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Water management changes in irrigation and drainage canals under climate change and urbanization

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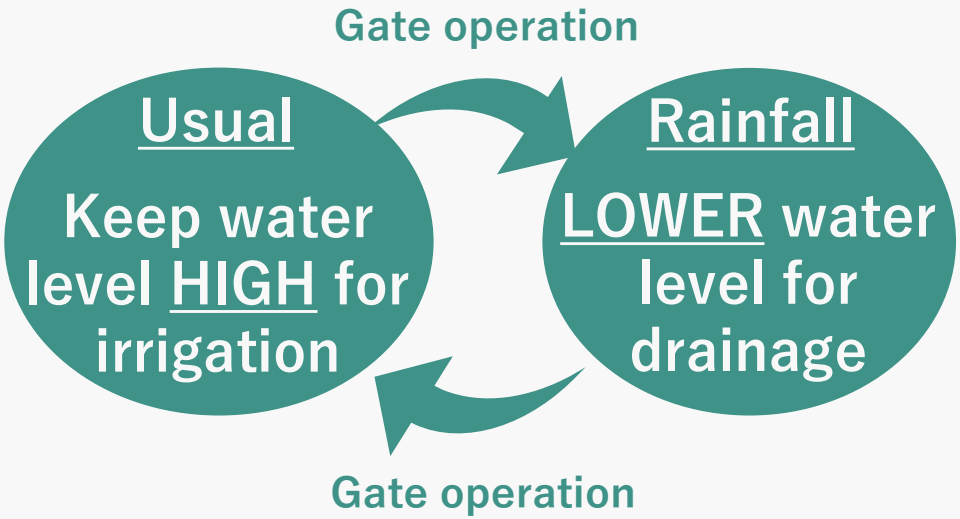
- **Increased localized heavy rainfall and urbanization**
  →Increased risk of flooding
- **Areas undergoing urbanization**
  →Infrastructure facilities such as canals have flood protection functions
- **Most of the studies focused on the function of just facilities**
  There is little consideration of the function of flood prevention by water management for irrigation or drainage purposes

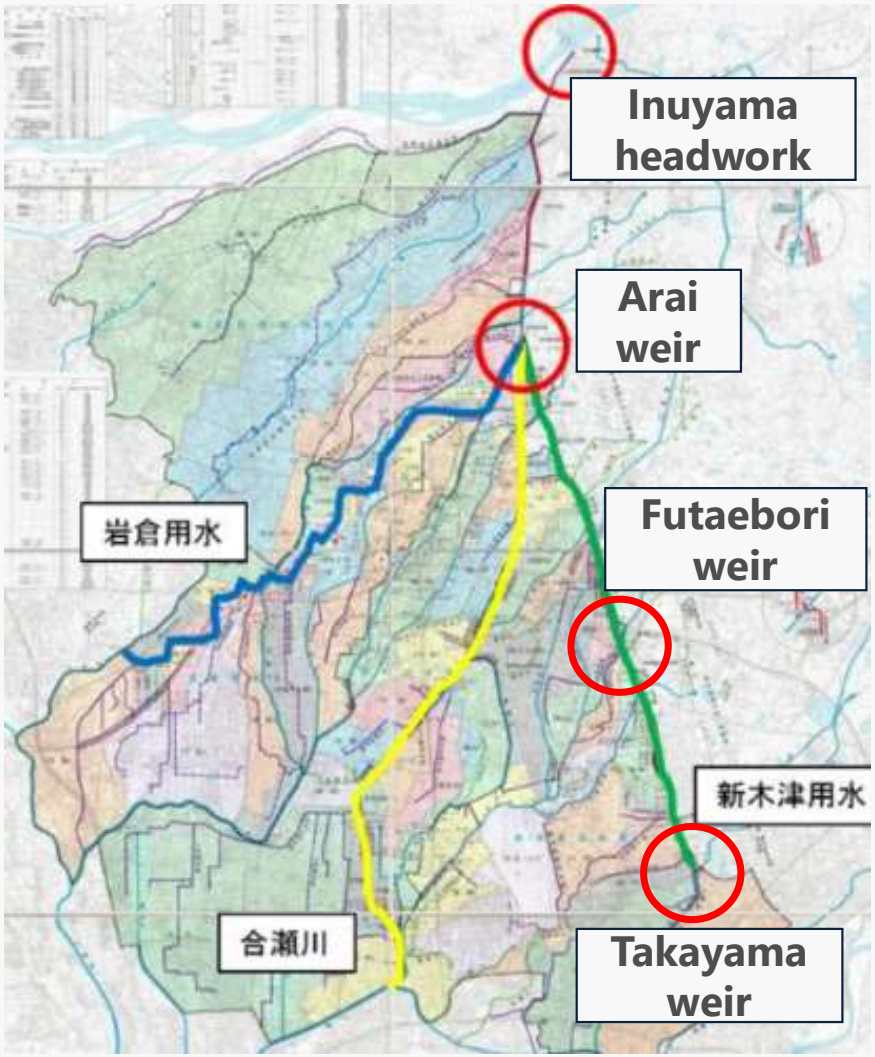


- **What is the irrigation and drainage canal?**
  - Receives water irrigation and drainage in the same canal
- **To satisfy both of the purpose irrigation and drainage, adjust gate opening and change to the appropriate water level**
- **LID operates the gate mainly for irrigation**

Purpose of Research

- **Evaluate the difference in the number of gate operations**
- **Consider factors that lead to different operation counts**

Method: Water use of the study area



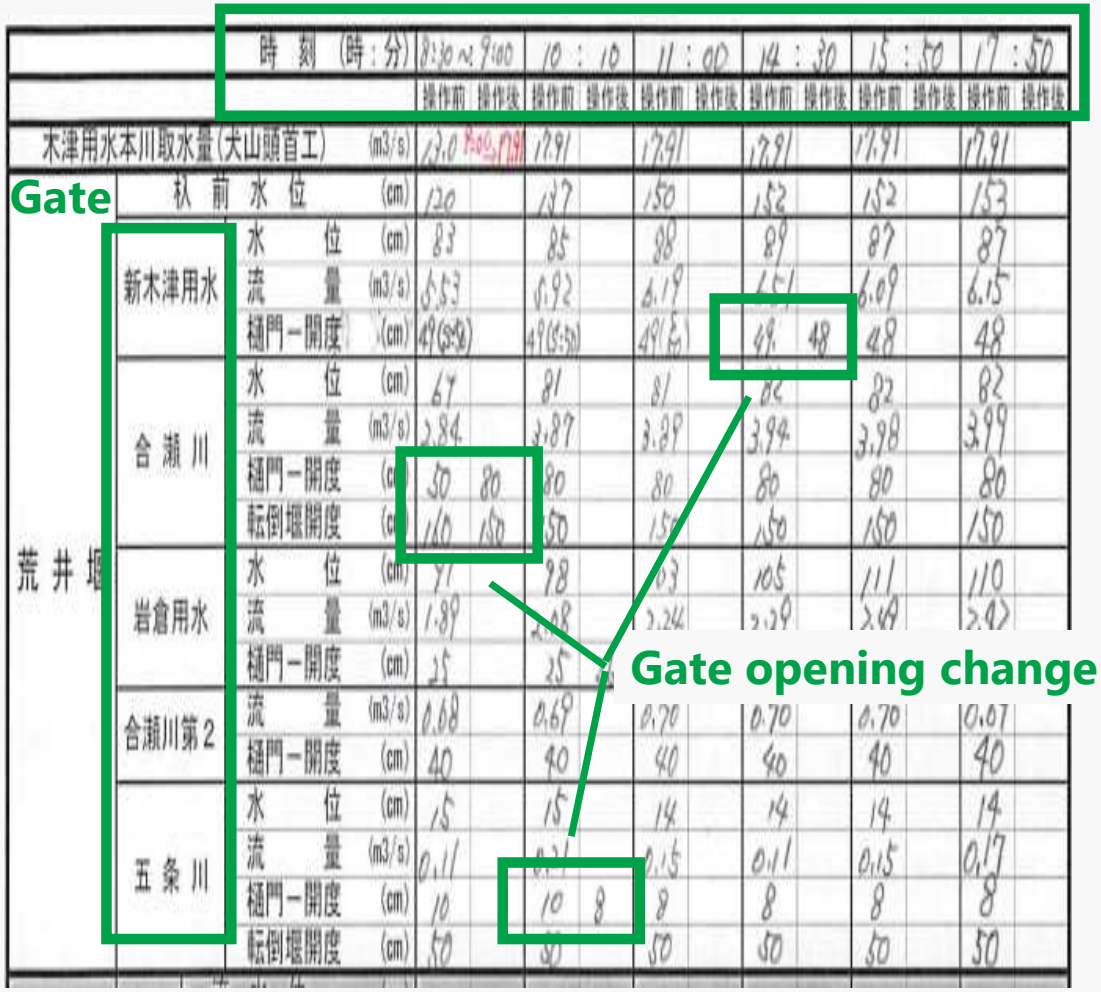
- **Kotsu irrigation district**
  - Draw water from Inuyama headwork and irrigate on the west side
  - Several rivers from the east inflow to the main canal
  - Bedtown of Nagoya→Significant urbanization

Change in Beneficiary Area of Kotsu Irrigation

Year	1994	2007	2021
Beneficiary Area(ha)	2,255	1,821	1,421

- **Target three weirs that have important role for flood prevention**

Method: Extract gate operation count



- Data obtained from Daily Logbook handwritten by Kotsu irrigation LID
  - Recoad water levels, flow rates, and gate operation
  - Regular recoad + Additional recoad
- Extract number of gate operation and time
- Past: 1994~1998
  Present: 2017~2021
- Only irrigated season (4/1~9/30)

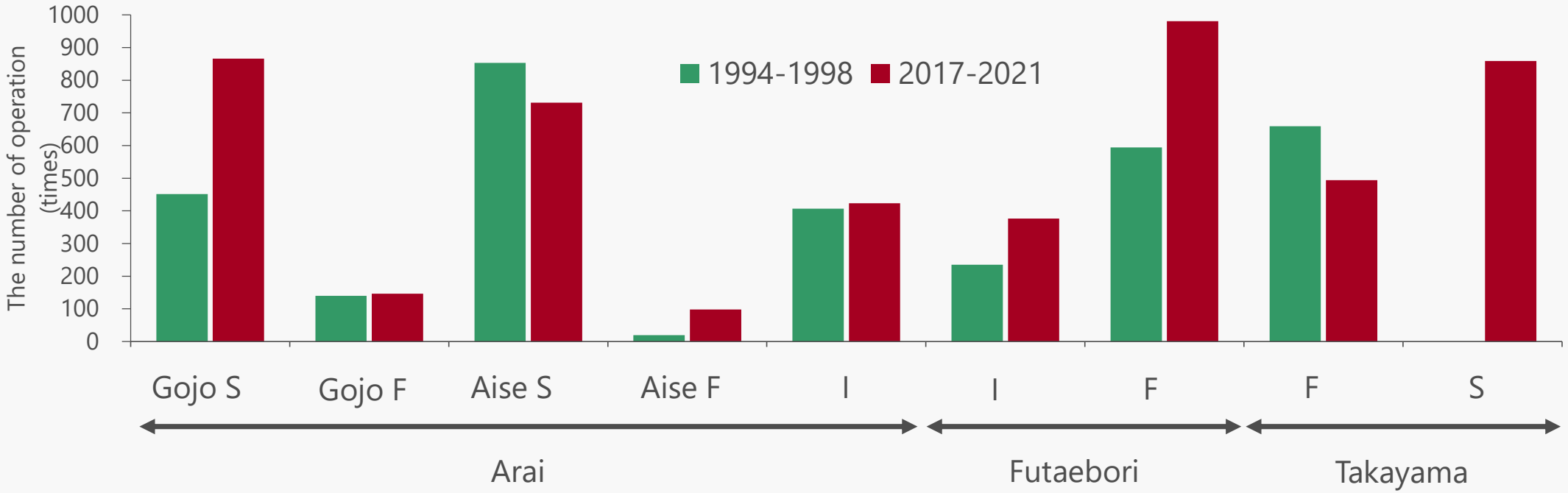
- **TOTAL number of gate operations**
- **Number of gate operations by RAINFALL INTENSITY**
  - Rainfall data: AMeDAS observations near the study site
  - Connect gate operations to daily maximum values of hourly rainfall

Classes of rainfall intensity

- 0-5mm : operate for IRRIGATION
- 5-10mm
- 11-20mm : operate for DRAINAGE
- 21-mm

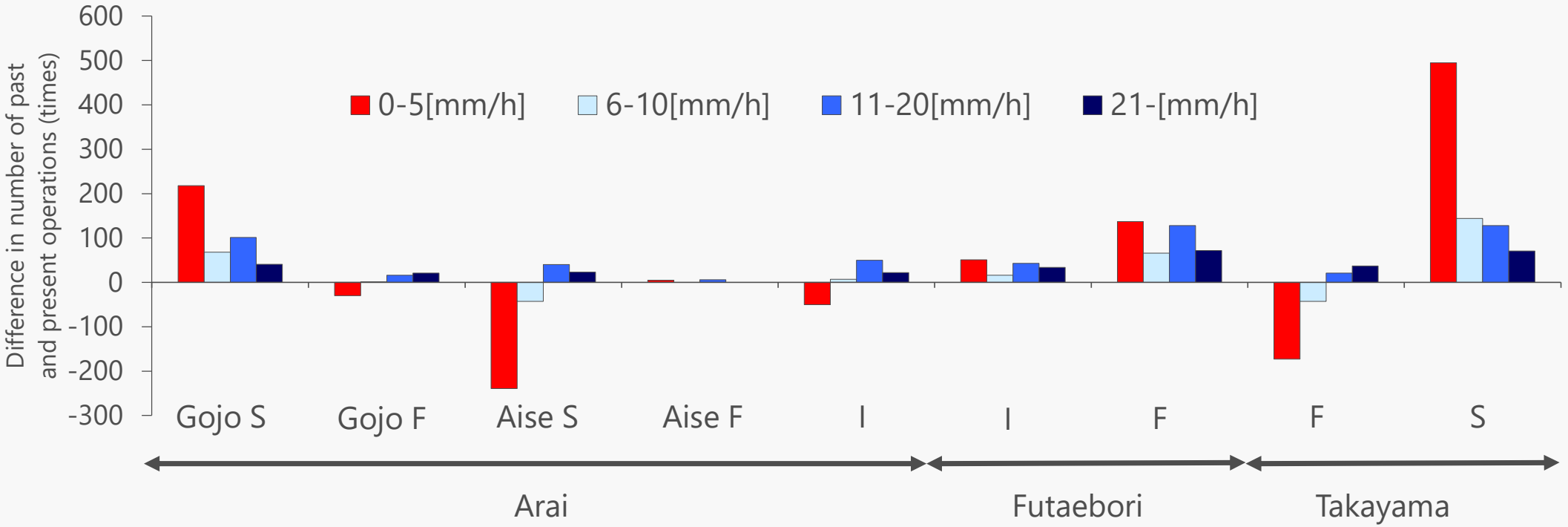
- **Number of gate operations PER DAY by rainfall intensity**
  - Dividing the total number of gate operations by the number of days in the same rainfall intensity class
  - Remove the effect of rainfall change, only affect the urbanization

Result: Comparison of total number of gate operation



- **Trend of increase/decrease varies from each gate due to changing the order of operations, updating gate and constructing a new gate.**

Result: Comparison of number of gate operations PER DAY by rainfall intensity

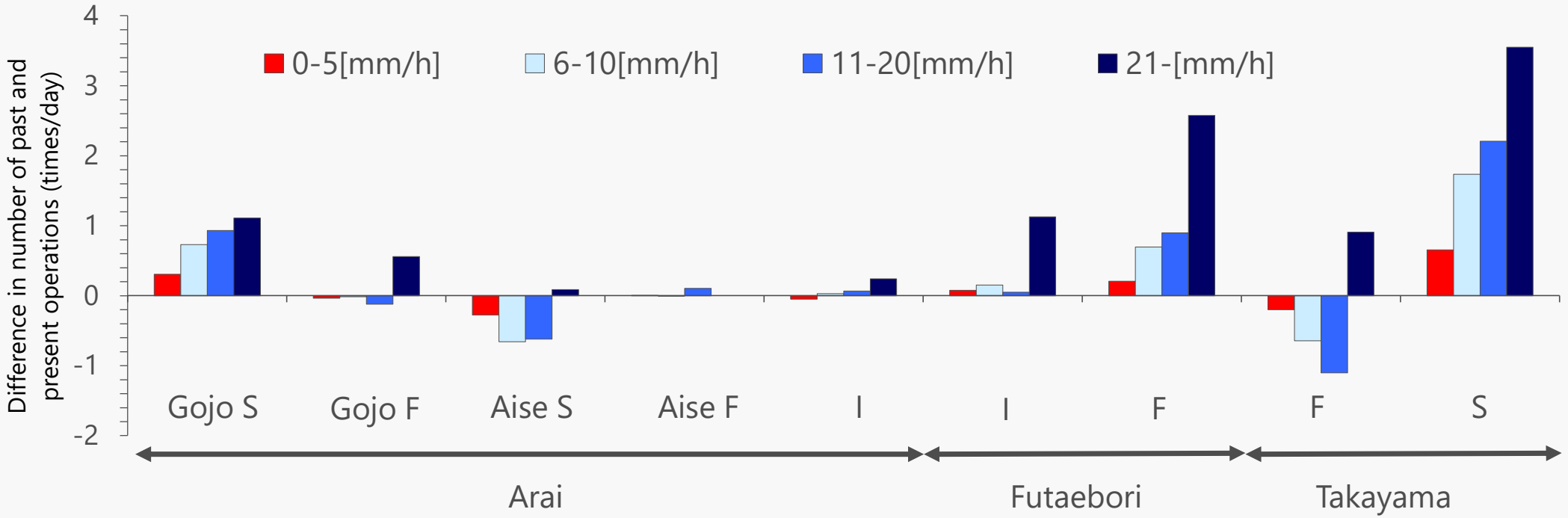


- **Effected by rainfall change and urbanization**
  - Irrigation purpose: decrease
    due to raise water level for irrigation in past
- **Drainage purpose: increase**

Number of days

Rainfall intensity	0-5	6-10	11-20	21-
Past	798	77	29	11
Present	754	83	58	20

Result: Comparison of number of gate operations PER DAY by rainfall intensity



- **Affected only by urbanization**
- **Irrigation purpose: same → Urbanization has had little impact.**
- **Drainage purpose: increase → Urbanization has impact. Particularly affected during heavy rainfall.**

- A comparison of the total number of gate operations did not reveal the relationship between water management, rainfall change, and urbanization.
- Comparison by rainfall intensity showed an increase in the number of operations for drainage purposes, which was particularly evident in the effect of rainfall changes.
- When the effects of rainfall changes are excluded, it is clear that urbanization has increased operations for drainage purposes.