significant increase of the probability of failure of structures may occur.
- Changes of the policies in regard to structural design may be required to maintain the present level of structural reliability.