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Thermo-mechanical adjustement after impact during planetary growth.

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The thermal evolution of planets during their accretionary growth is strongly influenced by impact heating. The temperature increase just after a collision occurs mostly below the impact in a volume comparable to that of the impactor. The maximum temperature increase varies like the square of the radius of the impacted planet. For Moon to Mars size planets where impact melting is limited, the long term thermo-mechanical readjustment is driven by spreading and cooling of the heated zone. To determine the time and length scales of the adjustment, we developed a numerical model in axisymmetric cylindrical geometry with variable viscosity. We show that if the impactor is larger than a critical size, the spherical heated zone isothermally flattens until its thickness reaches a value for which motionless thermal diffusion becomes more effective. The thickness at the end of advection depends only on the physical properties of the impacted body. The timescales for the adjustment are comparable to the duration of planetary accretion and depend mostly on the physical properties of the impacted body. For larger impacted undifferentiated planets, where impact melting becomes important, a local differentiation may occur between heavy iron and light silicates in the heated anomaly. We present a numerical model in axisymmetric spherical geometry showing the effect of melting on thermo-mechanical readjustment after a large impact. We discuss the conditions for which the iron moves toward the center of the planetesimal via thermo-chemical convection and contributes to core formation.