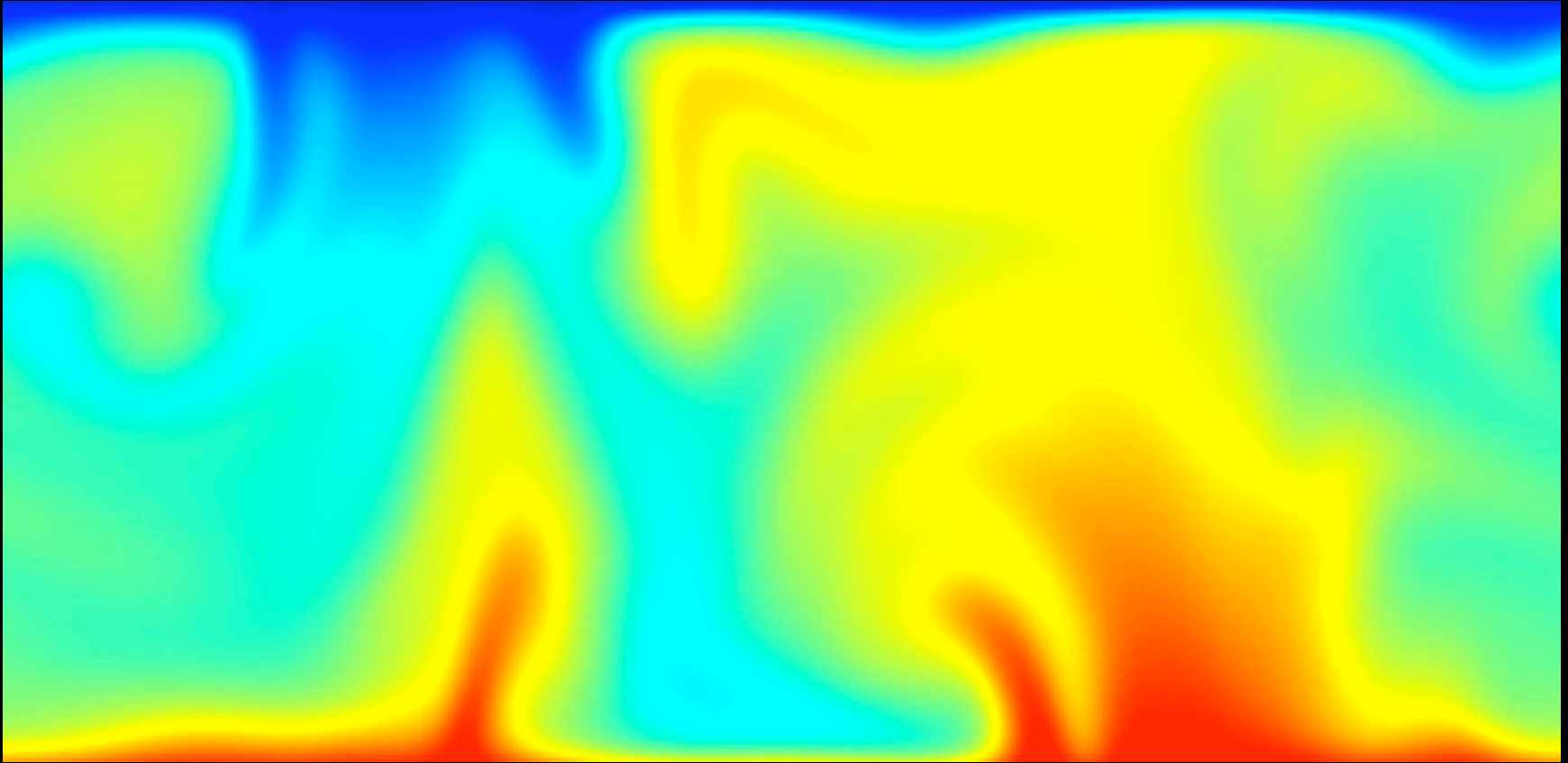


**Computer simulations of
fluid flows and magnetic fields
in planets and stars**

Gary A Glatzmaier
University of California Santa Cruz

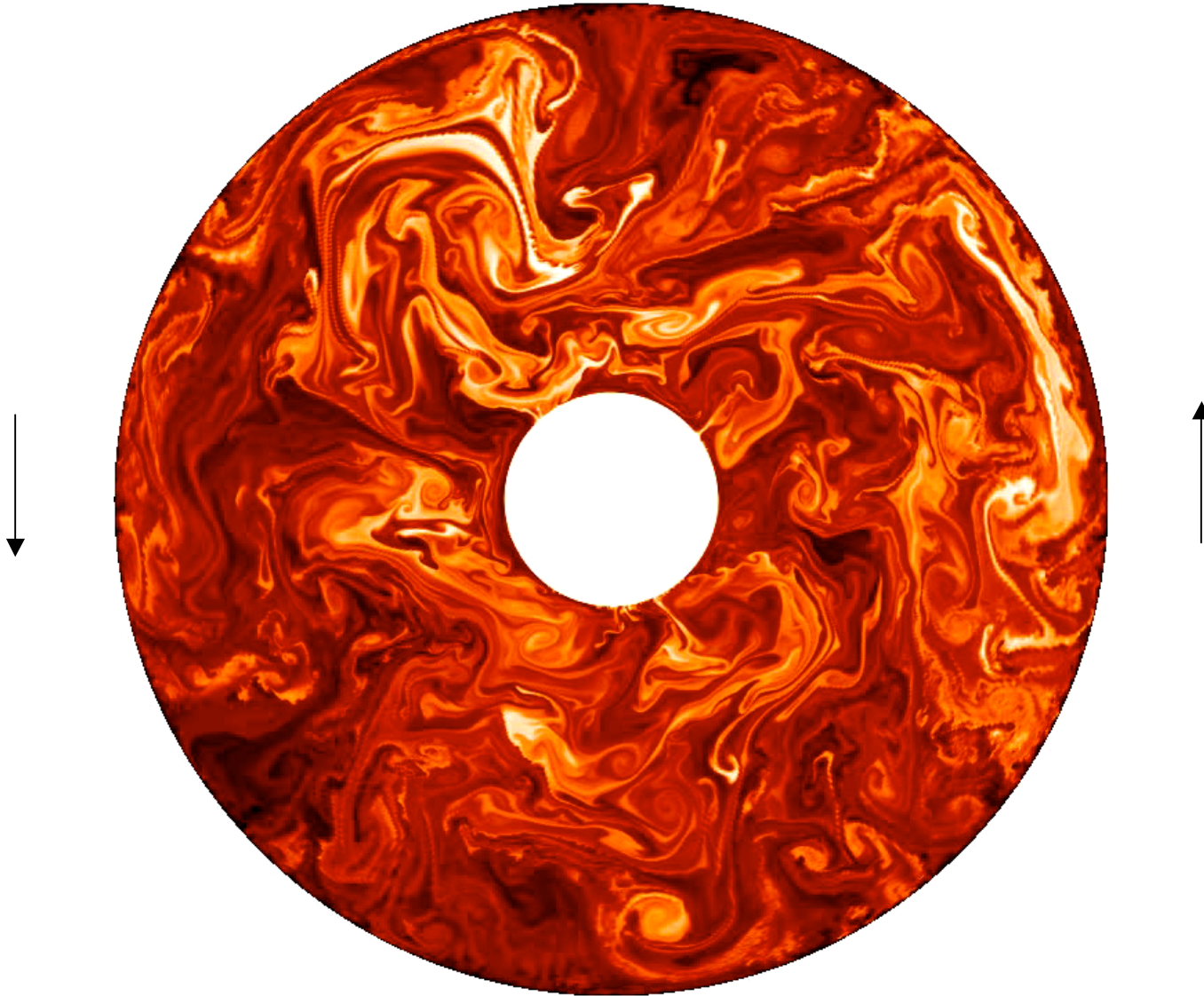
Convection

Laminar convection



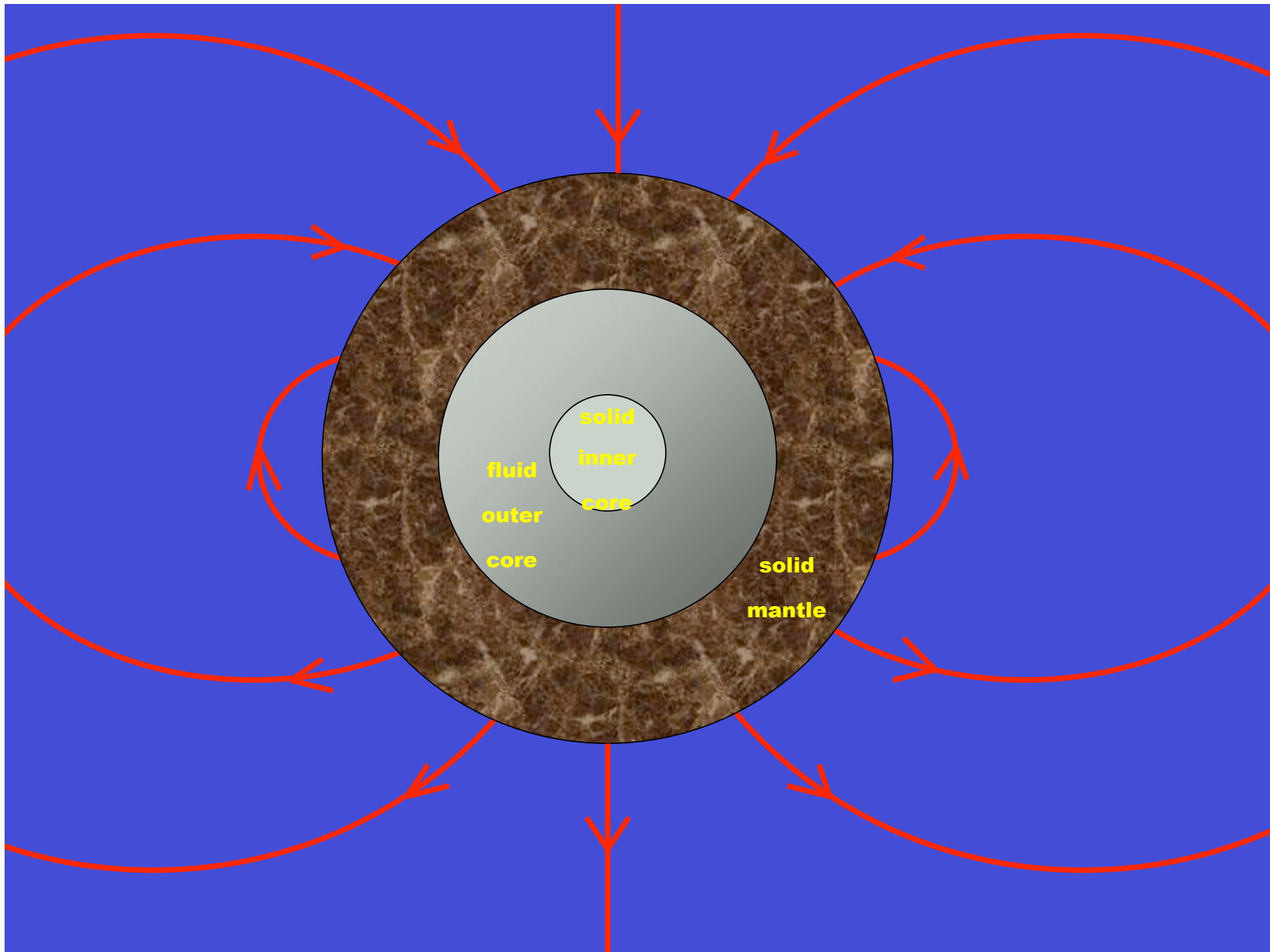
large viscous and thermal diffusivities

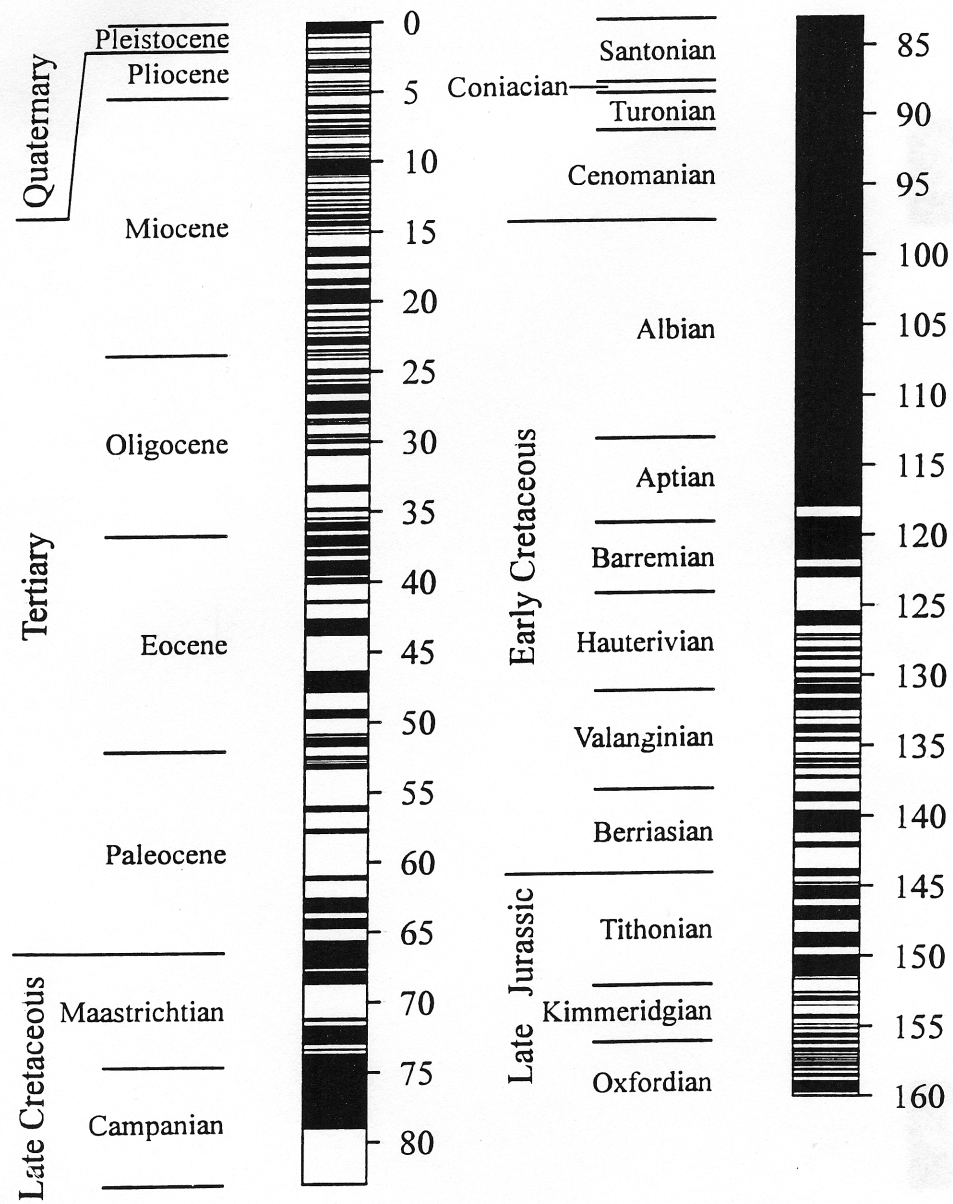
**Differential rotation maintained
by rotating density-stratified turbulent convection**



Entropy perturbations

**Convection in the Earth's core
and magnetic field generation
(the geodynamo)**





Convective dynamo equations

Conservation of mass

Conservation of magnetic flux

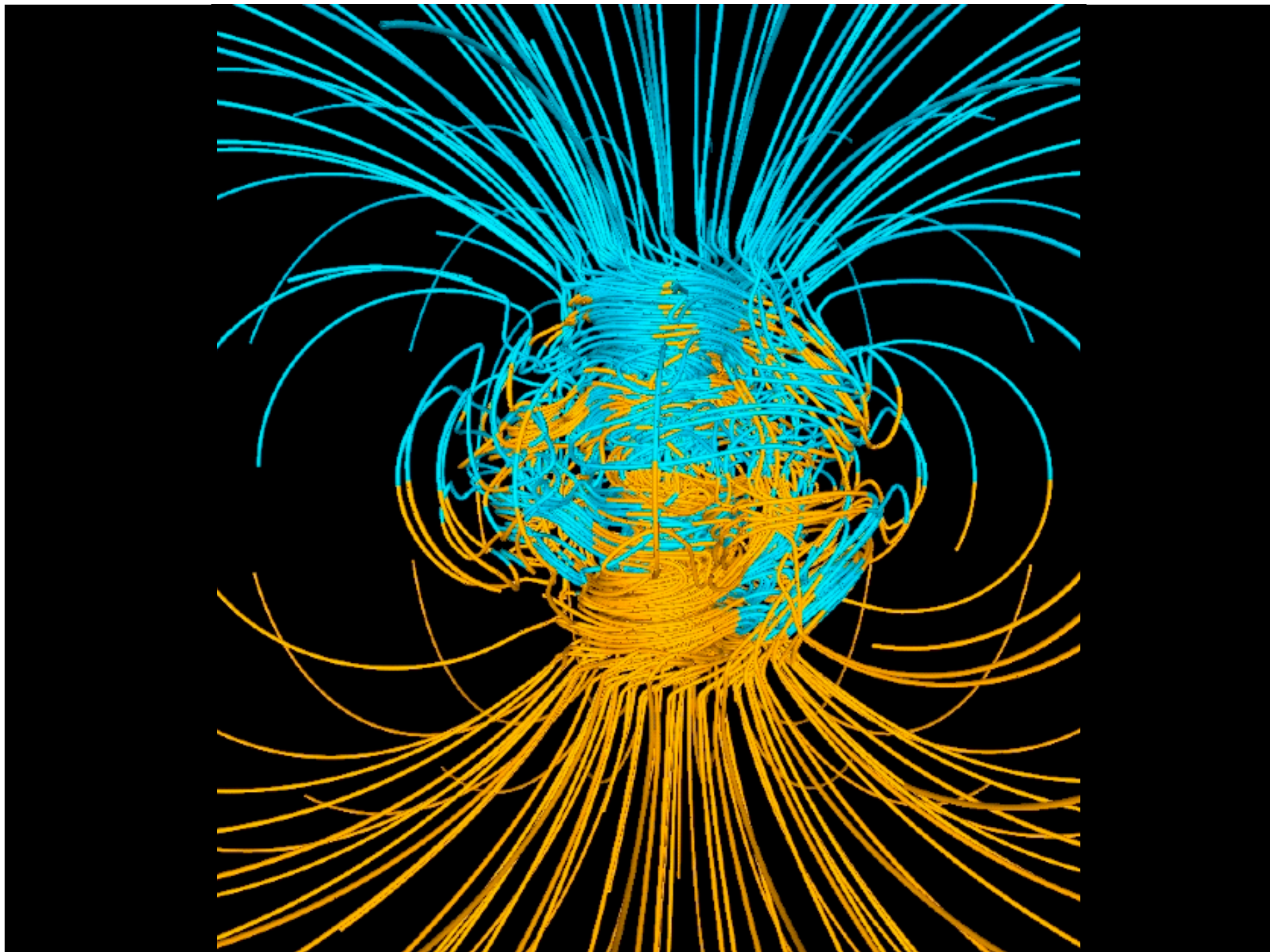
Equation of state

**Rate of change of velocity = - pressure gradient + buoyancy
+ advection + diffusion
+ Coriolis + Lorentz**

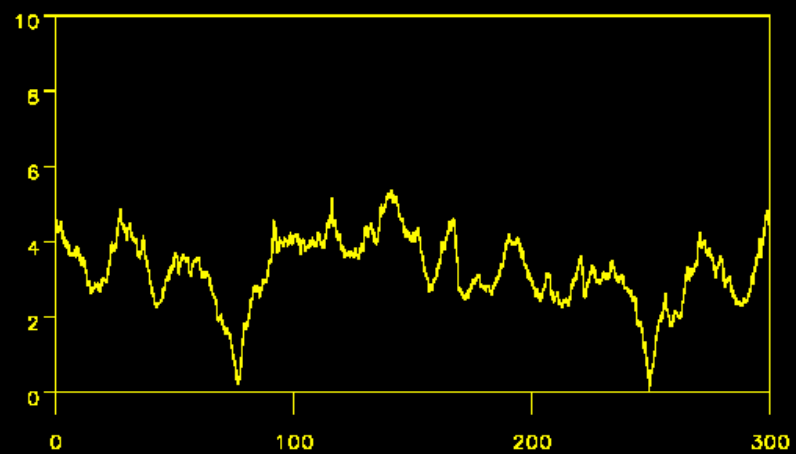
Rate of change of magnetic field = induction + diffusion

**Rate of change of entropy = Joule heating + viscous heating
+ advection + diffusion**

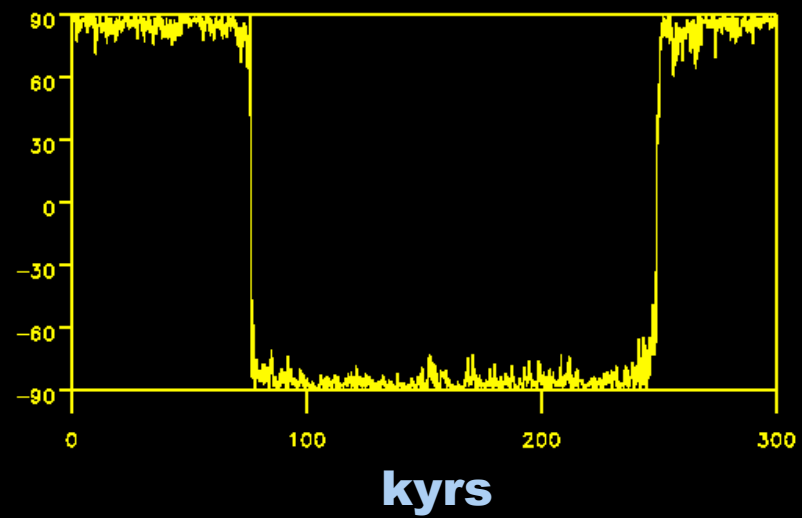
Rate of change of composition = advection + diffusion

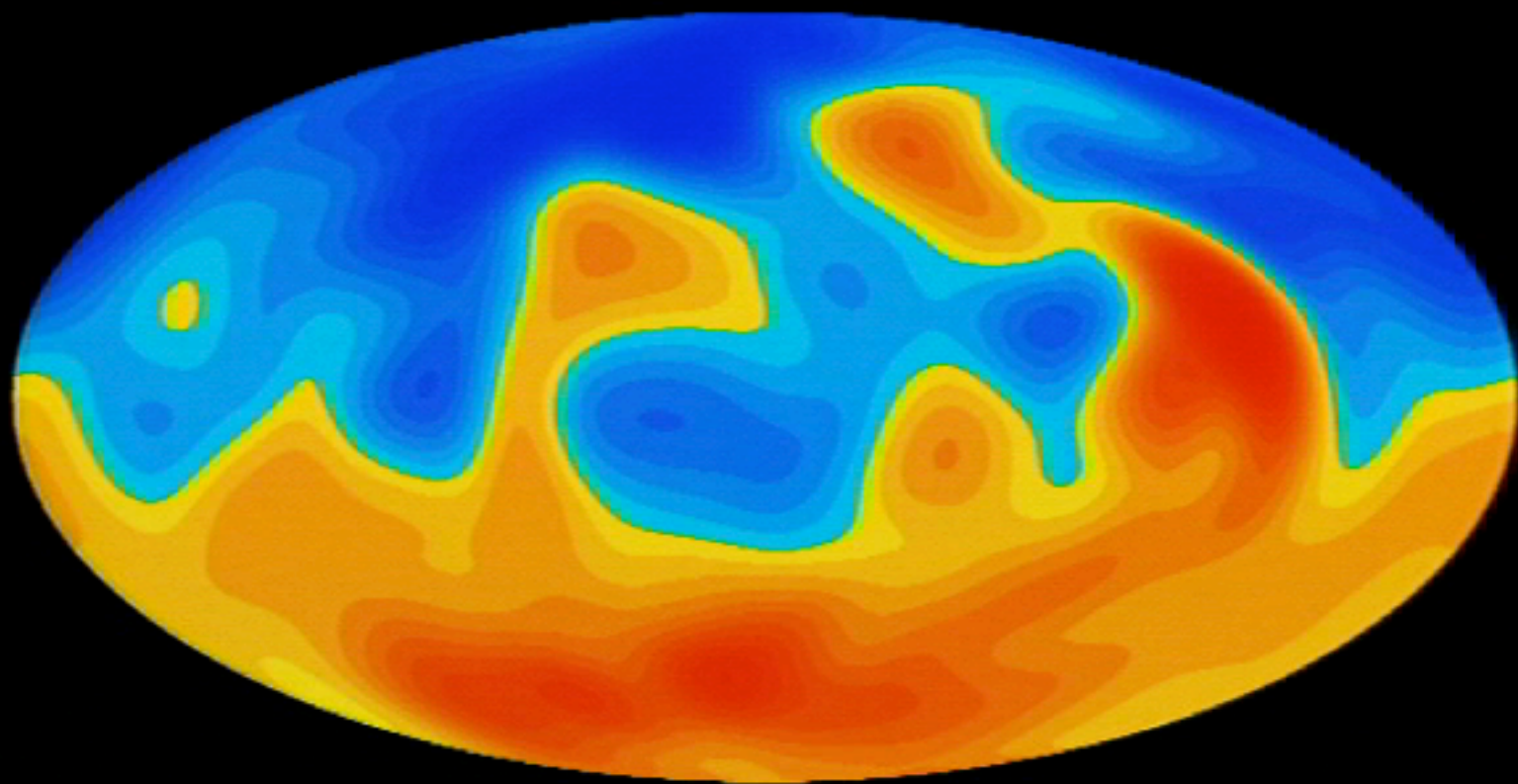


Dipole moment

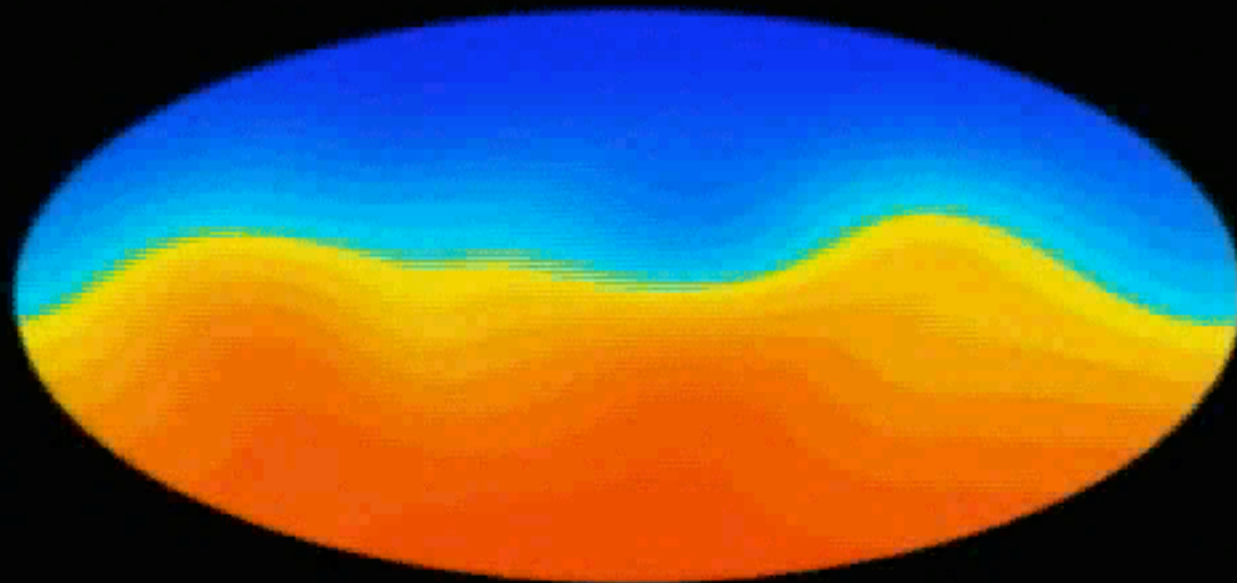


Pole latitude

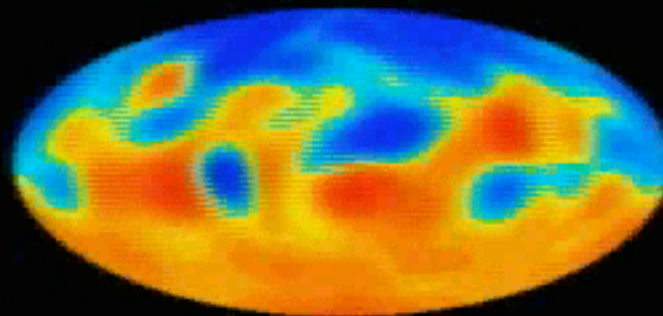


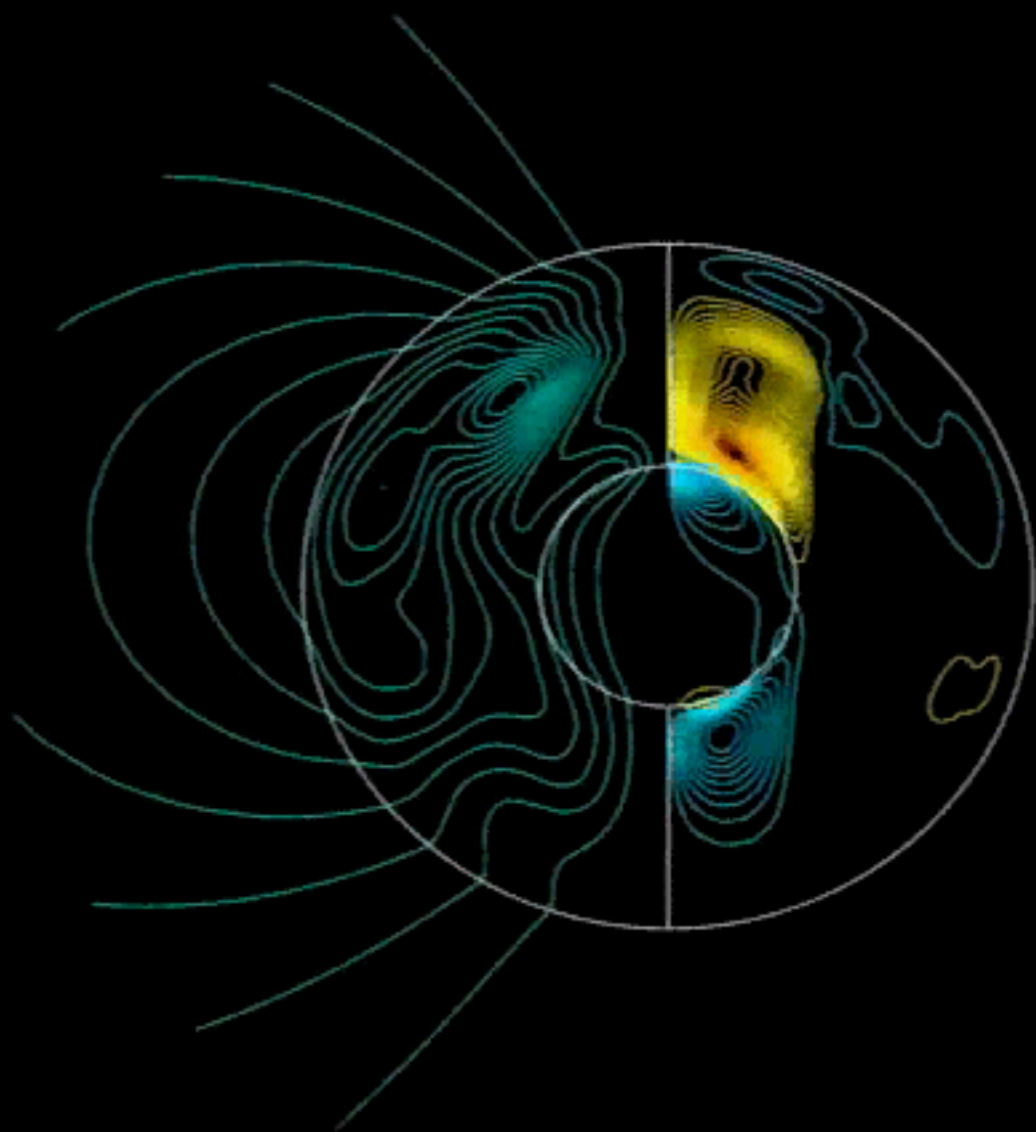


Surface of the Earth

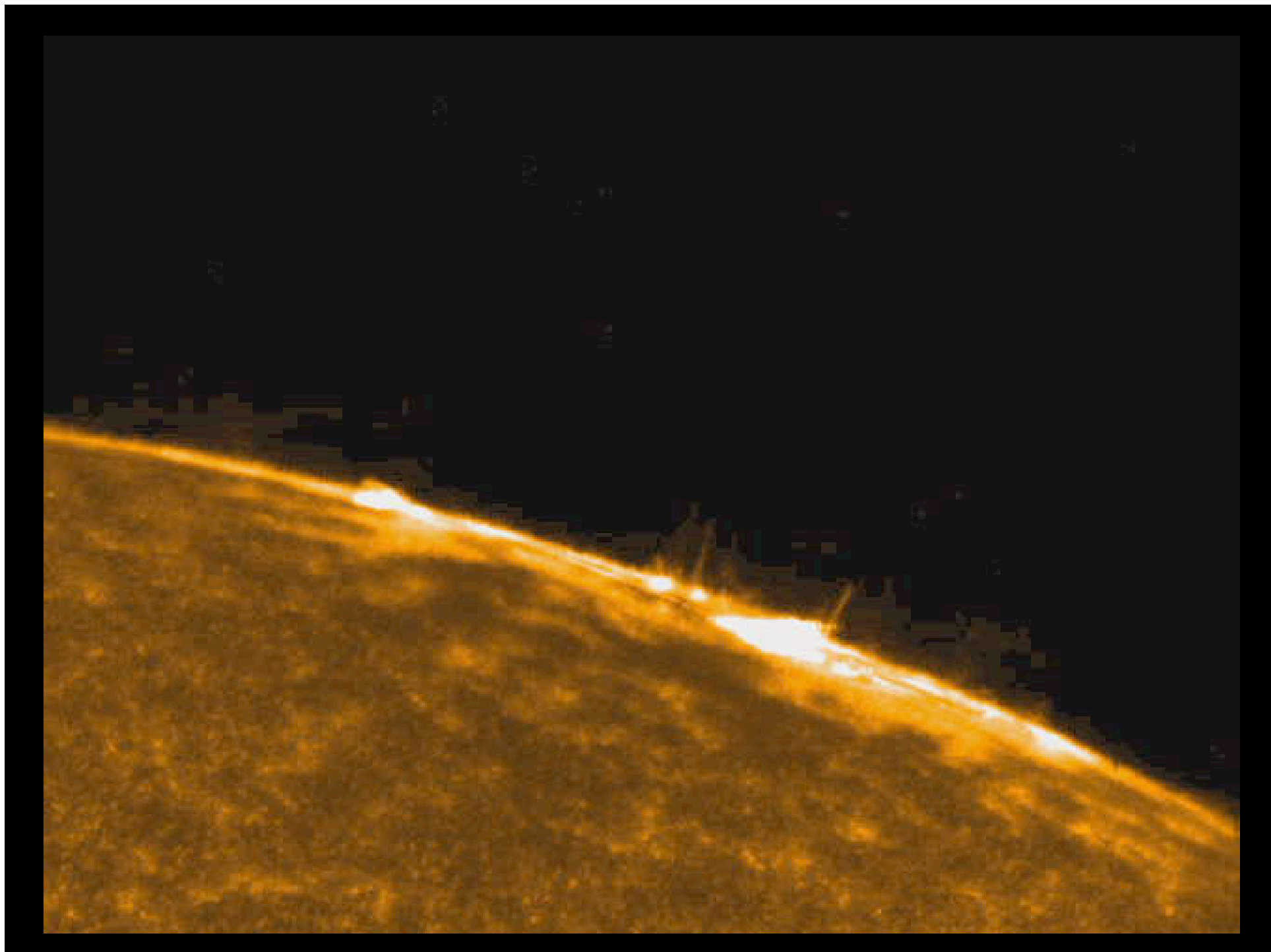


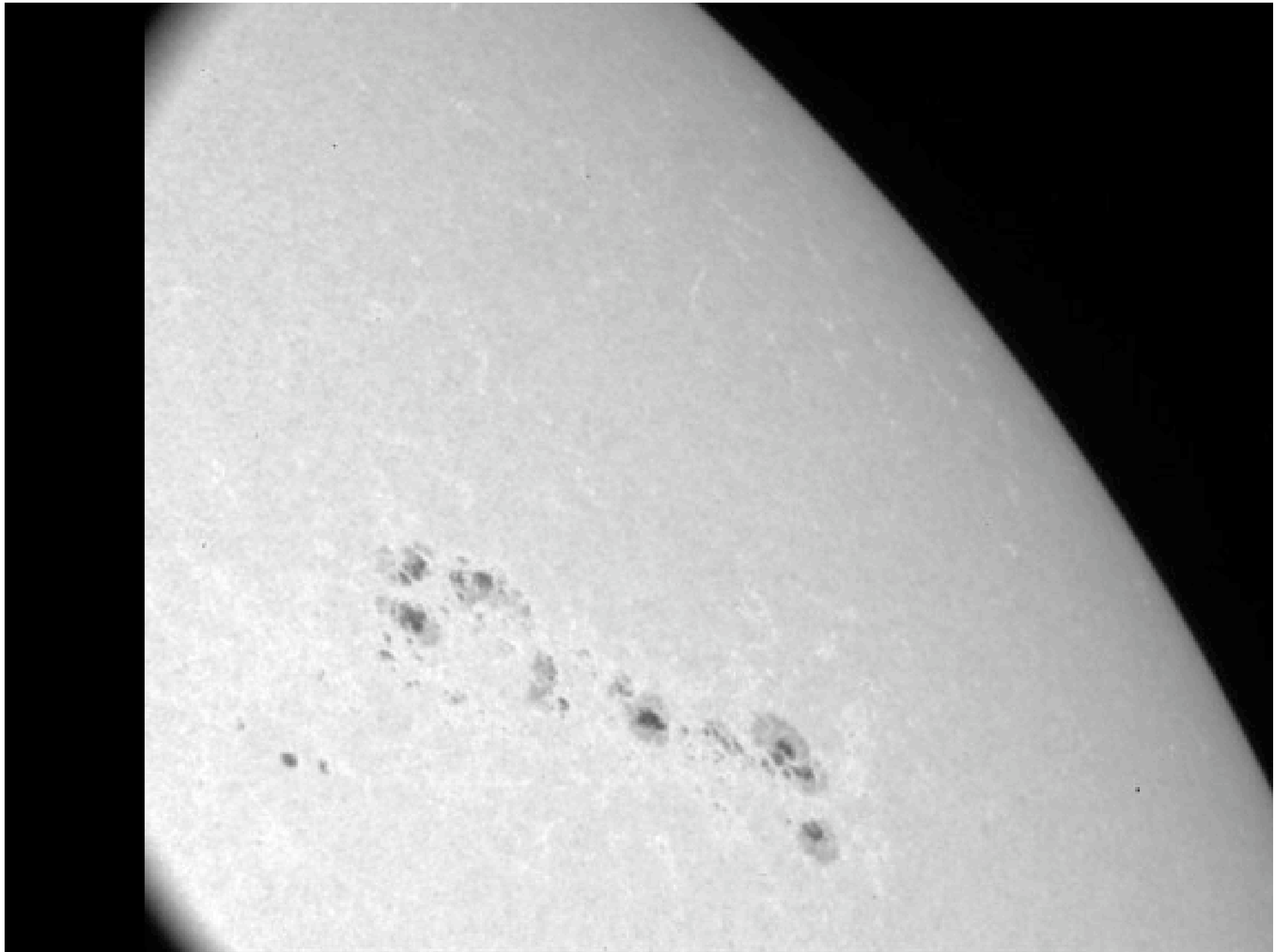
Surface of the Outer Core



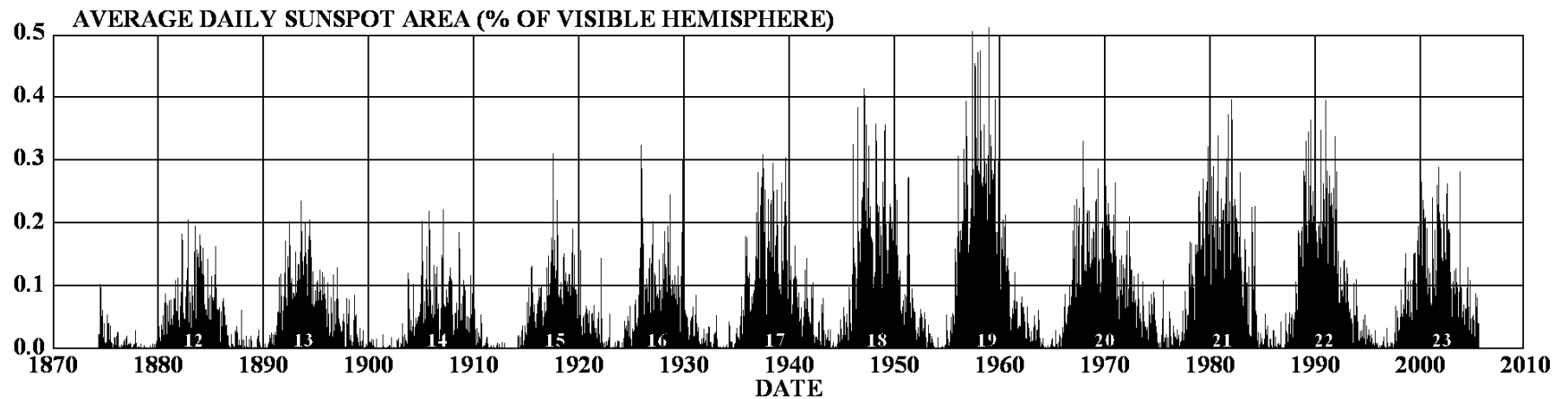
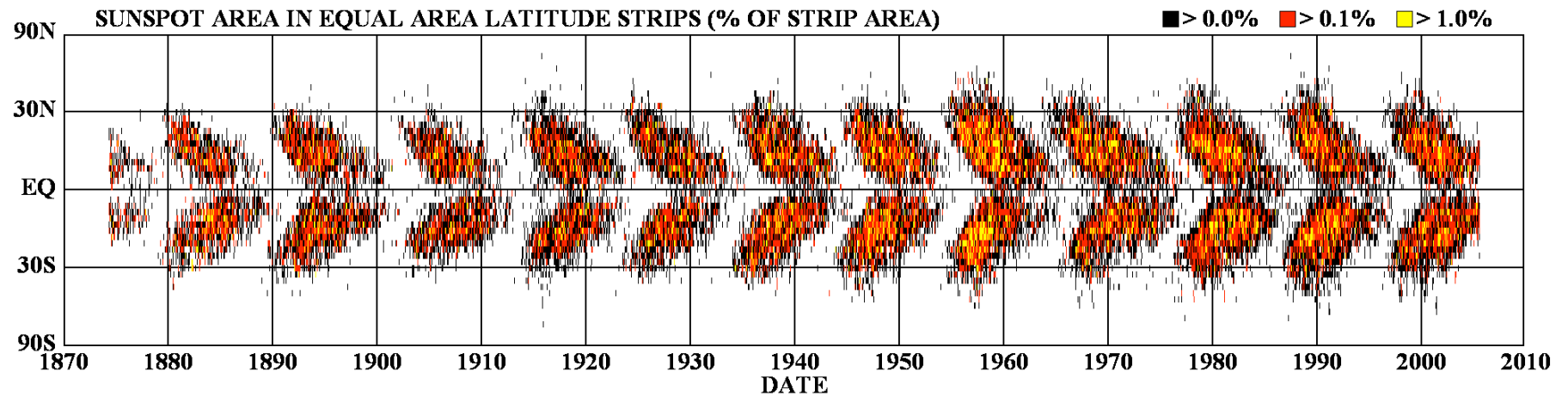


The solar dynamo

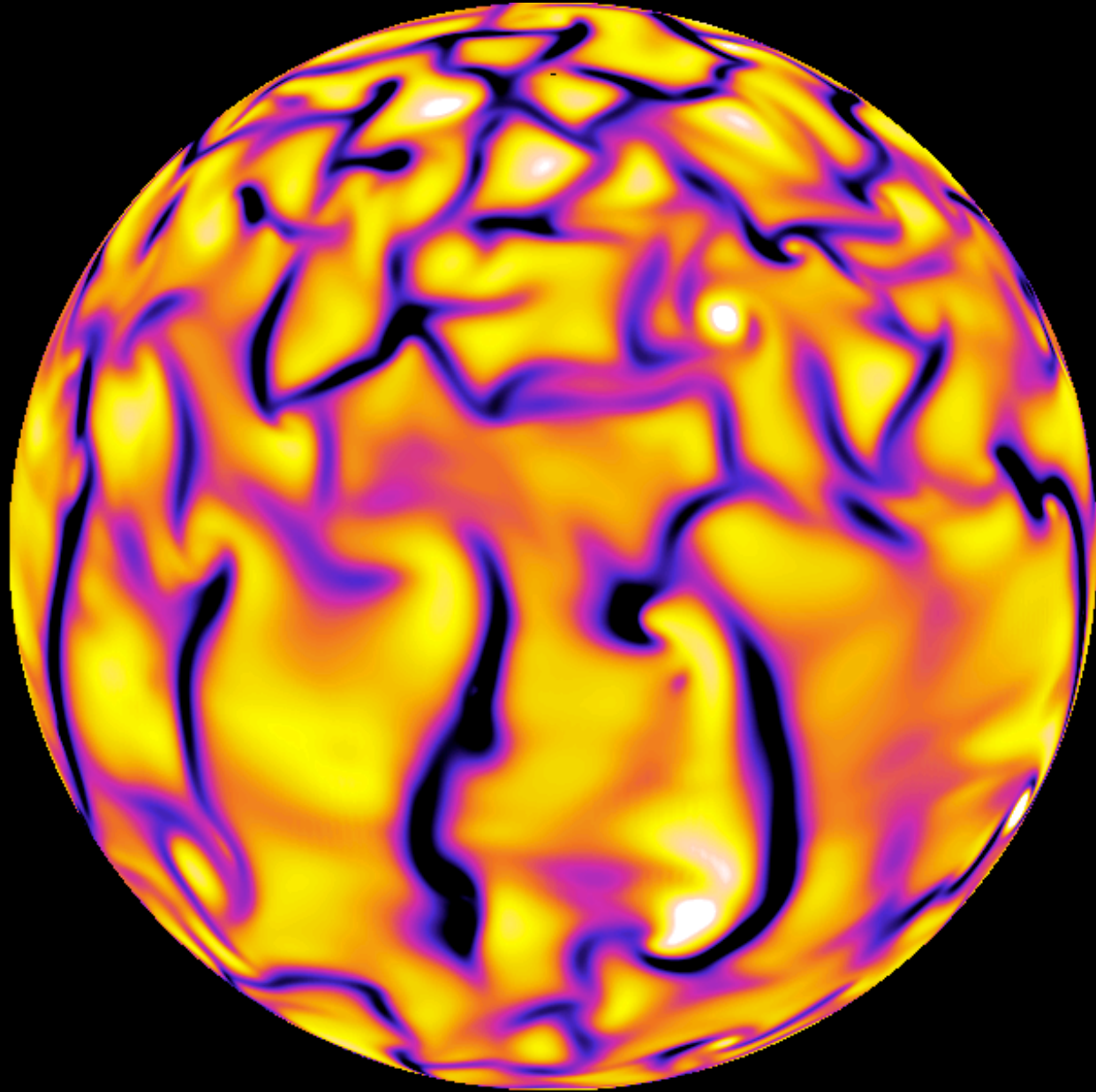




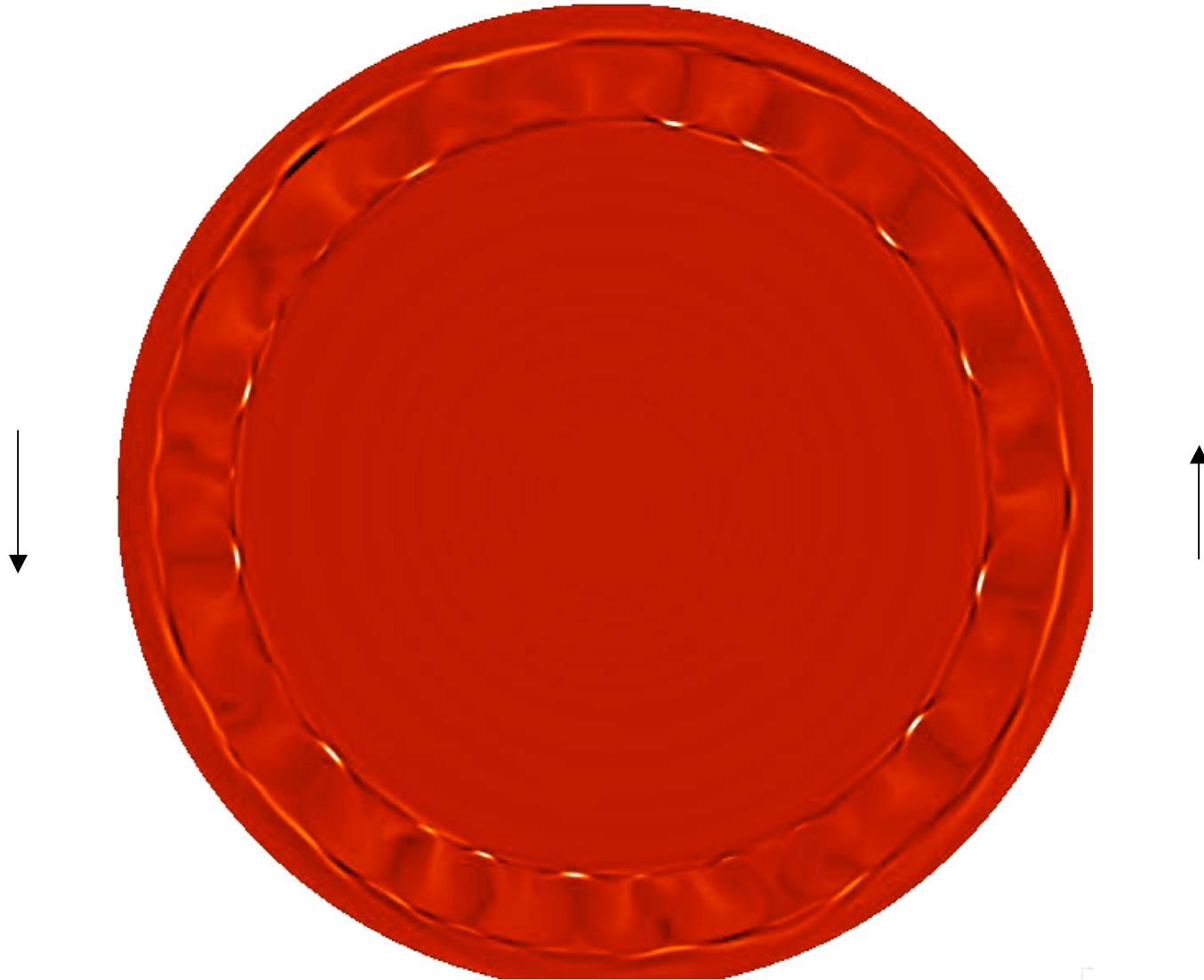
DAILY SUNSPOT AREA AVERAGED OVER INDIVIDUAL SOLAR ROTATIONS



Radial velocity



Stable radiative interior and unstable outer convection zone



Entropy perturbations in the equatorial plane

Tami Rogers