How to derive the real pattern of magnetic helicity injection in an active region?

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Magnetic helicity, a topological quantity which measures the twist, the writhe and the shear of a magnetic field, has recently appeared as a key quantity to understand some mechanisms of the solar activity such as Coronal Mass Ejections and flare onset. It is thus becoming of major importance to be able to compute magnetic helicity in active regions. Looking at the pattern of the photospheric injection of magnetic helicity may provide new useful pieces of information to understand the basic properties of solar activity.

If several helicity flux density maps were published no one yet wondered if helicity flux density is a correct physical quantity. Unfortunately, the classical helicity flux density do induce spurious signal (fake polarities) which mask the real injection of helicity. To map the real helicity injection, the knowledge of the complete connectivity of the field lines is fundamental. Even without the connectivity, improved helicity flux density maps can be derived which present strong differences with the previous incorrect maps. This leads to a complete new way of understanding the dynamics of the active region, in the frame of the magnetic helicity study.