Observations of quiescent reconnection (and associated heating!, and topological energy release!, but no time!)

Lucas Tarr, Dana Longcope, Dave McKenzie, & Keiji Yoshimura

MSU Solar Physics

July 10, 2013
Purpose and motivation

Goal: Measure the amount of reconnected flux between a small, bipolar active region and surrounding, preexisting field over the course of multiple days.
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Past Simulations: See series reviewed by [Archontis 2008, JGR 113], which shows emerging flux will also continuously reconnect, with as much as 75% of emerging flux reconnecting to external fields, depending on the orientation of the overlying field. FOCUS: small, bipolar emergence associated with Xray Bright Points, Jets, etc. [eg Karpen\#100.43, Fang\#100.102]
Key points of the radial field evolution:

- Emerged positive field complete surrounded by preexisting negative flux in emergence zone: **magnetic dome topology**
- Emerged positive flux moves West, negative flux moves South/East
- Region N2, West of emergence contains *unambiguously preexisting* negative flux
AIA UV and EUV wavelengths:
“By eye” determination of boundary at each point:

- “Procedure” performed at every timestep at a 1 hour cadence
- Should really automate to reduce hand fatigue, and also apply to statistical study the HEK Emerging Flux module.
Both EUV and Magnetogram together:
Linear fit: $0.38 \times 10^{16}$ Mx/s

20 – 40% of emerged flux has reconnected at any given time

First measured reconnection flux: 17 hours after emergence

First reconnection according to fit: 11 hours after emergence
Summary

- Track radial magnetic field over the course of several days
- Identify a region of unambiguously pre–emergence flux
- Track the boundary of emerging flux system using EUV data
- Intersection gives average reconnection rate of $0.38 \times 10^{16}$ Mx/s for $\sim 40$ hours.
- Reconnection lags emergence by $\sim 12$ hours
- 40% of emerged flux eventually reconnects with preexisting field