Numerical simulation of the direct aerosol effect due to sea salt particles on the regional scale

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Motivation and Tool

Most studies concerning the direct aerosol effect due to sea salt particles are applied for the global scale and rather few for the regional scale. The magnitude of the forcing still shows large uncertainties. In this study the comprehensive regional model COSMO-ART [1] is applied to simulate the spatial and temporal distribution of sea salt particles and their direct aerosol effect, with the purpose to increase the understanding of the sea salt direct radiative forcing.

Results and Discussion

An example of simulated sea salt AOD with maximum of 0.4 is illustrated in Figure 1 for the Mediterranean Region.

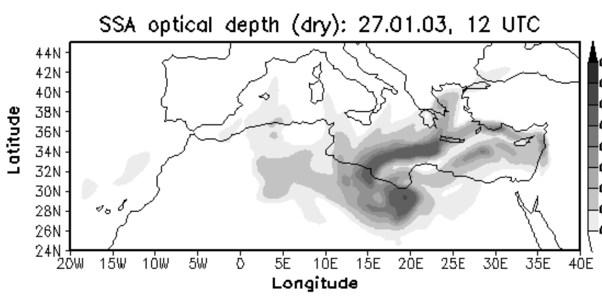

Figure 1: Simulated AOD of sea salt in the Mediterranean region.

Further simulations of the temporal and spatial distributions of sea salt particles and their impacts on atmospheric radiation, and resulting feedback processes will be presented and discussed.

[1] Vogel, Vogel, Bäumer, Bangert, Lundgren, Rinke & Stanelle (submitted) *APCD*.

Convergent margin magmas: Revisiting plutonic-volcanic questions

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Since the publication of Orogenic Andesites in 1981, the concensus opinion has been that flux melting of the mantle wedge produces basaltic magmas which ascend into the crust, differentiate and erupt andesites (on average) from stratovolcanoes. However, the differentiation process between source and volcano remains poorly understood. Observations from intrusive rocks, voluminous granodioritic batholiths in continental settings, have been generally overlooked.

Indeed, why arcs produce andesitic lavas but more silicic plutons remains a mystery. It is worth noting that the spacing of co-temporal plutons in the Sierra Nevada is the same as stratovolcanoes in the Cascades begging a connection [1]. General explanations such as increased viscosity are unsatisfying given pluton emplacement depths of as little as 4 km. Here, I provide a new model for production of convergent margin granodiorite plutons through the process of thermal migration zone refining (TMZR). Experiments at 0.5 GPa [2] show that a wet andesite in a temperature gradient evolves to a granitic composition at its cool end through the diffusion-based process of thermal migration. Because diffusive length scales are limited, TMZR (combining advection by downward magmatic underplating with thermal migration in a moving thermal gradient zone) is required to produce km scale plutons. Numerical modeling using IRIDIUM shows that normally zoned plutons of granodioritic mineralogy can be produced by sequentially injecting sills of andesitic magmas. The model predicts thermal diffusion isotopic signatures, consistent with observed Fe isotopic variations and is consistent with geochronology requiring incremental assembly over million year time scales. The model provides an explanation for why granodioritic plutons develop beneath stratovolcanoes, reflecting thick volcanic piles leading to underplating of andesitic magmas when ascent is inhibited. This temporal scenario follows the known compositional evolution of the San Juan volcanic field [3].

If there is no compositional difference between magmas feeding statovolcanoes vs plutons, whether arc magmas stall and differentiate at all in the lower crust/upper mantle is up for debate. ^{10}Be and some U-series observations constrain erupted magmas to pass from slab to surface in a few million years; the model of pluton formation by TMZR is consistent with fast ascent followed by ponding at shallow depths.

[1]. Glazner *et al*. SOTA ab, 2007. [2]. Huang *et al*. GCA **73**, 729 2009. [3]. Lipman *et al*. GSAB **89** (59), 1978.