雨天時越流量分布と潮汐条件を反映したお場における大腸菌濃度変化データベース
Database of *Escherichia coli* concentration change at Odaiba seaside park reflecting combined sewer overflows distribution and tidal conditions

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Background

Odaiba seaside park is famous as a location for water activities and a triathlon race venue during Tokyo 2020 Olympic and Paralympic Games. The park is faecally contaminated after rainfall. Therefore, a 3D water quality model was developed to reproduce *E. coli* concentration as a water safety indicator considering combined sewer overflows (**CSOs**). Using the model, **a database of *E. coli* temporal trends was constructed under varied rainfall patterns and tidal conditions**. The database can assist in forecasting the water safety for bathing in combining with on-site water quality monitoring. The forecasting information can be provided to swimmers in advance.

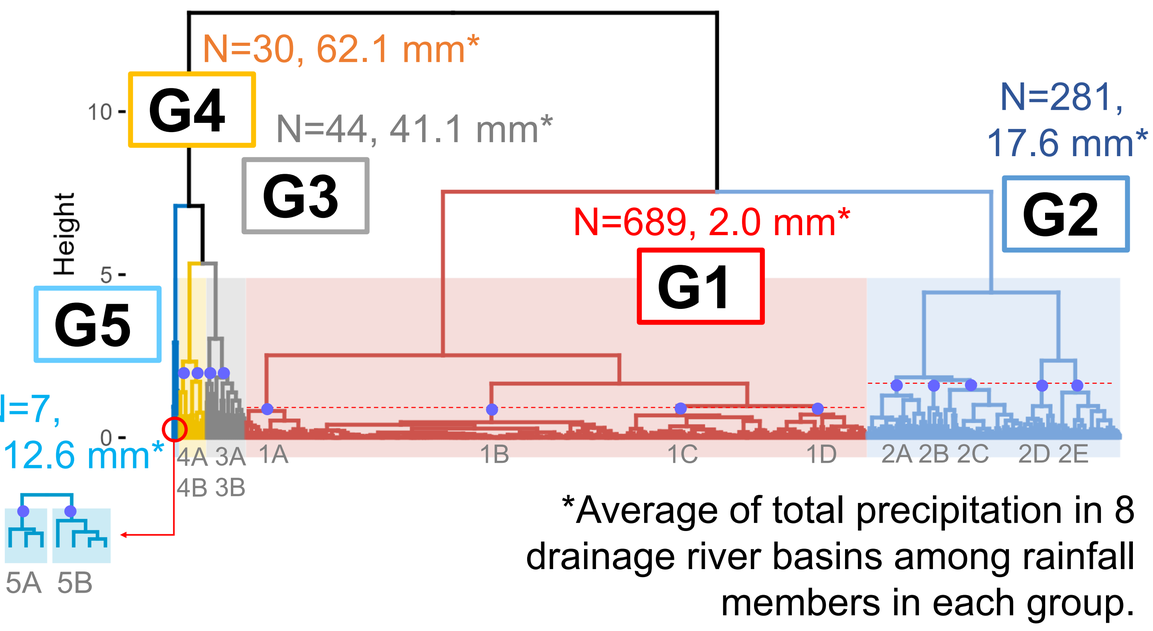
Objectives

- To construct a database of *E. coli* concentration change for the purpose of bathing water quality forecasting.
- To investigate tidal effects on *E. coli* temporal trend after rainfall events with different characteristics.

Materials and Methods

➢ Rainfall categorization by *Cluster analysis*

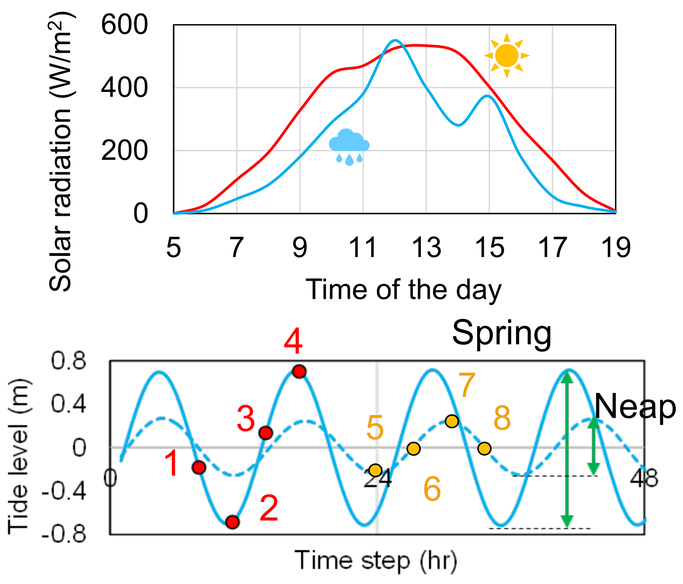
1051 rainfall events in **2008 – 2020** was categorized into **5** groups (with sub-groups) using *Drainage area-weighted* rainfall data (Max. hourly rainfall intensity, Rainfall duration, and Total precipitation)



*Average of total precipitation in 8 drainage river basins among rainfall members in each group.

➢ Input data

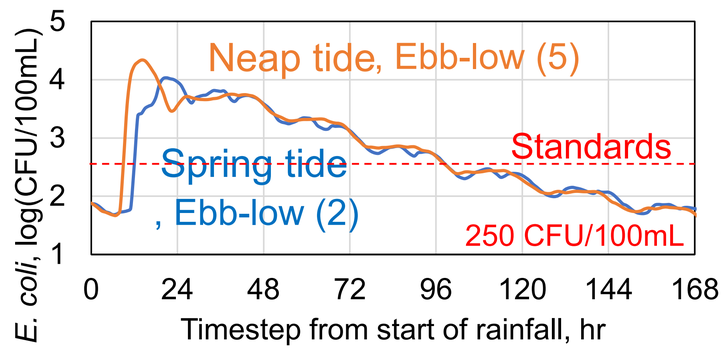
- ✓ Weather data ex. actual sunlight radiation data (cloudy during rain and sunny after rain)
- ✓ Rainfall data from representative rainfall events in 5 groups
- ✓ 8 tidal scenarios from the start of rainfalls



Results and Discussion

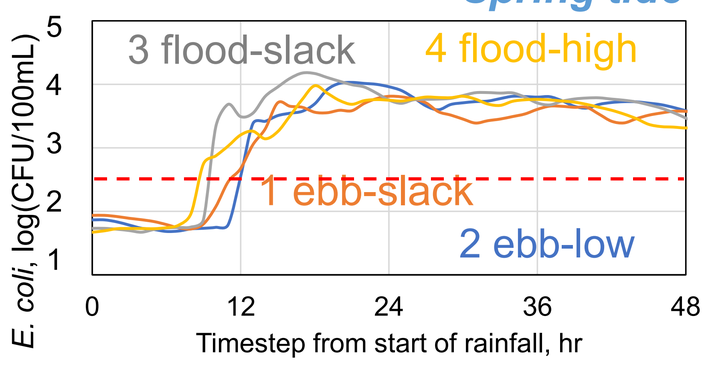
➢ Tidal effects on *E. coli* temporal trend in small rainfall group (Group2B)

Total rain = 10.5 mm., Max. intensity = 9 mm./hr., Duration = 2 hrs.



It is shown that **tide conditions** (spring and neap tides) affects the timing of *E. coli* rising trend and peak concentration. Under the neap tide condition, the mixing and dilution of polluted water is limited.

→ When rainfall starts at different timing of tidal phase

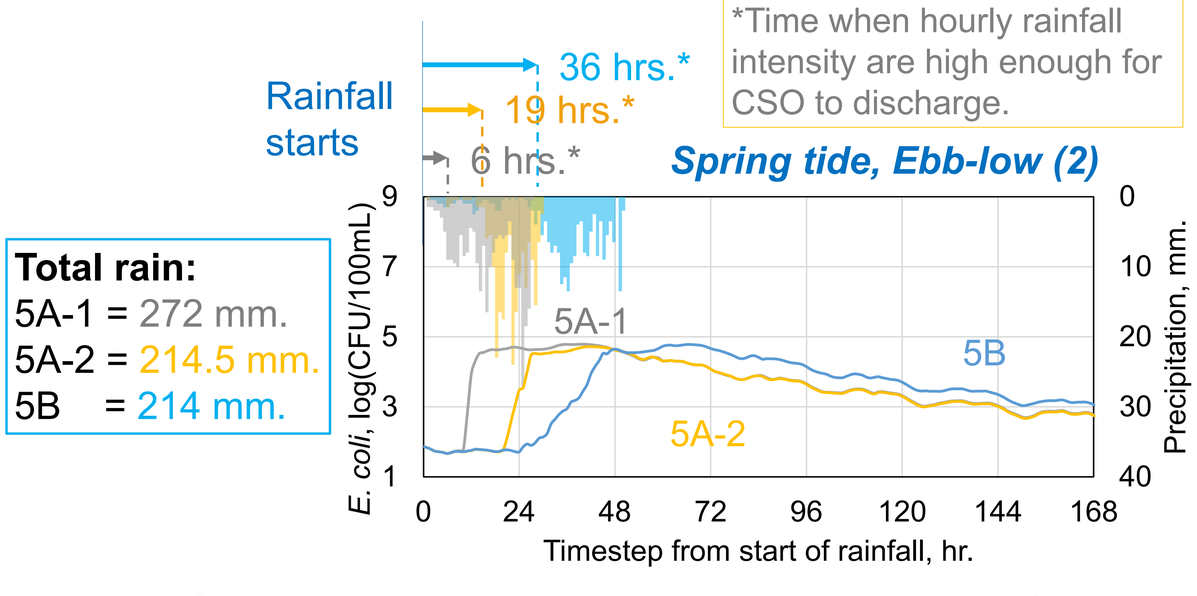


E. coli temporal trends are also distinct depending on the **tidal phase**, which rainfall started.

➢ *E. coli* temporal trend depending on timing of strong rainfall intensity in intense rainfall group (Group5)

*Time when hourly rainfall intensity are high enough for CSO to discharge.

Total rain:
5A-1 = 272 mm.
5A-2 = 214.5 mm.
5B = 214 mm.



- Among Group5, which are intense and long duration rainfalls, the differences in *E. coli* temporal trends are more distinct.
- Despite similar total rain volume, the *E. coli* rising trend was delayed in 5A-2 and 5B, when strong rainfall intensity comes later at 19 and 36 hrs. after rainfalls start. Whereas, peak concentration does not show differences.
- *E. coli* temporal trends are more dependent on the timing of strong rainfall intensity (4 mm./hr.), rather than tidal conditions, for the intense rainfall group.

Conclusions

In this study, we used a 3D water quality model to investigate *E. coli* temporal trend as an indicator of CSOs pollution. The input data and simulation scenarios were carefully selected and designed to construct *E. coli* concentration database. Solar radiation condition was selected to generate conservative results, since it is a major factor affecting *E. coli* inactivation.

➡ It was found that under **small rainfall** conditions, *E. coli* trends are susceptible to different tidal conditions and tidal phase at which rainfall started. On the other hand, they are more affected by the timing of strong rainfall intensity under **heavy rainfall** conditions. The findings are beneficial to comprehend the *E. coli* temporal trends after various types of rainfall under different tidal conditions.

➡ The database can be used to determine whether bathing is possible without complex model simulation works.