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Impacts of Eruptions of Volcanoes around Korean Peninsula: Simulation for Hypothetic Eruptions by using LADAS-VA model

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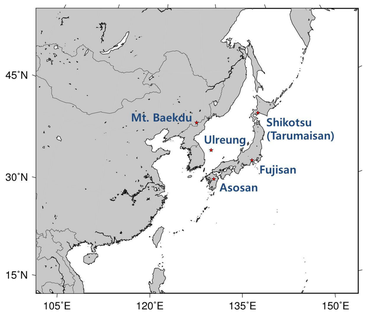
LADAS-VA model

A three-dimensional atmospheric dispersion model, Lagrangian Atmospheric Dose Assessment System (LADAS) has been developed at the Korea Atomic Energy Research Institute (KAERI) for the purpose of predicting and assessing atmospheric dispersion of radionuclides released into the air when a nuclear accident occurs elsewhere around the world. It was successfully employed to the environmental impact assessment for the Fukushima Daiichi nuclear disaster. Reflecting recent demand on the response system against potential volcanic risk around Korea, we have been developing LADAS-Volcanic Ash (LADAS-VA) model, a derivative of the LADAS in the form of a Volcanic Ash Transport and Dispersion Model (VATDM). The LADAS-VA model has been constructed based upon the LADAS-regional model so that it utilizes the Unified Model (UM) based Numerical Weather Prediction (NWP) product, which is provided by the Korea Meteorological Administration (KMA), as a primary meteorological data.

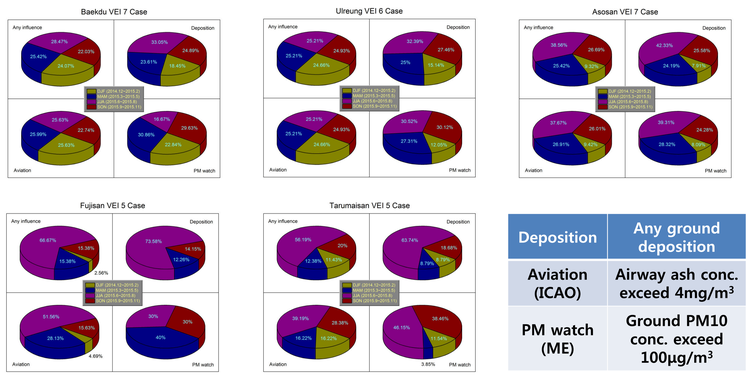
Simulation for Hypothetic Eruptions

By using the LADAS-VA model, we performed a series of simulations for (year-round) hypothetic eruptions of several representative volcanoes around Korea, such as Mt. Baekdu (Changbaishan), Asosan, Ulreung, Fujisan, and Shikotsu (Tarumaisan).



Simulation period	2014.12.1~2016.2.29
Meteorological data	KMA UM-RDAPS (12km-horizontal resolution)
Eruption detail	Start at 00 UTC (each day and lasted 24h)
Calculation period	72h (after eruption started)
VEI (eruption scale)	Historical maximum VEI (for each volcano)
TGSD	Gaussian in Φ

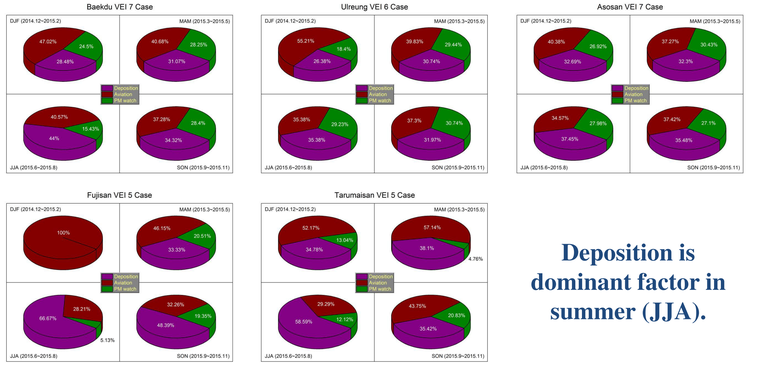
Fig 1. Coverage of the UM-RDAPS meteorological data and 5 representative volcanoes around Korean Peninsula with some simulation information.



Deposition	Any ground deposition
Aviation (ICAO)	Airway ash conc. exceed 4mg/m^3
PM watch (ME)	Ground PM10 conc. exceed 100μg/m^3

Fig 2. Ratio of influenced days for each season classified into three impact factors (deposition, aviation, and PM watch) with criteria of influence.

Seasonal Influence



Deposition is dominant factor in summer (JJA).

Fig 3. Comparison of seasonal ratio of influenced days due to each impact factor for hypothetic eruptions of representative volcanoes.

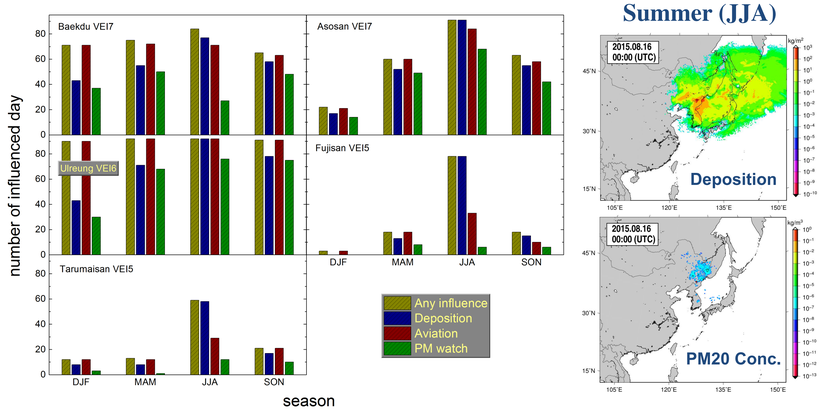


Fig 4. Number of influenced days by hypothetic eruptions of representative volcanoes due to each impact factor for each season (of eruption).

Illustrative Examples

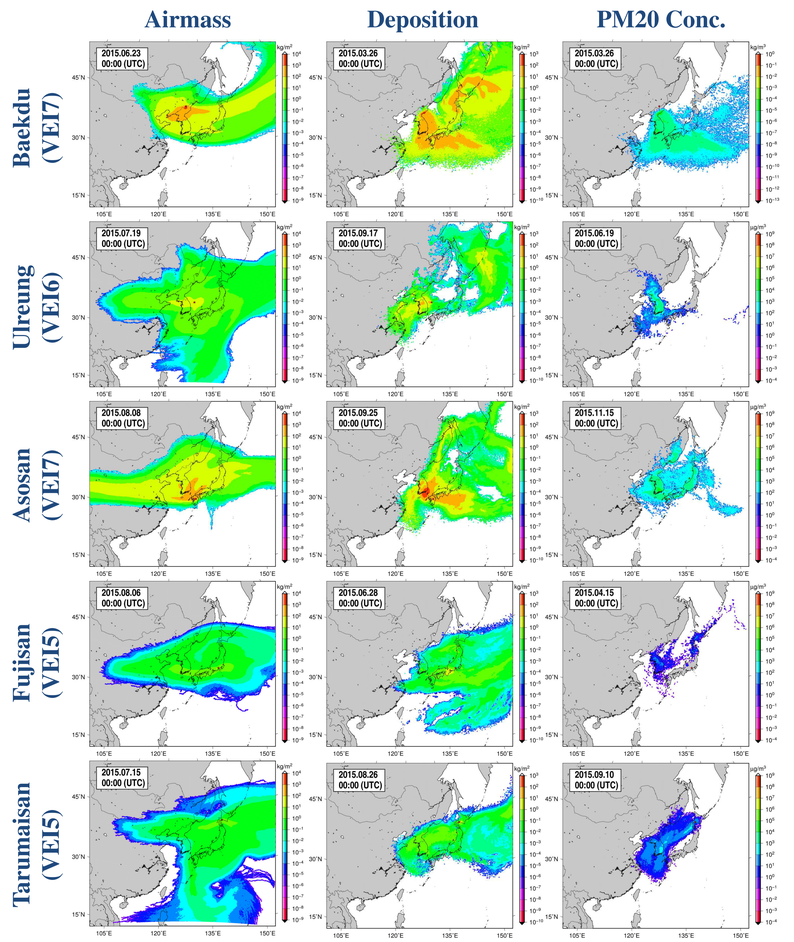


Fig 5. Examples of some hypothetic eruptions which influenced on Korean peninsula.

Concluding Remarks

Of course, eruptions of volcanoes located closer to/within Korea, such as Mt. Baekdu and Ulreung, influence much more and have weak seasonal tendency. Overall, eruptions in summer cause higher impact then those in other seasons, because of additional influence of ground deposition by intensive rainfalls around Korean peninsula during summer. In spring and fall, one can find slightly higher influence due to increased ground PM concentration. Impacts by deposition and ground level PM concentration are somewhat in complementary relation. Wet deposition considerably reduces PM influence. For impact on aviation, relatively small seasonal dependency is shown. Eruptions of Fujisan and Shikotsu (Tarumaisan), relatively far apart from Korea, less affect and show strong seasonal deviation. Most of air current entering into Korean peninsula from southern region in lower troposphere occur during summer. Different air current depending on season makes different seasonal influence of eruptions. Certainly, further investment and more detailed analysis are necessary, and we will continuously improve LADAS-VA model and disaster response system in Korea.

References

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