Parameterization of Giant CCN in the ECHAM5 GCM

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Increased Cloud Condensation Nuclei (CCN) load due to anthropogenic activity might lead to non-precipitating clouds because the cloud drops become smaller (for a constant liquid water content) and, therefore, less efficient in rain formation (aerosol indirect effect). Adding giant CCN (GCCN, $r_{dry} > 3$ µm) into such a cloud can initiate precipitation (namely, drizzle) and, therefore, might counteract the aerosol indirect effect.

The effect of GCCN on global climate on warm clouds and precipitation within the ECHAM5 General Circulation Model (GCM) is further investigated with the prognostic rain scheme [1]. A new parameterization of GCCN by Mechem and Kogan [2] has been introduced for a more precise representation of the condensational growth of GCCN in the subcloud layer. It is assumed that GCCN with dry radii larger than 3 µm can deliquesce and grow above the critical 20-µm coalescence threshold and act immediately as drizzle droplets, which in the bulk framework falls into the rainwater category. The 3-µm GCCN lower bound is consistent with other studies (e.g. [3, 4]). They point out the importance of GCCN to the precipitation process, particularly in polluted conditions.

Results from this new water uptake parameterization for GCCN shall be presented, which comprise especially the influence on cloud properties (i.e. liquid and rain water, cloud drop number, etc.) and the hydrological cycle.

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Magnetite-bearing mineral assemblages in igneous and metamorphic facies, North Portugal

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Petrographic studies were carried out in the Lavadores Granite Massif which cross cuts a metamorphic and igneous complex composed by pelitic metasediments, anfibolites, leucocratic gneisses and granites, deformed by the Porto-Tomar shear zone. The granite is biotitic, porphyritic, coarse to medium-grained with quartz + plagioclase + orthoclase + biotite + zircon + alanite + sphene + apatite + opaques. The anfibolite presents a fine to medium-grained granoblastic to grano-nematoblastic texture and contains horneblende + plagioclase + quartz + chlorite + calcite + opaques. The gneiss presents a fine to medium-grained granoblastic texture, contains quartz + plagioclase + orthoclase + biotite + cordierite + andalusite + opaques, and shows quartz-feldspatic layers and andalusite + cordierite nodules. Metasediments have granolepidoblastic texture with quartz + K feldspar + plagioclase + andalusite + opaques.

In order to investigate the opaque mineralogy, studies of magnetic susceptibility (MS) and isothermal remanent magnetization (IRM) were carried out. MS measurements using a Kappabridge KLY-4S susceptometer (±3.8 x 10^{-4} T; 920 Hz, AGICO) have shown values of 16477.50x10^{-6} SI for the granite, 1348.88x10^{-6} SI for the anfibolite, 22.71x10^{-6} SI for the leucocratic gneiss and 3965.56x10^{-6} SI for the metasediments. A Molspin pulse induction magnetizer was used to create magnetic fields at room temperature to a maximum of 1T; the IRM of the samples was measured with a Molspin spinner magnetometer. The magnetization obtained in this maximum field was defined as the effective saturation isothermal remanent magnetization value for each of the samples. The magnetization of the samples after each exposure was measured with a Molspin spinner magnetometer controlled by a micro-computer. The data obtained point out three distinct magnetic behaviors: in the granite the MS and the IRM data are due to the ferrimagnetic fraction; in the metasediments and anfibolites are due to both the paramagnetic and ferrimagnetic fractions; finally the gneiss values are controlled by the paramagnetic fraction. Magnetite is present in granite, metasediments and anfibolites which point out oxidant genesis conditions but in the gneiss opaque mineralogy is controlled probably by ilmenite.