# Historial emissions of atmospheric compounds resulting from biomass burning

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Inventories of emissions of particles (black and organic carbon), as well as of several gases ($CO_2$, CO, $NO_x$, $SO_2$ and VOCs) from biomass burning have been developed for the period 1900-2005.

For the period 1997-2005, fire emissions have been estimated from satellite products, using distributions of burned areas as well as of active fires. The emissions for the year 2000 were first estimated using the GBA2000 burned area product. The temporal and spatial distribution of the $CO_2$ emissions was estimated for the other years, through a scaling of the active fires detected by the ATSR instrument. This scaling was applied for each vegetation class and for different latitudinal bands. The emissions of the other species, including particulate compounds, were estimated using emission factors.

An historical reconstruction of burned areas at a 1x1 degree resolution was used to calculate the emissions of the compounds for each decade of the twentieth century. The emissions of the different coumpounds are calculated as the product of burnt areas, biomass densities, burning efficiencies, and each species emission factors. A scaling factor is applied for forest and savanna ecosystems separately, in order to ensure continuity between the historical inventory and the satellite-based 1997-2005 inventory. Finally, monthly emissions are derived using the average seasonal variation over the 1997-2005 period.

The methodology will be detailed and the distributions of emissions over the twentieth century will be discussed. The total emissions and their trends will be compared with other existing inventories of particles and gases.

# Melting of carbonated pelites at 8-13 GPa: Generating potassic carbonatitic melts for mantle metasomatism

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The sedimentary layer of the oceanic crust is part of the oceanic lithosphere subducting into the mantle. In this study we investigate the composition of melts from mostly dehydrated but not decarbonated pelites, at pressures beyond subarc depths. Experiments at 8 and 13 GPa on three different bulk compositions (dry and with 1 wt% $H_2O$ added) result in subsolidus mineralogies consisting of garnet, jadeitic cpx, coesite/stishovite, kyanite or corundum, phengite (with $H_2O$ to 8 GPa) or K-hollandite, a Ti-phase and carbonates (magnesite or aragonite+magnesite). Melting reactions are controlled by carbonates and by the various potassium and hydrous phases present. The first melts produced at 1000°C-1150°C (8-13 GPa), temperatures higher than for typical slabs, are carbonatitic melts (in composition similar to alkali- and $CO_2$-rich melt/fluid inclusions found in diamonds), contrasting the melting behaviour at < 5 GPa where silicate melting occurs at lower temperatures than carbonate melting (Thomsen and Schmidt, 2008, EPSL). These potassium-rich Ca-Mg-Fe-carbonatite melts, which composition has been verified by inverse experiments, have extreme $K_2O/Na_2O$-values (up to 50 at the solidus). $K_2O/Na_2O$ decreases with increasing temperature or degree of melting and also with increasing pressure when K-hollandite extends its stability field far above the solidus.

Comparison of our solidus temperatures with typical subduction and mantle geotherms yields melting of carbonated pelites at 250-400 km depth only feasible when subduction slows down or stops and thermal relaxation occurs. As the adiabatic temperature of the mantle is much higher than the solidus of $K_2O$-rich carbonated peridotites, our low viscosity melts will rise into the mantle and percolate upwards as long as the surrounding temperature in the mantle is higher than 1100-1200°C, and $K_2O$ and $CO_2$ remain stored in the liquid phase. In the relatively cold sublithospheric mantle keels of continental shields, these melts may freeze and react with the surrounding mantle creating potassium-, carbonate- and incompatible element-rich metasomatized zones, which are most likely at the origin of kimberlites and ultrapotassic volcanism.