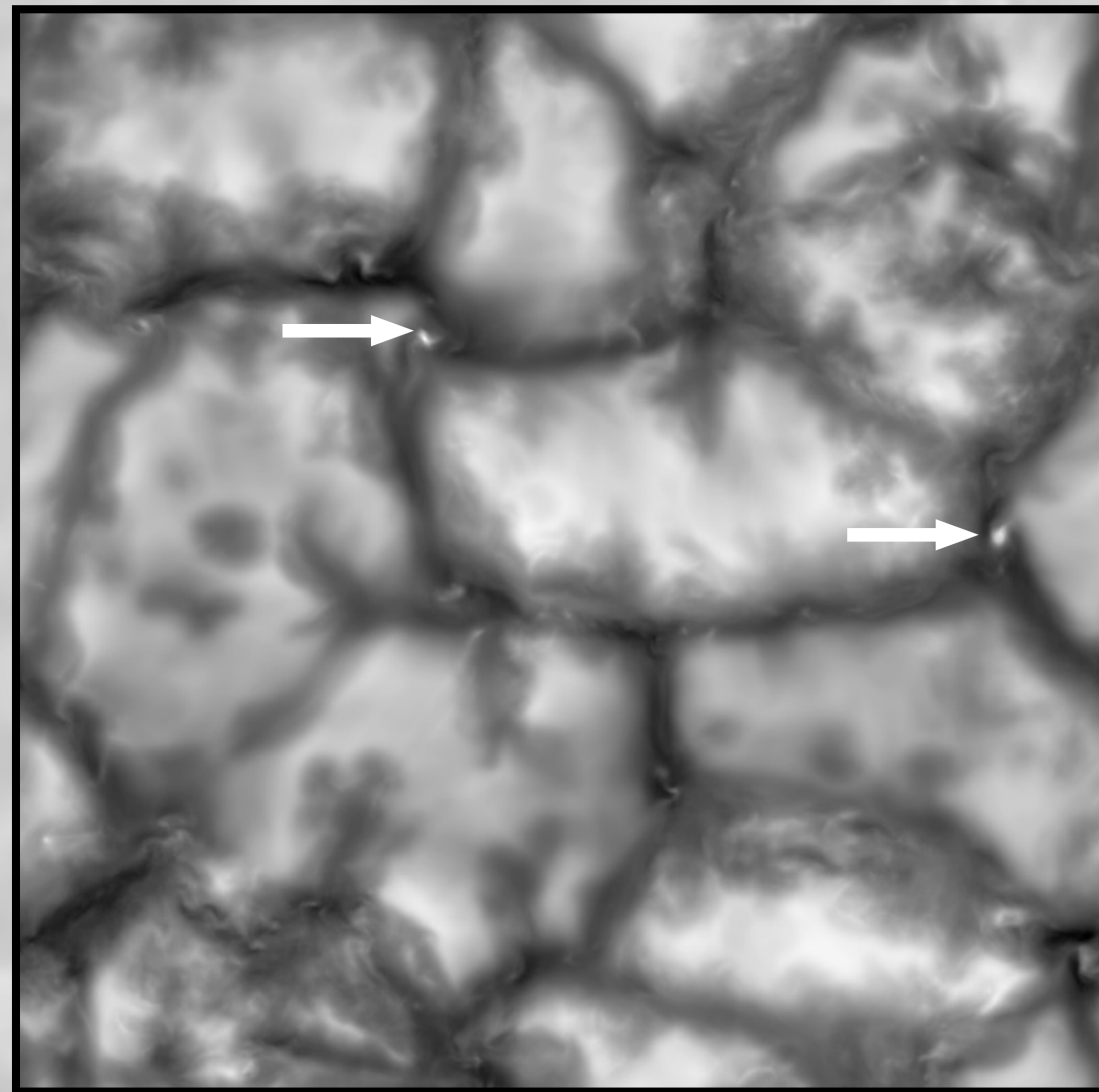# Recent RMHD simulations with CO^{5}BOLD

Oskar Steiner[1,2], René Salhab[1], Bernd Freytag[3,4] & Matthias Steffen[5] [1]Kiepenheuer–Institut, Freiburg, [2]Istituto Ricerche Solari, Locarno, [3]Centre de Recherche Astrophysique de Lyon, [4]École Normal Supérieur de Lyon, [5]Leibniz-Institut für Astrophysik Potsdam

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Intensity map over a field-of-view of 5.6 x 5.6 Mm of a high-resolution hydro-dynamic simulation with a grid constant of 7 km in the horizontal directions. The white arrows point to two non-magnetic bright points that develop as a consequence of swirling motions at votices of inter-granular downdrafts.
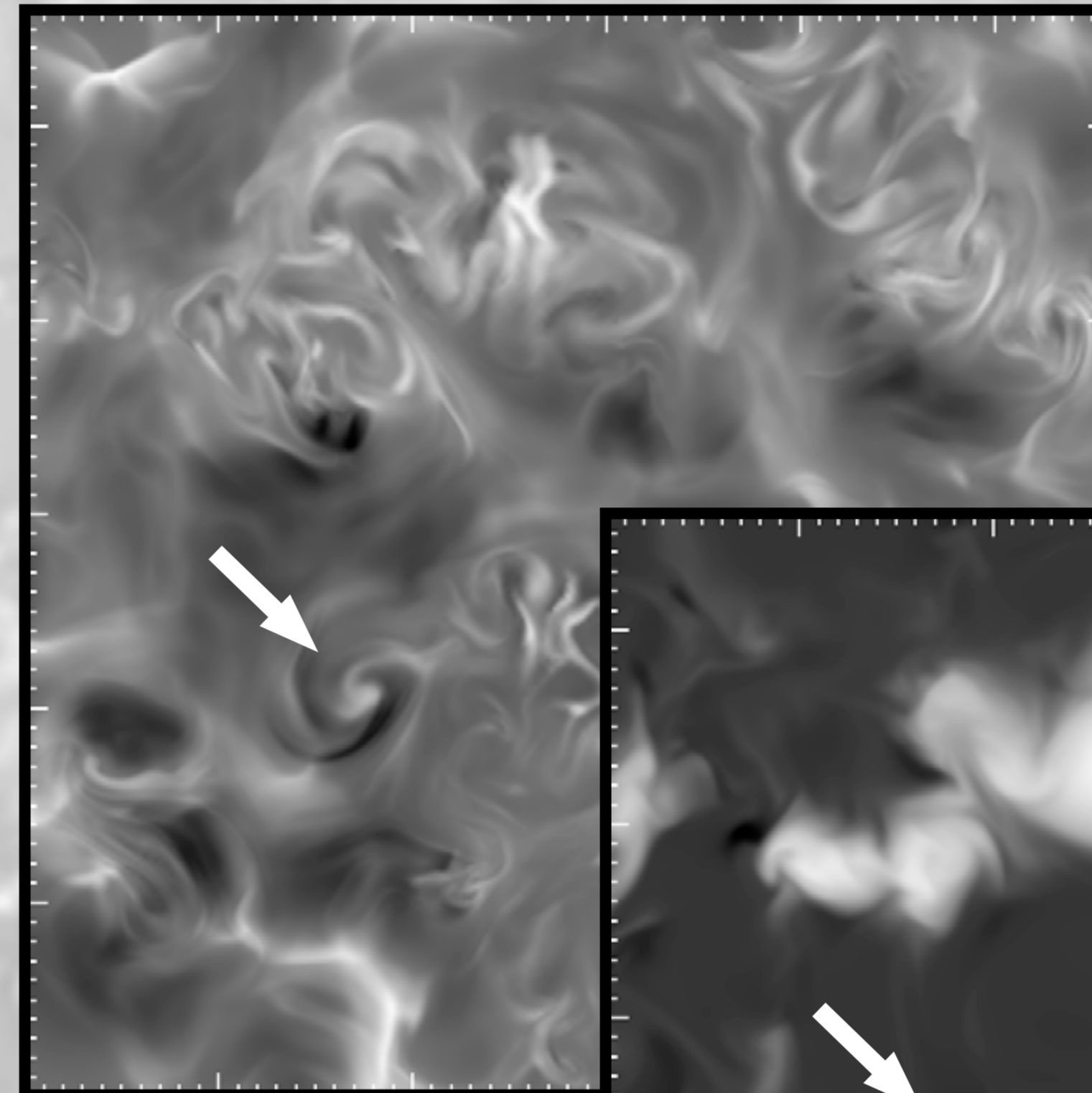

From bottom right to top left: Bolometric inensity, vertical magnetic field component, B_z, at z = 0 ($<\tau> = 1$), B_z at z = 500 km, and the temperature at z = 800 km. Snapshot from a simulation of a field-of-view of 5.6 x 5.6 Mm with a horizontal grid constant of 14 km.
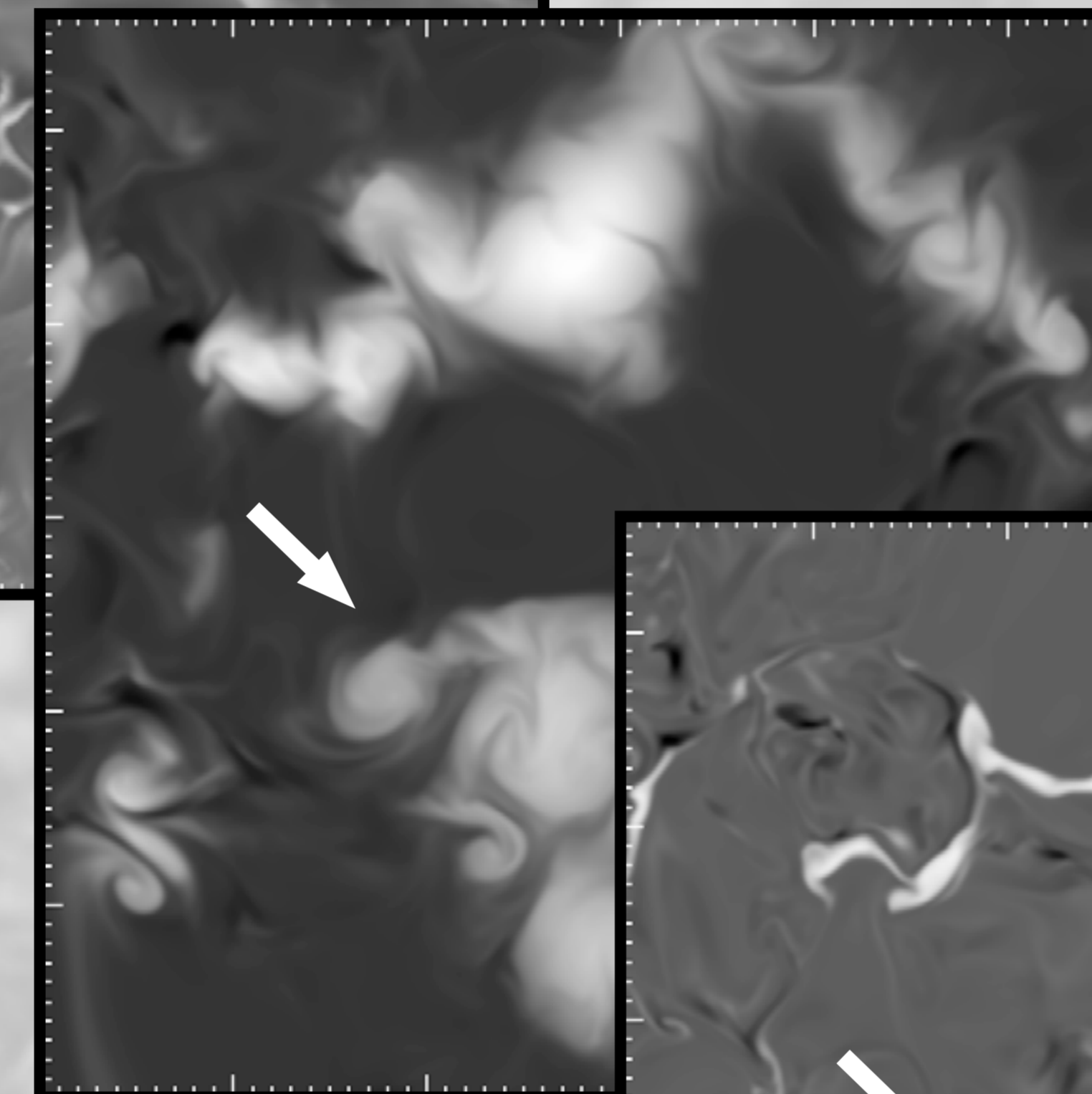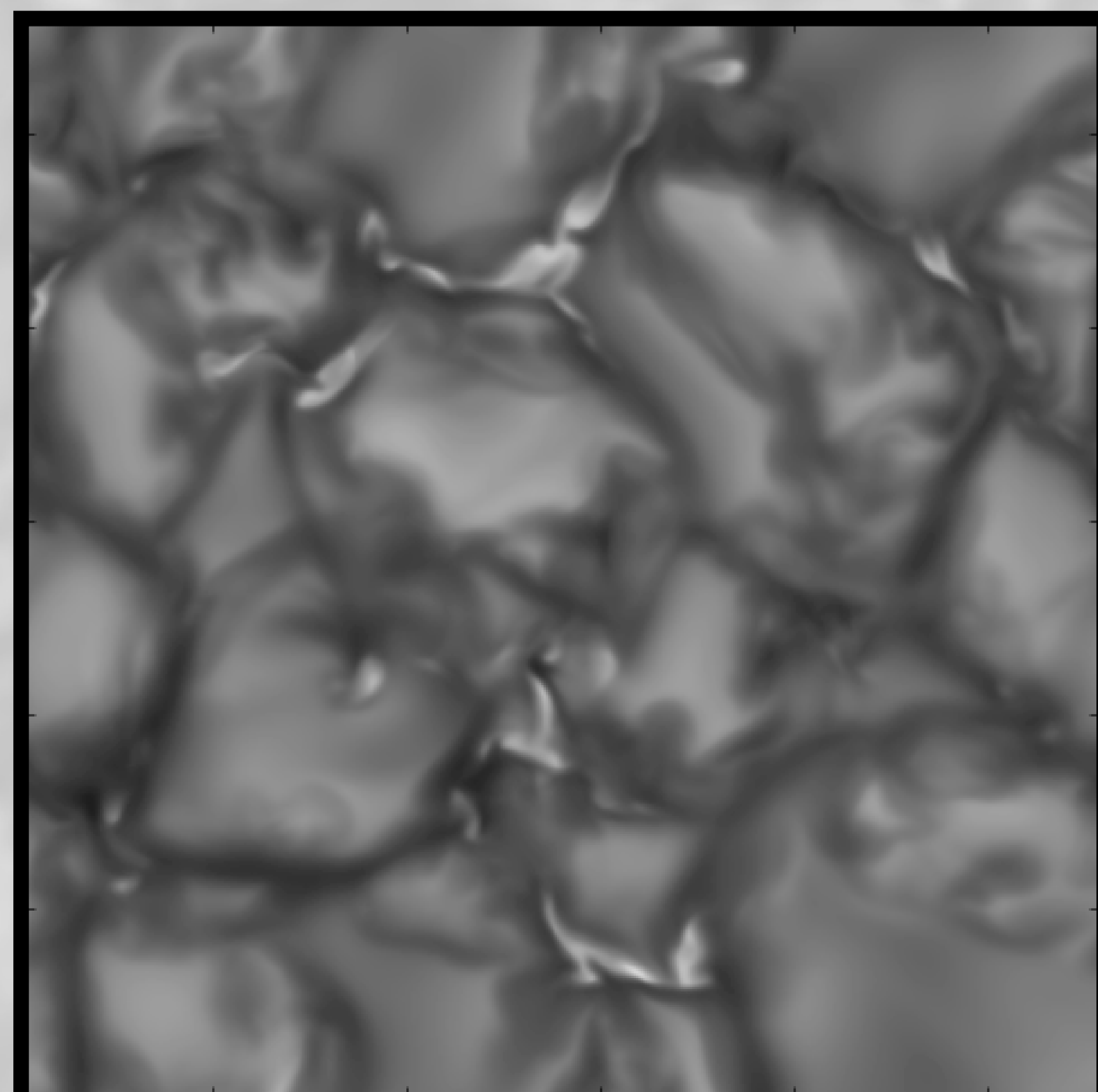
The temperature map and magnet-field maps in the higher layers show numerous swirl-like structures. A prominent swirl and subjacent magnetic and intensity structure are indicated with white arrows.
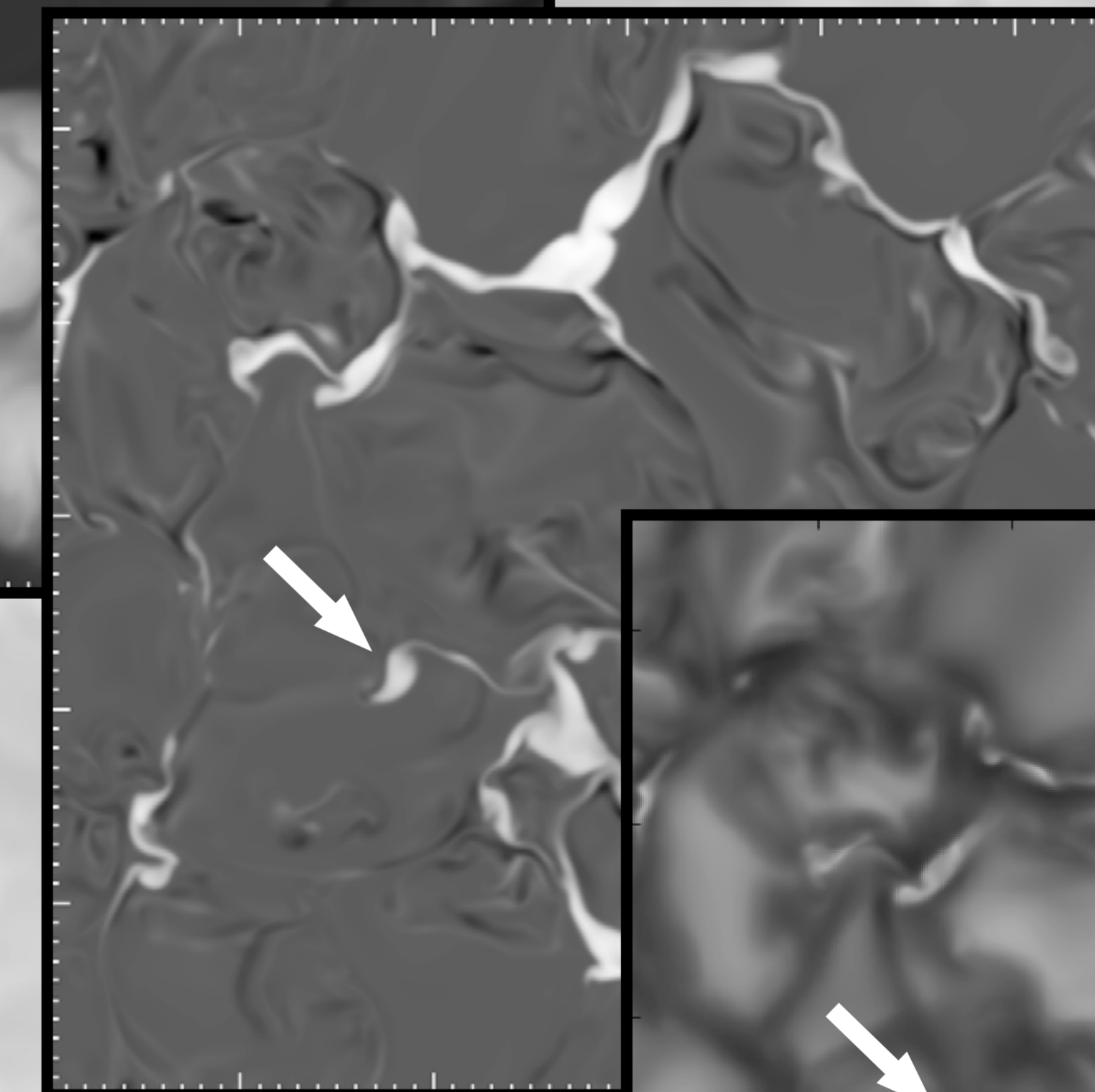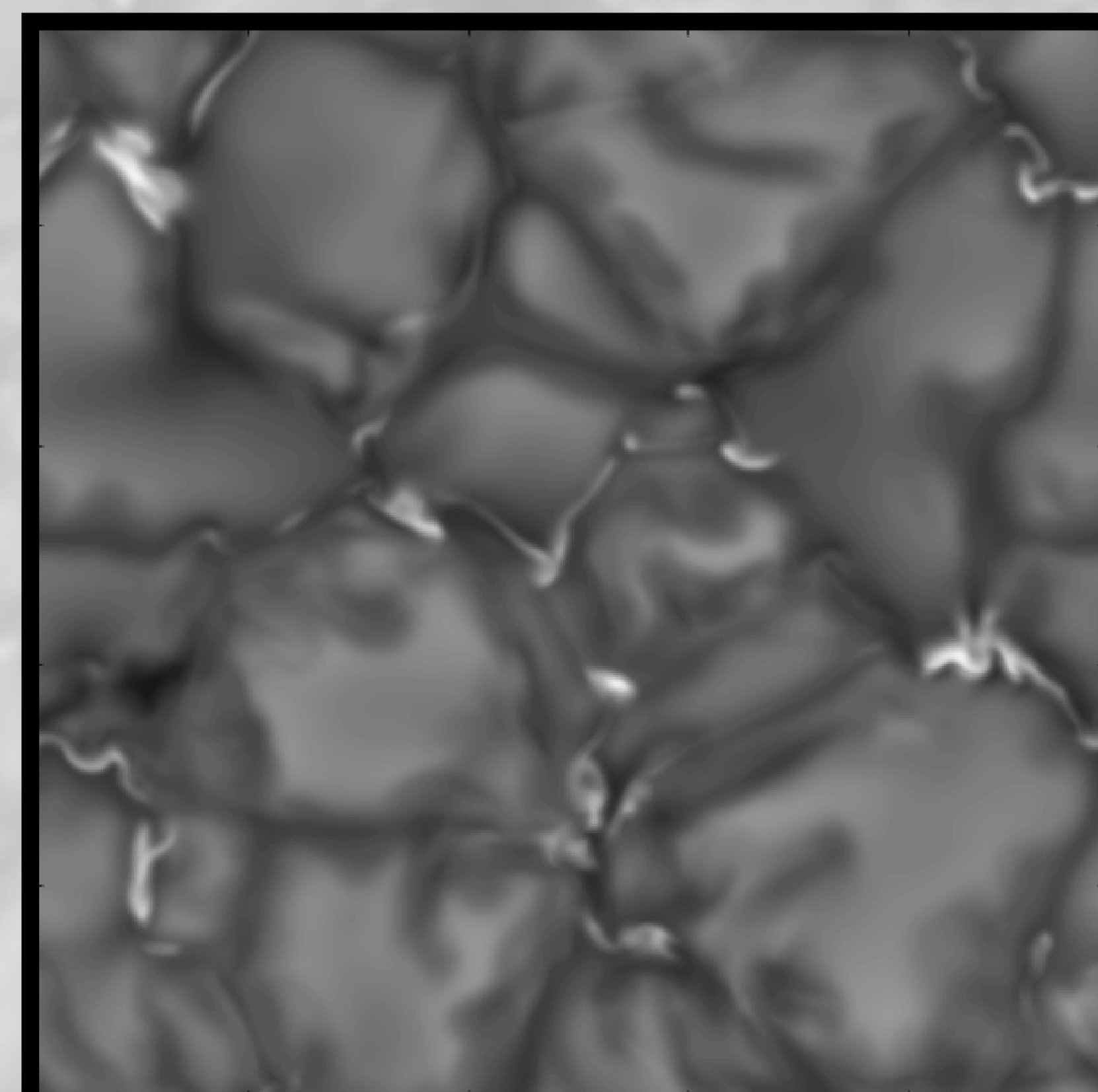
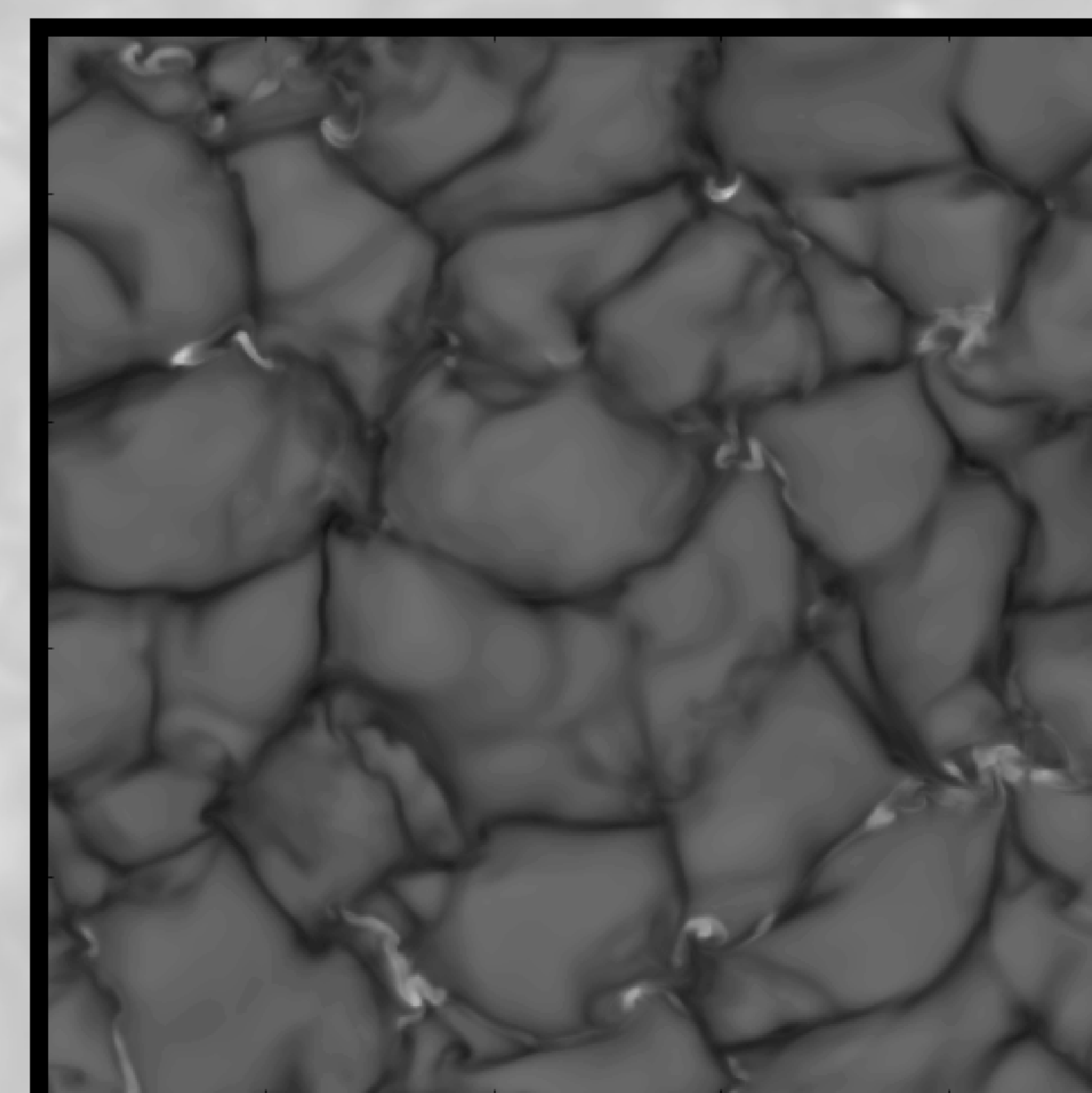The simulation started with a vertical, unipolar, homogeneous magnetic field of 50 G strength.
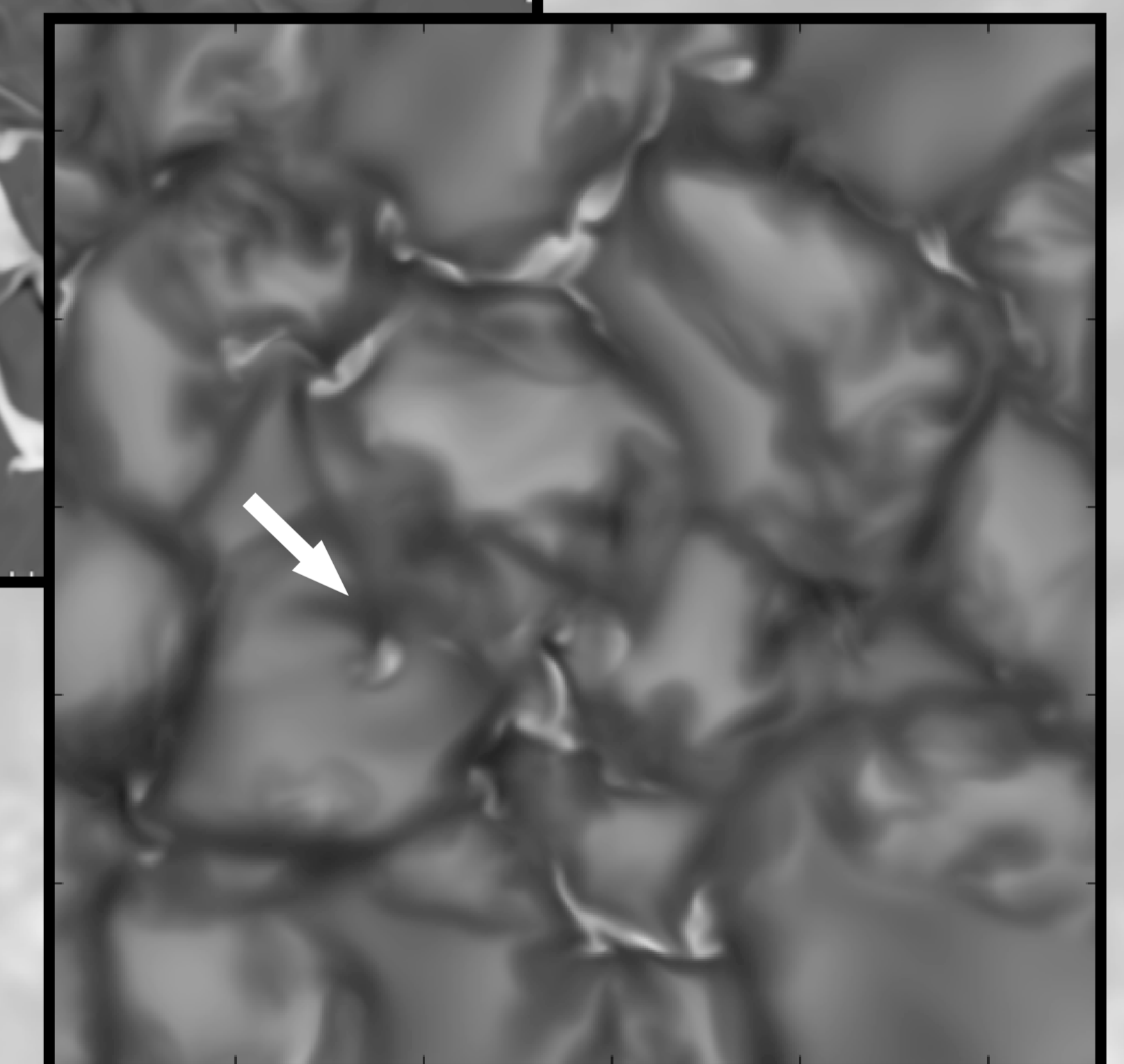
T$_{eff}$ = 5770 K

T$_{eff}$ = 5000 K

T$_{eff}$ = 4000 K

Magnetic elements of stellar atmospheres: Like for the Sun, magnetic knots and sheets form in the intergranular lanes. The maximum field strength of magnetic elements at average optical depth unity increases and their Wilson depression strongly decreases with decreasing effective temperature, leaving the field strenght at $\tau = 1$ inside the magnetic elements unchanged. Note the change of shape of the magnetic elements with changing effective temperature.

Background: Broadband image of the Sun