

# Study on climate change impact on human health

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Collaboration with Phung Vera Ling Hui, Yasuaki Hijioka (NIES)

Yasushi Honda, Kim Satbyul Estella (University of Tsukuba/NIES)

# Study team

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## ■ Background

- Climate change is threatening to human health domestically and globally.
- NIES CCCA has been organizing and strengthening a study team to conduct studies on human health impact by climate change since 2020.

## ■ Core member

- Kazuataka Oka (NIES)
- Phung Vera Ling Hui (NIES)
- Hijioka Yasuaki (NIES)
- Yasushi Honda (University of Tsukuba/NIES)
- Kim Satbyul Estella (University of Tsukuba/NIES)

# Research projects

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## 1. NIES adaptation research program (2021-2025)

- ① Study on combined impacts of climate change and air pollution on human health and projection of their impacts in Asia (PJ1-2a/PJ2-2a)
- ② Study of climate change impact on human health and its future projection in Japan (PJ1-3e/PJ2-3e)

## 2. Collaborative research with LCCAC (2020; 2021-2023)

- Study on climate change impact on human health

## 3. JST e-ASIA Joint Research Program (2021-2023)

- Climate change and human Health in Asia: current impacts, future risks, and health benefits of mitigation policies

# 1-① NIES adaptation research program

## ■ Temperature increases

- In Japan, the temperature is increasing at the rate of 1.24 °C/100 years.
- In Tokyo, the temperature is increasing at the rate of 2.5 °C/100 years.

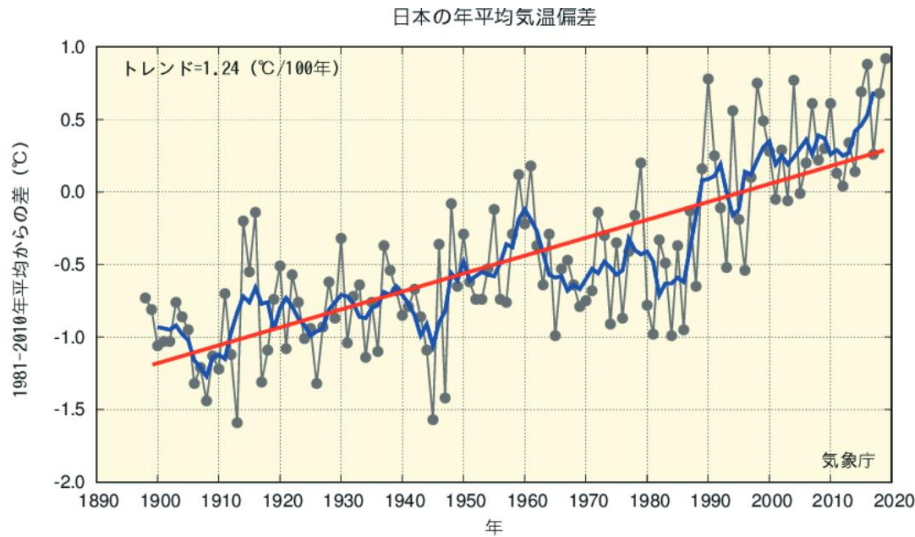


図 I.1-1 日本の年平均気温偏差の経年変化 (1898~2019 年)

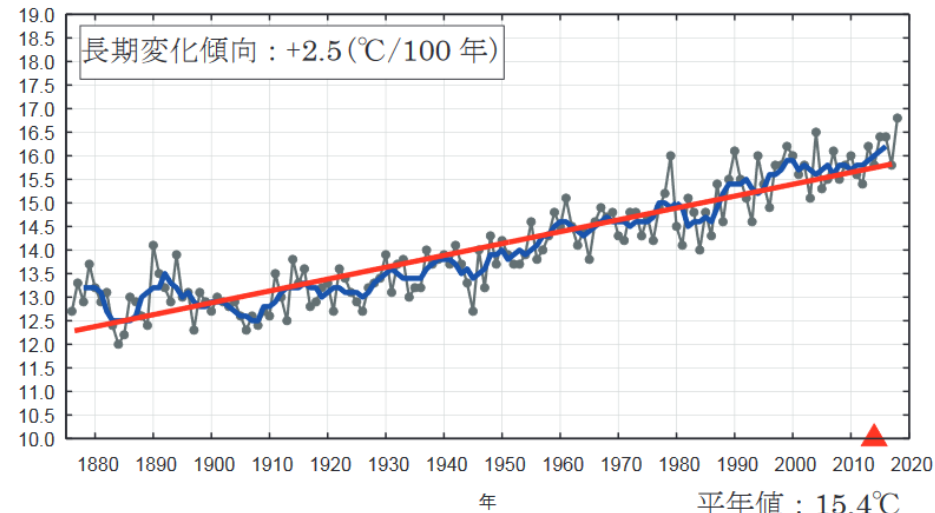


図 1.7.1 東京管区気象台の年平均気温の経年変化

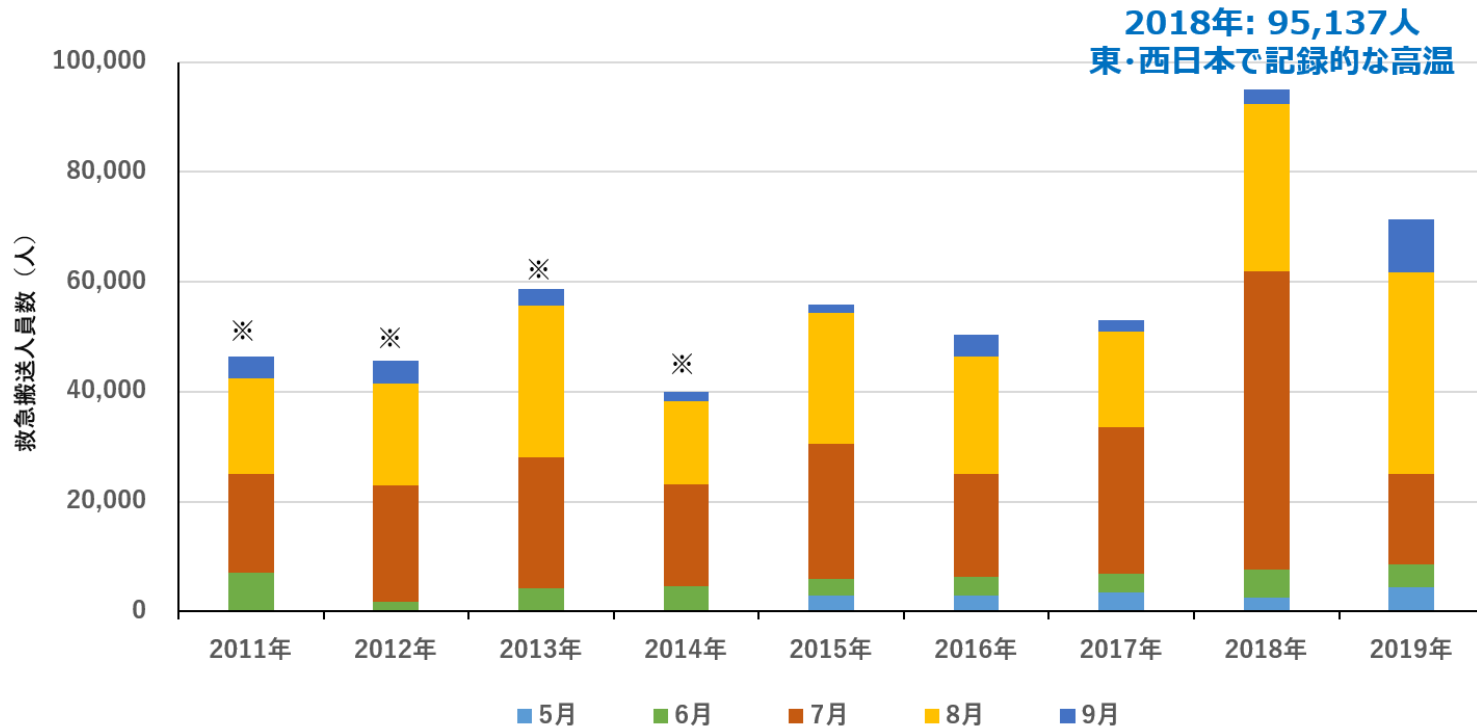
Source : right : 気象庁「気候変動監視レポート2019」; left : 気象庁「気候変化レポート 2018 - 関東甲信・北陸・東海地方 -」

# 1-① NIES adaptation research program

## ■ Heatstroke patients

- More than 40,000 people are transported by ambulance each year due to heatstroke.

熱中症による救急搬送人員数の経年変化



※2011-2014年は5月の調査データなし

出典：下記資料を基に国立環境研究所が作成。

総務省消防庁「平成29年（5月から9月）の熱中症による救急搬送状況」[https://www.fdma.go.jp/disaster/heatstroke/item/heatstroke001\\_houdou\\_01.pdf](https://www.fdma.go.jp/disaster/heatstroke/item/heatstroke001_houdou_01.pdf)

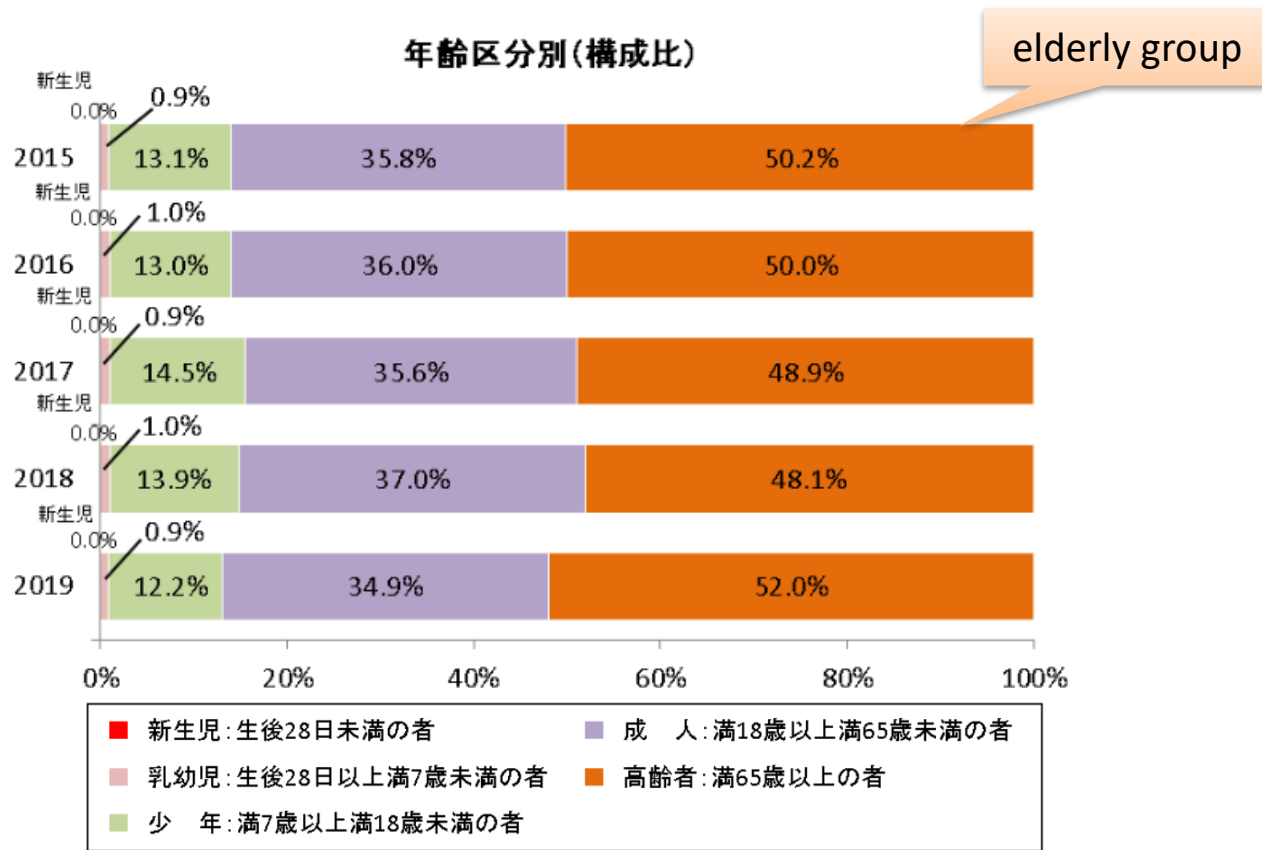
総務省消防庁「平成30年（5月から9月）の熱中症による救急搬送状況」[https://www.fdma.go.jp/disaster/heatstroke/item/heatstroke003\\_houdou01.pdf](https://www.fdma.go.jp/disaster/heatstroke/item/heatstroke003_houdou01.pdf)

総務省消防庁「2019年（5月から9月）の熱中症による救急搬送状況」[https://www.fdma.go.jp/disaster/heatstroke/items/heatstroke\\_geppou\\_2019.pdf](https://www.fdma.go.jp/disaster/heatstroke/items/heatstroke_geppou_2019.pdf)

# 1-① NIES adaptation research program

## ■ Heatstroke patients

- The elderly population (>64 years) accounts for 50% of the patients.
- Heatstroke is a very serious issue for Japan's aging society.



Source : 総務省消防庁「2019年(5月から9月)の熱中症による救急搬送状況」

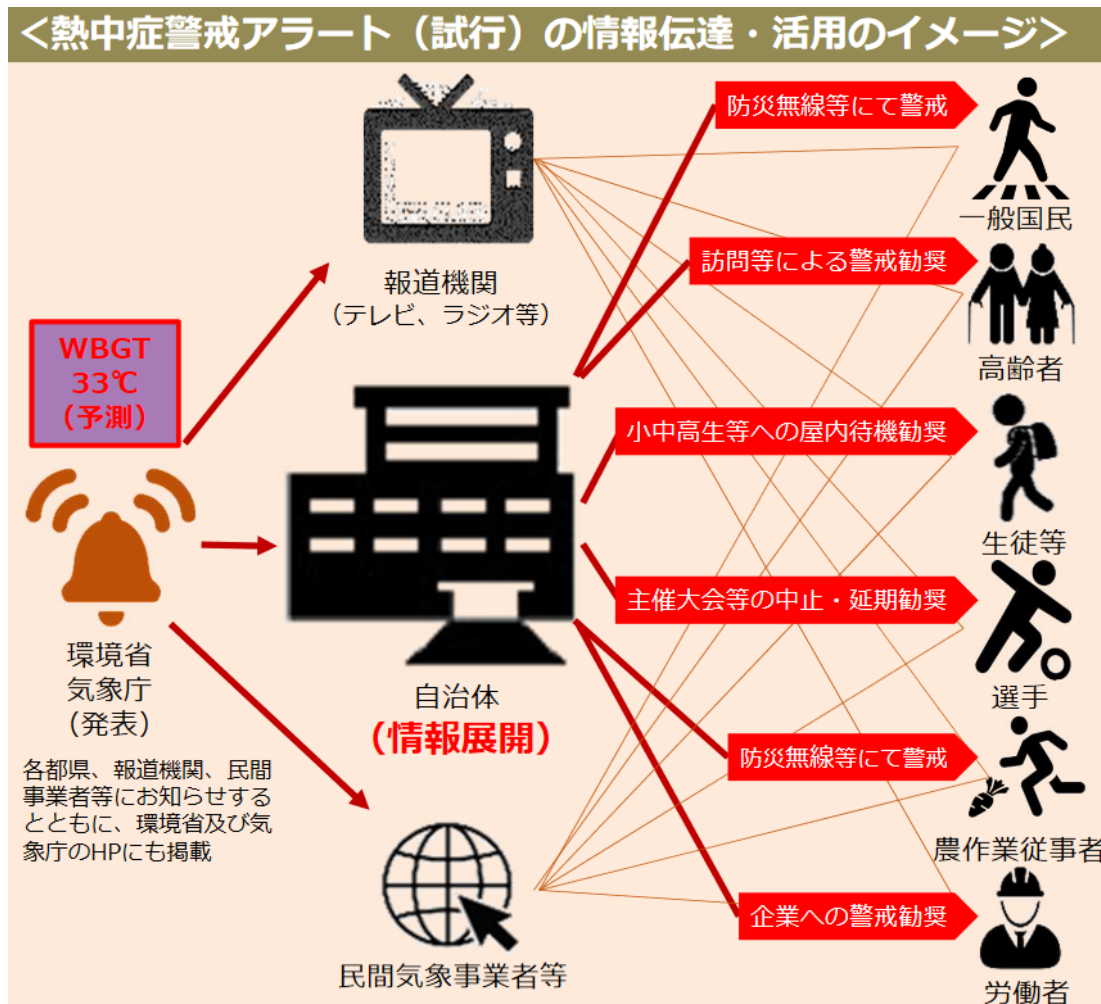
# 1-① NIES adaptation research program

## ■ Description

- A “heatstroke alert” is issued when the **Wet Bulb Globe Temperature (WBGT)** is expected to reach 33 °C or higher on a given or next day.

## • Target region

- ✓ In 2020, only Kanto-Koshin was issued.
- ✓ expanded to other regions from 2021.



Source : 気象庁「熱中症予防対策に資する効果的な情報発信に関する環境省と気象庁の共同検討会の開催」

# 1-① NIES adaptation research program

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## ■ Wet Bulb Globe Temperature (WBGT)

- The WBGT is a type of apparent temperature used to estimate the effect of temperature, humidity, wind speed (wind chill), and radiation on humans.
- The WBGT is used by industrial hygienists, athletes, sporting events and the military to determine appropriate exposure levels to high temperatures.

$$WBGT = 0.7T_w + 0.2T_g + 0.1T_d$$

**T<sub>w</sub>**: Natural wet-bulb temperature (combined with dry-bulb temperature indicates humidity)

**T<sub>g</sub>**: Globe thermometer temperature (measured with a globe thermometer, also known as a black globe thermometer)

**T<sub>d</sub>**: Dry-bulb temperature (actual air temperature)



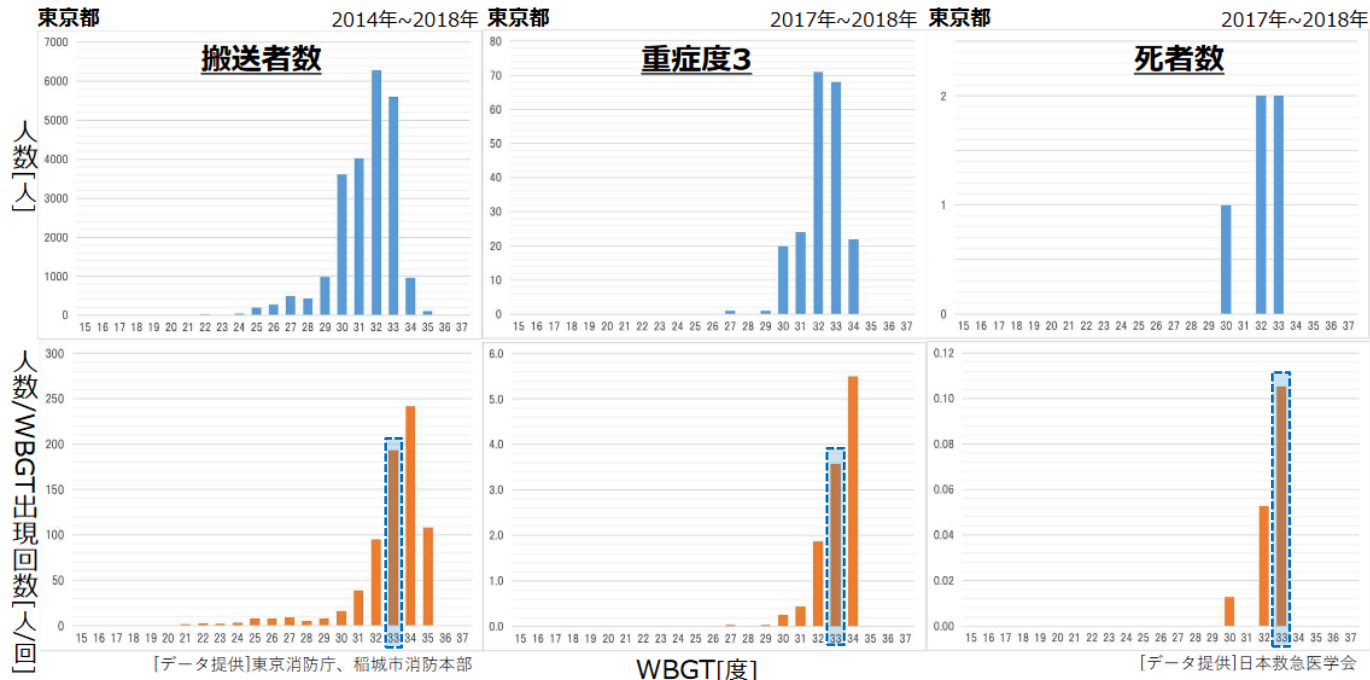
# 1-① NIES adaptation research program

## ■ Why WBGT of 33°C ?

- The numbers of patients and deaths increased significantly when the WBGT exceeded 33 °C in case of Tokyo → **33 °C is set as the reference value.**

救急搬送中の重症例や死亡等のデータから基準の妥当性を確認したところ、以下のとおりであった。

- いずれのデータにおいても暑さ指数が上昇すると発生者数が急増する関係となっており、搬送者数の傾向と大きな違いはない。
- 重症度3・死者数はデータが少ないものの、総じて、**総数(青色)は32°Cで多くなる傾向である一方、1回当たりの人数(橙色)は33°C以上で顕著に増加する。発表頻度や適中率(参考資料参照)も考慮すると、WBGT33°Cを基準とすることが妥当ではないかと考えられる。**



(参考) WBGT35度は、2014年7月27日の1回のみ。

# 1-① NIES adaptation research program

## ■ Background

- The incidence of heatstroke when the daily maximum WBGT at 33°C vary by region.
- Need to investigate the regional characteristics of heatstroke and to verify the validity of this criterion.

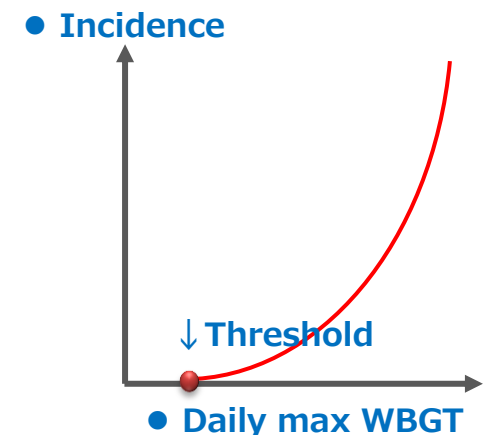
## ■ Objective

- ① The impact of WBGT of 33°C on the numbers of patients will be different by region.

→ Calculate the incidence of heatstroke by prefecture given the reference value (WBGT of 33 °C)

- ② The WBGT threshold for increases in the numbers of patients may differ by region.

→ Calculate the daily maximum WBGT at which heatstroke start to increase by prefecture



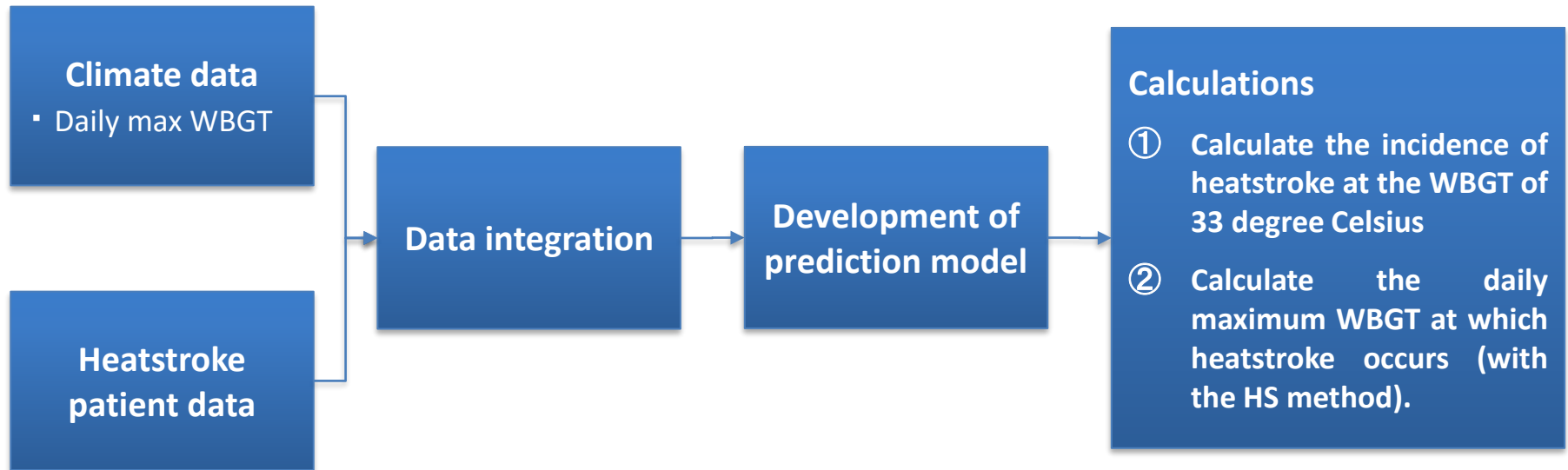
# 1-① NIES adaptation research program

## ■ Analysis Flow

- The analysis flow is shown below.

### ➤ Method

- Construction of relationship between number of patients and daily max WBGT by prefecture. (quasi-Poisson glm)



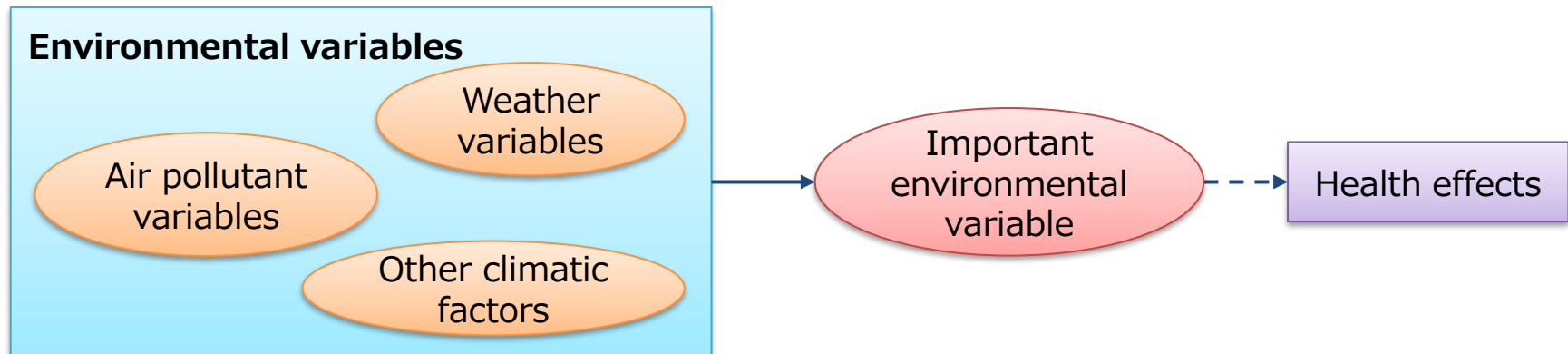
## 1-② NIES adaptation research program

- ① Association between PM10, smoke haze, and under-5 mortality in Klang Valley, Malaysia ⇒ *Poster (P-28) by Vera-san*
- ② Investigating the association between temperature and under-5 mortality in Malaysia: an epidemiological approach



*What is the health risk if the population is exposed to variation in temperature?*

- ③ Identifying important environmental variables in the association with under-5 mortality in Malaysia: a random forest approach



# Conclusion

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- NIES CCCA has been organizing and strengthening a study team to conduct studies on human health impact by climate change since 2020.
- We have been conducting various studies targeting not only for Japan but also Asia under several projects.
- We welcome collaborative research with researchers in the AIM group!

**Thank you for kind attention**

