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# Mathematical analyisis of the consentrationaof radioactive aerosol from the Chernobyl accident

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One of the important case of atmospheric pollution in the modern age, there is a problem of contamination of radioactive aerosol of the Chernobyl nuclear power plant accident.

Examples the accident, former Soviet Union on 26 April 1986, there was a huge explosion at the Chernobyl nuclear power plant reactor 4 of the Republic of Ukraine. Nuclear accident open the air reactor core, so it took several days to cease the accident. And also a large amount of radioactive aerosol fly over wide area. So,this accident become a nuclear the worst in history.

Atmospheric Diffusion Studies in the past have been many studies. However, these studies are intended to safety and temporary refuge, the scope is much more than a few years. In situations that half-life of 30.7 years of Cs, Sr half-life of 28.78 years, we must predict the long-term and wide-area model.

Also, because this radionuclide is highly specific, it can be considered as a tracer in the air, and you can get a basic knowledge of atmospheric dispersion. And, applied to other substances , it can also be considered to obtain long-term and wide-area diffusion about carbon dioxide.

Previous studies have the following equation.

C (t) = Aexp(-LAMBDA phy t) t^-BETA

This is a prediction model describes the change in concentration of the fixed point in time, there are two parameters of the model prediction that 2 A and BETA. A is the amount of traces of radioactive aerosol at that point, BETA is a purification of the environment at that point. In addition, LAMBDA phy decay of radioactive elements In addition, LAMBDA phy is disintegration for each elements, Cs, Sr, etc. it's a different value.

In previous studies, we followed the fitting accuracy of Cs. And, applied to other elements,we can followed the fitting accuracy of Sr. So,we think it is possible that we check the safety of the region of fitthing other radioactive aerosol. But there are also disadvantages of this prediction model. Because, this model can predict only time-scale function, so we must also consider space-scale function, otherwise it is not possible to understand the diffusion. I do mathematical analysis to predict the spatial distribution.

To analyze the spatial distribution is the starting advection equation, in order to give an analytical solution of this advection equation, I've a variety of assumptions. First , Using the autocorrelation of turbulent flow by Obukhov proposed. Thereby, changing in time-scale diffusion coefficient was announced.

Second, we focused on environmental purification, it's rivers, plants, and in the purifying of the sea, but near Chernobyl most dominant purification is plant and the uptake rate decreased in inverse proportion to the time. So,we can get the inverse value of power function.

Finally, we do mathematical approximation proposed by Kappor and Gelhar, and if we have a constant spatial distribution, I get the function of previous studies.

However, in the spatial distribution of the derived the analytical solutions were Gaussian function.The Gaussian function only can distribute normal diffusion, we try to fit the real experimental data in Chernobyl accident that was published IAEA. But this function couldn't follow this data.

By this, as what we are studying now, there are two approaches.One is prediction using Probability Density Functions. It is one of the Monte Carlo model, I use Levy Flight model. Levy flight model is applied to Random Walk model, in random walk model , the jump distance is constant, but Levy Flight model the jump distance is not constant, and the jump distance function is inverse value of power function. In this model we can fit space distribution, however we don't know physical meaning, it's advanced research.

Another one is space-scale autocorrelation of turbulent flow by Sreenivasan proposed. This property can introduce the changing in time-scale and space-scale diffusion coefficient, this theory demonstrated the possibility of fitting space distribution.

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