Radiative hydrodynamical simulations of stellar surfaces.

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The 3D numerical simulations of the near surface convection in stellar envelopes have been initiated by Å. Nordlund and co-workers already two decades ago. The realism of such simulations led to a great success in reproducing solar line profiles, granulation and helioseismic properties. They solve the full set of non-linear hydrodynamical equations in a cartesian mesh at the stellar surface. The radiative energy exchange is found by solving non-gray LTE radiative transfer along vertical and inclined straight rays. Realistic equation-of-states and opacities are also taken into account. I will present the current status of these simulations and their applications to stellar abundance determinations and limb darkening calculations.