

**(SS28) Recent methodology for pollen dispersal forecast**

**Date:** August 24 (oral), 25 (poster)

**Place:** Room 5233 (oral), Room 6310 (poster)

**Organizers:** Motoo Suzuki, Kyu Rang KIM & Hidetoyo Teranishi

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**Purpose:** Currently, pollen allergy has become a worldwide problem. It is important to improve pollen dispersion forecast accuracy in order to avoid pollen exposure. This symposium purposes summarize the recent and advanced forecasting method of the pollen dispersion in the world and discuss both these advantages and disadvantages for the information accuracy and handling simplicity. And then we hope that these results will be induced to be useful in the treatment of symptoms of the pollinosis and the control in the patients increase.

Oral Presentation

Aug. 24 [PM2] Room: 5233

Chair: Kyu Rang Kim

14:30-14:50 **A model to account for variations in holm-oak (*Quercus ilex* subsp. *ballota*) acorn production in southern Spain** [SS28-O01 \(146\)](#)

Herminia García-Mozo, Eugenio Dominguez-Vilchez, [Carmen Galán](#)

14:50-15:10 **Significance of the pollen counts on pollinosis symptoms measured by an automatic pollen monitor (KP-1500)** [SS28-O02 \(521\)](#)

[Hidetoyo Teranishi](#), Kei Hamazaki, Hidekuni Inadera, Setsuo Hayashi, Motoo Suzuki

Chair: Hidetoyo Teranishi

15:10-15:30 **Eolian pollen transport towards Sable Island, Nova Scotia, Canada** [SS28-O03 \(276\)](#)

Elisabeth Levac

15:30-15:50 **Pollen dispersion 3-month forecast of Japanese cedar and cypress using JMA's seasonal forecast** [SS28-O04 \(506\)](#)

Motoo Suzuki

Aug. 24 [PM3] Room: 5233

Chair: Hidetoyo Teranishi

16:20-16:40 **Pollen simulations in a coastal urban area of Ulsan, Korea: preliminary results using WRF-CMAQ model** [SS28-O05 \(387\)](#)

[In-Bo Oh](#), Yangho Kim, Kee-Ryong Choi, Motoo Suzuki, Jiho Lee

Poster Presentation

Aug. 25 [PM1] Room: 6310

13:30-14:30 **An experiment with the multiple regression models for forecasting pollen quantity of Japanese cedar** [SS28-P01 \(472\)](#)

[Itaru Shiotani](#), Yukiko Ito

SS28-O01 (146)

**A model to account for variations in holm-oak (*Quercus ilex* subsp. *ballota*) acorn production in southern Spain**

Herminia García-Mozo, Eugenio Dominguez-Vilchez, Carmen Galán

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One of the characteristics of the holm-oak acorn production is its high variability among individuals and years. To examine the main causes of this fact, a study was conducted in a holm-oak natural area of South Spain from 1998 to 2010 where floral phenology, fruit production, fruit size, airborne pollen emission and meteorology factors were analyzed with the ultimate aim of developing a model for forecasting holm-oak yield. Pollen emission during flowering season was the main factor determining final acorn harvest, but also some meteorological variables played an important role to explain acorn crop variations, specially humidity and temperature of April and September months. The reliability of the proposed model was externally validated using data not included in its construction; validation yielded acceptable results, with a minimum error of estimation. Our results appear to be very useful for planning cropping and pig feeding strategies. Further research could extend the use of airborne pollen counts in forest studies relating anemophilous species, in order to optimize agricultural policies.

**Keywords:** acorn production, pollen, oak forest, model, holm oak.

SS28-O02 (521)

**Significance of the pollen counts on pollinosis symptoms measured by an automatic pollen monitor (KP-1500)**

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**Introduction:** The prevalence of pollinosis to Japanese cedar (*Cryptomeria japonica*) is increasing rapidly in Japan. Avoidance of allergenic pollen exposure is very important for the disease prevention. Airborne pollen monitoring is a key for the information service to prevent the disease. The purpose of this study was to clarify the significance of daily pollen counts on the clinical symptoms of the pollinosis patients measured by both an automatic pollen monitor and a volumetric spore trap. **Materials and methods:** An automatic pollen monitor (KP-1500, Kowa Co Ltd, Nagoya, Japan) was introduced at the University of Toyama, Faculty of Medicine in 2007. The principle of the measurement by the monitor is based on the autofluorescence of the individual pollen grains excited by a laser light ( $\lambda = 405$  nm). We examined the relationships between the number of particles counted by the monitor and the pollen counts by the volumetric method using a Hirst type (Burkard) spore trap. We also compared the relationships between the daily pollen counts and the number of the patients consulted with the doctors of otolaryngology and ophthalmology clinics in Toyama Prefecture, Japan. **Results:** Significant associations were obtained between the clinical symptoms and daily pollen counts measured by both methods. Thus we concluded that the automatic pollen

monitor was a useful method. However, further studies will be necessary to improve the equipment for more precise and accurate pollen counting.

**Keywords:** *Cryptomeria japonica*, pollinosis, autofluorescence, volumetric method, symptom.

SS28-O03 (276)

**Eolian pollen transport towards Sable Island, Nova Scotia, Canada**

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Airborne pollen and spore concentrations were monitored daily on Sable Island, a long but narrow sandy island located at the edge of the continental shelf offshore from Nova Scotia during the summer seasons 2010 and 2011. A volumetric Burkard-type sampler was used to take samples following criteria established by IAATA. The goal of this project is to quantify how much tree pollen is transported by air masses over long distances, since no tree is growing on Sable Island. The samples provide hourly pollen concentrations. Back trajectories are performed for episodes of pollen arrival on the island, to trace the path of air masses and the source of the pollen. Potential sources for the tree pollen are located in the New England States of the United States, and in the eastern Canadian Provinces. These pollen sources vary with weather patterns. One difficulty arises from the fact that tree pollen is usually identified at the genus level and not at the species level. Even within one region, various maple species have slightly different pollination seasons. Another difficulty arises from the fact that reliable pollen counts are not necessarily available for verification in the identified source region. Pollen and spores are relatively abundant in marine sediments from the Scotian Shelf, all the way to the edge of that continental shelf (which is located more than 200 km away from the shore and the nearest vegetation). For that reason, eolian transport was always suspected but never confirmed.

**Keywords:** palynology, pollen monitoring, microscope, Canada, mounting medium.

SS28-O04 (506)

**Pollen dispersion 3-month forecast of Japanese cedar and cypress using JMA's seasonal forecast**

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Previously, the empirical models are made available for the seasonal pollen dispersion forecasts. Therefore, the tendencies of wind field annual change, which has the impact on the pollen dispersion, are not reflected on the forecast results. For example, in 2009 season (February – April), mainly westerly wind blew around the Kanto plain in Japan. On the other hand, in 2010, mainly easterly wind blew. In this study, using 3-month seasonal ensemble numerical forecast GPVs produced by Japan Meteorological Agency (JMA), seasonal average of Japanese cedar and cypress pollen concentration is calculated by WRF and the numerical pollen dispersion model. JMA's 3-month ensemble numerical forecast GPVs have 51 members. Only 1 member which has close to the average values of the major meteorological elements, temperature and humidity, wind speed, wind

direction, is extracted from these members. Using this member's GPV as initial and boundary condition of WRF, 3-month hourly meteorological forecast, that is WRF GPVs for about 2160 hours, is calculated. Additionally, the flowering process and the pollen emissivity of Japanese cedar and cypress are estimated and the pollen advection-diffusion process is calculated on the basis of these WRF GPVs. As a result, the variations of the pollen advection-diffusion process involved with the long distance transformation of the pollen can be represented, and more advanced forecast technique was established.

**Keywords:** ensemble forecast, *Cryptomeria japonica*, pollinosis, numerical model.

SS28-O05 (387)

**Pollen simulations in a coastal urban area of Ulsan, Korea: preliminary results using WRF-CMAQ model**

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Numerical modeling techniques can enhance our understanding about spatiotemporal concentration patterns of airborne pollen and help to achieve a better management of pollen-related allergic diseases. However, currently there have been no modeling approaches based on established methods for estimating allergenic pollen emissions in Korea. In this study, test runs for tree pollen simulation were conducted using the Community Multiscale Air Quality (CMAQ) model with Weather Research and Forecasting (WRF) model-based input during an episode of the 2011 spring pollen season in a coastal urban area of Ulsan, Korea. An attempt was made to incorporate tree pollen emission into the CMAQ model; A simple methodology was used to calculate pollen emission inventory based on measured pollen counts and detailed land cover information. High-resolution simulations with a grid size of 1 km were carried out in order to better describe and pollen dispersion in a complex coastal urban area. Modeled pollen concentrations were evaluated against data collected at the Ulsan Environmental Health Center sampling site within the model domain. The results showed that the daily pollen levels reasonably followed the measured profiles of tree pollen, but large discrepancies are noticeable for peak concentrations and temporal patterns; this can be primarily due to incomplete current pollen emission inventory. Some simulations indicated meteorological condition such as mesoscale winds (mainly sea-breeze) and boundary layer structure is critical to determine pollen distribution in this area. Many uncertainties remain concerning quantitative predictions for these test runs. A better understanding of biology of pollen release and pollen deposition processes will be needed to improve pollen prediction by numerical models.

**Keywords:** numerical modeling, airborne pollen, Ulsan, CMAQ model, pollen prediction.

SS28-P01 (472)

**An experiment with the multiple regression models for forecasting pollen quantity of Japanese cedar**

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About 63% of the Mie Prefecture area is a mountainous region, and is covered mostly with Japanese cedar (*Cryptomeria japonica*, “sugi”) forest. Clinical studies have identified sugi as a major cause of an allergic disease. Many patients range from children to the elderly. Our hospital has been continued monitoring airborne pollen since 1987. Sugi pollen count series takes basically an alternate rhythm with on year (high count) and off year (low count). A significant negative autocorrelation coefficient at time lag 1 in the series analysis is credible evidence of the alternate rhythm. The authors developed the regression models, aiming at a reliable forecast of pollen quantity. However, the proposed forecasts did not always provide sufficiently accurate results. Therefore, in order to improve the forecasting models, a MR (multiple regression) model experiment was carried out using the data over the last 25 years. A set of 28 different MR models were examined, which consists of all possible combination of 4 rhythm variables and 3 climate variables. The climate variables are temperature-base factors; each of them has been observed some correlation with the pollen count. To qualify for the models, the criteria are the smaller prediction error (less than  $\pm 30\%$ ), the high adjusted  $R^2$  value around 0.8, and the low VIF (variance inflation factor) value less than 10, and further, a model is accepted when all variables are statistically significant. The model is referred to the promising when it fulfills all the condition mentioned above. The model experiment was undertaken for each of the recent 5 years from 2007 to 2011. Finally, the authors proposed the promising model each for 2007, 2010 and 2011, respectively; they share the climate variable TJ3 (mean temperature for late-July). Further the promising model for 2009 has the climate variable HTJ2 (mean maximum temperature for mid-July). No model was found to be promising for 2008. One of the promising models is applied to predict the sugi pollen quantity for the year 2012. The results of the model experiment as well as a promising MR model will soon be evaluated by the pollen monitoring after the end of this spring. This topic will be reported by one of authors Y. Ito at the Japanese Palynology Conference held simultaneously.

**Keywords:** model experiment, forecasting model, Japanese cedar, pollen count, allergic disease.