Detection of volcanic ash clouds in MSG-SEVIRI IR data based on an neural network approach and comparison with in situ measurement data of DLR-Falcon

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We present the current state of the VADUGS algorithm (Volcanic Ash Detection Utilizing Geostationary Satellites). The algorithm is based on a backpropagation neural network, trained by simulated brightness temperatures for the SEVIRI channels. The algorithm is designed to reveal information on the column mass concentration (g/m²) and top altitude of volcanic ash layers. Results are compared with in situ airborne measurements of volcanic ash concentrations performed during the E15 eruption period in 2010.

Output of the algorithm – here shown for the E15 case, 17.05.2010

Results of the WMO Intercomparison: Examples

• Column concentration values: VADUGS is rather close to NOAA and gives a factor of ~5 smaller values than EUMOP
• General performance with respect to ash load shows promising; however, quality of VADUGS top altitude retrieval is dissatisfying in several cases

Towards operational use of VADUGS

➤ Within the project TeFiS (funded by the German Federal Ministry for Economic Affairs and Energy) we adapt the algorithm to specific requirements for operational use in the German Weather Service (DWD) facilities, in cooperation with German air traffic control (DFS), and the Lufthansa AG
➤ Beside improvements of the algorithm, special emphasis is given on user-friendly data formats, meeting the specific needs of DWD and users from the aviation sector

Departments/Institutes

Institut für Physik der Atmosphäre
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Imaginary part of refractive index

Input

Output

Design of the algorithm

Optical properties of volcanic ash

• Use of MSG-SEVIRI IR data
• Surface temperature from NWP ECMWF-IFS
• Training performed using simulated IR temperatures
• Different optical properties, altitudes, concentrations and vertical extent of ash layers
• Total columns concentration of the volcanic ash layer (g/m²)
• Top altitude of the volcanic ash layer above ground (km)

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• DLR Falcon measurement data of E15 2010 and other data are used for validation
• Example: North Sea measurements, May 17th 2010
• Note that VADUGS retrieves total VA column conc. (g/m²) while airborne in situ measurements reflect mass concentration (g/m³)

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