Development of Seasalt Particle Transport Model – Evaluation of Corrosion Environment and Prediction of Rapid Pollution of Power Facilities –

Background

The seasalt particles in the atmosphere cause corrosion of power facilities. In order to efficiently carry out their maintenance, it is necessary to predict the cumulative mass of seasalt particles transported there. On the other hand, when tropical cyclones pass over power facilities, the insulator is rapidly polluted, and it may cause the flash-over. In order to carry out precautions, short-term prediction of the mass of seasalt particles transported there is needed.

The seasalt particles in the atmosphere are generated by the breaking of ocean waves, transported by the wind, and scavenged by structures, ground, clouds, rains, and snows. For the evaluations of corrosion environment and rapid pollution of power facilities, the prediction method considering these processes is effective. In this institute, though a numerical model for evaluation of corrosion environment, the ‘NuWiCC-ST’, has been developed, its accuracy is not clear enough. Further, we do not have a numerical model for prediction of rapid pollution.

Objectives

The purpose of this study is to evaluate the numerical model for estimation of corrosion environment, the ‘NuWiCC-ST’. Further, it aims to develop a numerical model for prediction of rapid pollution, and to evaluate the applicability of prediction method with the numerical model and a meteorology model.

Principal Results

1. Evaluation of the numerical model for estimation of corrosion environment, the ‘NuWiCC-ST’

The numerical model, the ‘NuWiCC-ST’, estimates the amount of airborne seasalt on the ground by presuming the amount of seasalt particles in the sea with statistics of wind observations and then numerically simulating wind and seasalt particle transport corresponding to complex terrain (see Fig. 1 (a)). As the result of simulations with the NuWiCC-ST in some observation points (Akita, Sendai, Niigata and Matsuyama) (for instance, Fig. 2), numerical results showed positive correlations with observation data to suggest that this simulation code is able to estimate increasing and decreasing tendencies of the amount of airborne seasalt between any places. Moreover, simulations under the conditions of some different grid resolutions showed almost the same correlations with observation data (by Shikoku Electric Power Co., Inc.), and the effects of grid resolution are thus small in flat terrain, though you should take notice of those effects in largely undulating places and near rivers.

2. Development and accuracy evaluation of a seasalt transport model for rapid pollution prediction

We developed a numerical model which estimates the concentration of seasalt particles in the atmosphere considering the emission, transport, dry deposition, and wet deposition processes (Fig. 1 (b)). Further, we constructed a short-term prediction method of seasalt particle concentrations in the atmosphere, incorporating the seasalt transport model with the Numerical Weather Forecasting and Analysis System, NuWFAS. The prediction method was applied to the observation case at Niigata-shi, and its results were compared with the observation data. As a result, the time variations of the seasalt particle concentration obtained by the prediction method agreed well with those of observation (Figs. 3, 4).

Future Developments

In order to improve the quantitative accuracy of the numerical models, we will carry out field observation in which the relationship between the concentration of seasalt particles and the meteorology conditions are investigated.

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Reference

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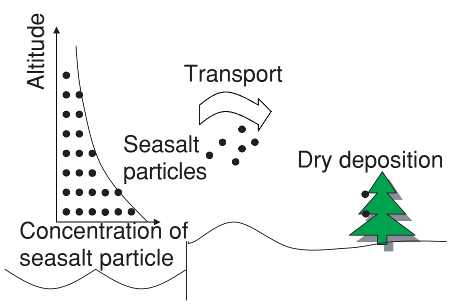
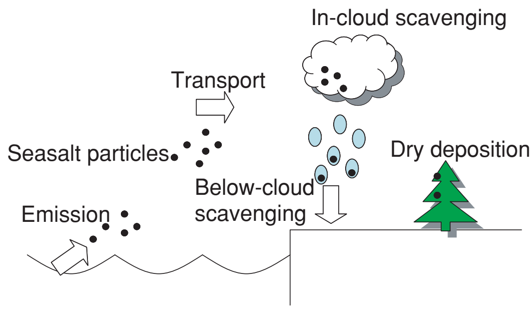


(a) Numerical model for evaluation of corrosion, the 'NuWiCC-ST'.



(b) Seasalt transport model for rapid pollution prediction.

Fig.1 Schematic diagram of seasalt particle transport models.

(a) The numerical model 'NuWiCC-ST' estimates the amount of airborne seasalt on the ground by presuming the amount of seasalt particles in the sea with statistics of wind observations and numerically simulating wind and seasalt particle transport corresponding to complex terrain.
(b) The seasalt transport model for rapid pollution prediction estimates the seasalt particle concentration in the atmosphere, considering the emission, transport, dry deposition and wet deposition processes.

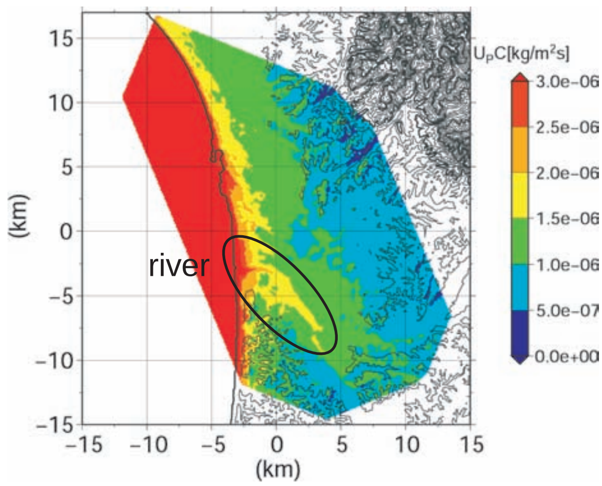


Fig.2 The amount of airborne seasalt particles near the ground (Akita-shi, 20m height).

The high concentration of seasalt particles is observed along the river.

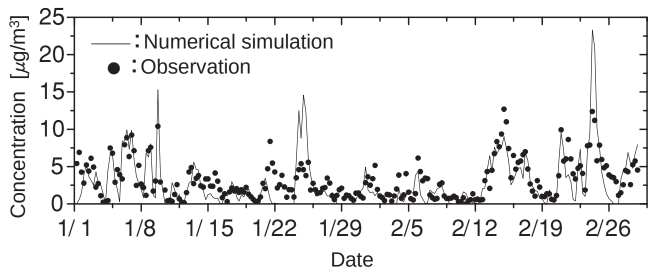


Fig.3 The time-series profile of seasalt particle concentrations in the atmosphere at Niigata-shi.

The time variations of concentration obtained by the numerical simulation agree with the observation data.

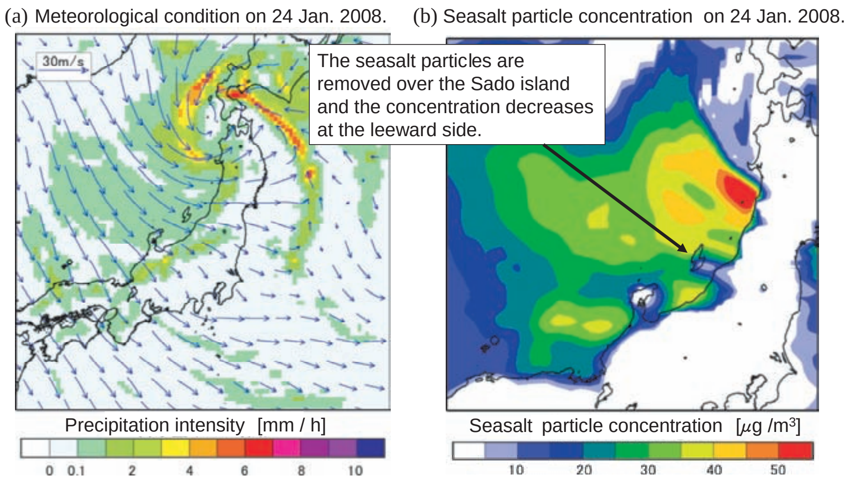


Fig.4 The distribution of wind velocity vectors and precipitation intensities (a), and the seasalt particle concentration near ground (b) on 24 January, 2008.