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Impact of water- and composition-dependent melting parameterisation on crust production and the geodynamic regime in the Archean

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We investigate the impact of water- and composition-dependent solidus and liquidus temperatures in numerical simulations of global mantle convection.

The amount, composition, and enrichment in trace elements of melts produced during partial melting of mantle rocks are very parameter-dependent quantities. In these preliminary calculations, we compiled a set of solidi and liquidii temperatures applicable to a basalt-harzburgite composition spectrum. Solidii and liquidii are obtained via non-linear interpolation between end-members instead of using an extrapolation from a pyrolitic composition. Water is partitioned in the melt during the melting process, which results in large variation of solidus temperature during melt production. Moreover, the amount of melt produced for a given temperature excess above the solidus temperature is considered to be non-linear.

Water saturation is also computed in both melt and solid in the whole mantle. When water concentration exceeds the solubility of the host, it is now propagated upward and potentially outgassed in the atmosphere.

We investigate the effect of these non-linearities in solidus, melt productivity and water solubility on the global geodynamic picture and especially on the amount of crust produced at the Archean when widespread volcanism might have been occuring.