

Differences in **ECOR** and **EBBR** Flux Measurements and Their Impacts on the Large-scale Forcing Fields

SHUAIQI TANG

Lawrence Livermore National Laboratory

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Collaborator: Shaocheng Xie, Minghua Zhang, Qi Tang, Yunyan Zhang, Stephen A. Klein, David R. Cook and Ryan C. Sullivan

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Turbulent Flux Measurements at ARM SGP



ECOR (Eddy Correlation Flux Measurement System)



- Error covariance method
- 2003.9 – current
- 14 stations at SGP (currently 8 stations)
- **QCECOR** (quality controlled ECOR data)

EBBR (Energy Balance Bowen Ratio Station)

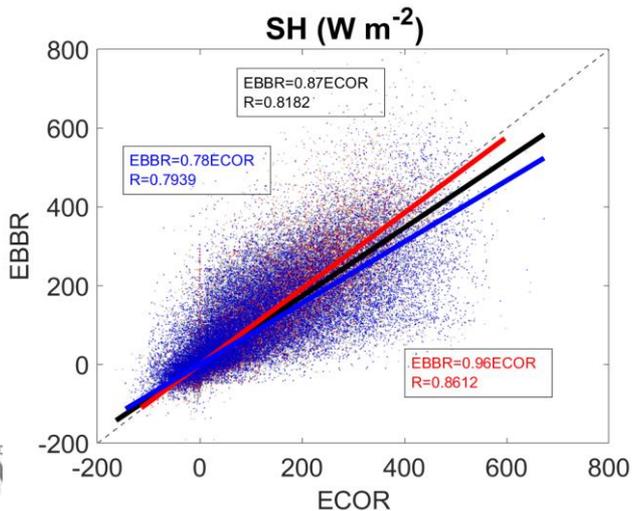
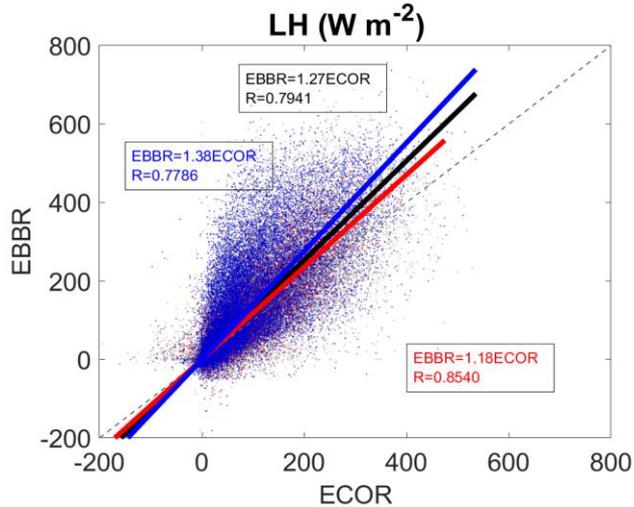


- Energy balance – Bowen Ratio method
- 1993.7 – current
- 19 stations at SGP (currently 11 stations)
- **BAEBBR** (combined with Bulk Aerodynamic method)

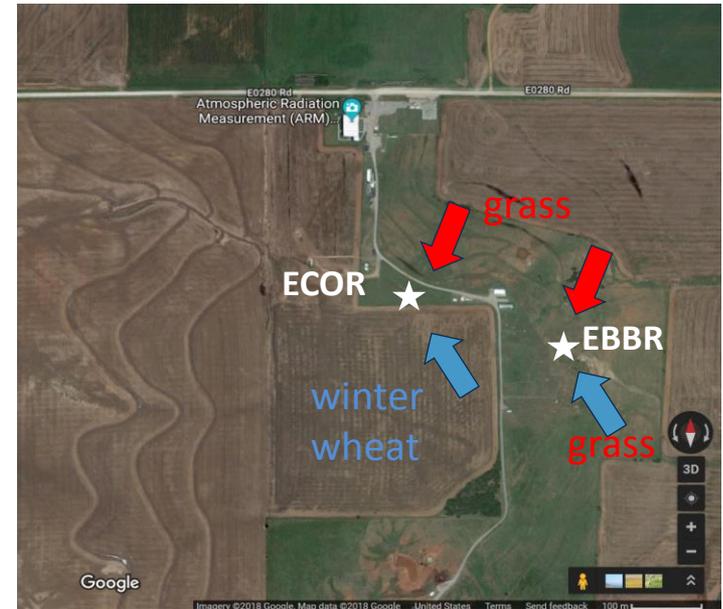
ECOR and EBBR at the collocated central facility



30-min LH and SH at CF during 2004-2015

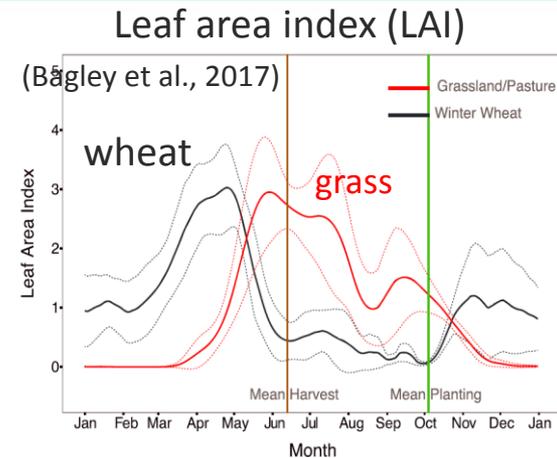
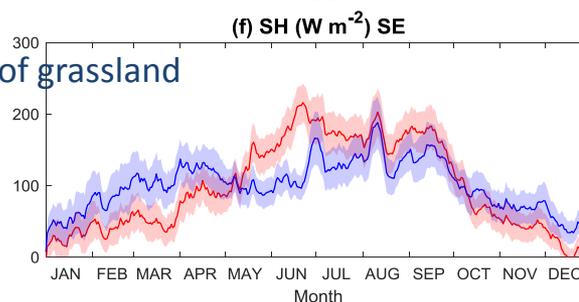
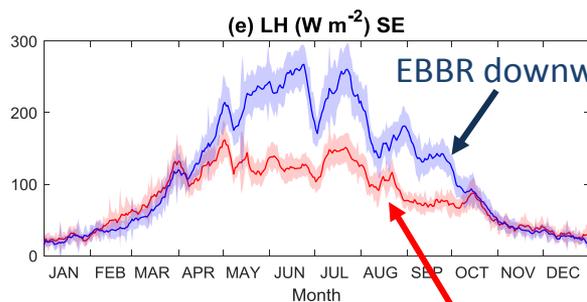
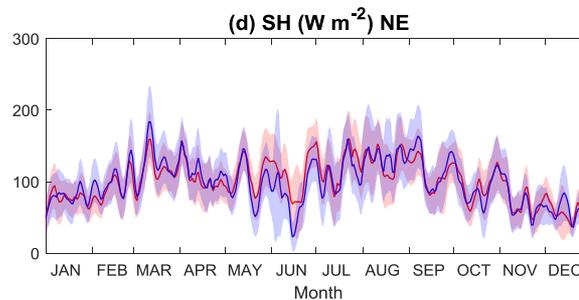
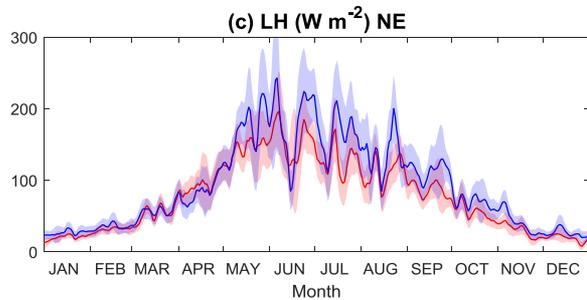
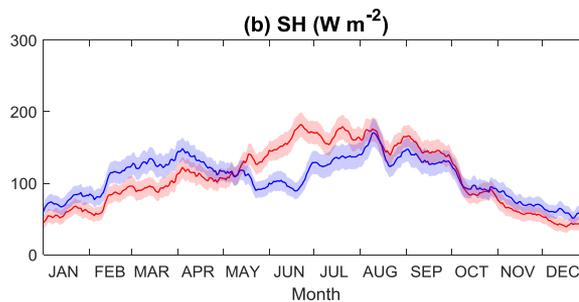
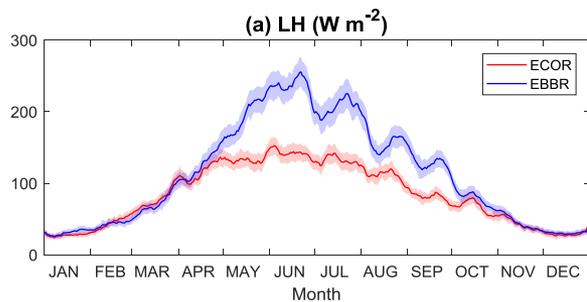


The ARM SGP Central Facility



ECOR and EBBR are more close to each other when they are downwind of the same surface type. When they are downwind of different surface types, the difference is larger.

Different seasonality of different surface types



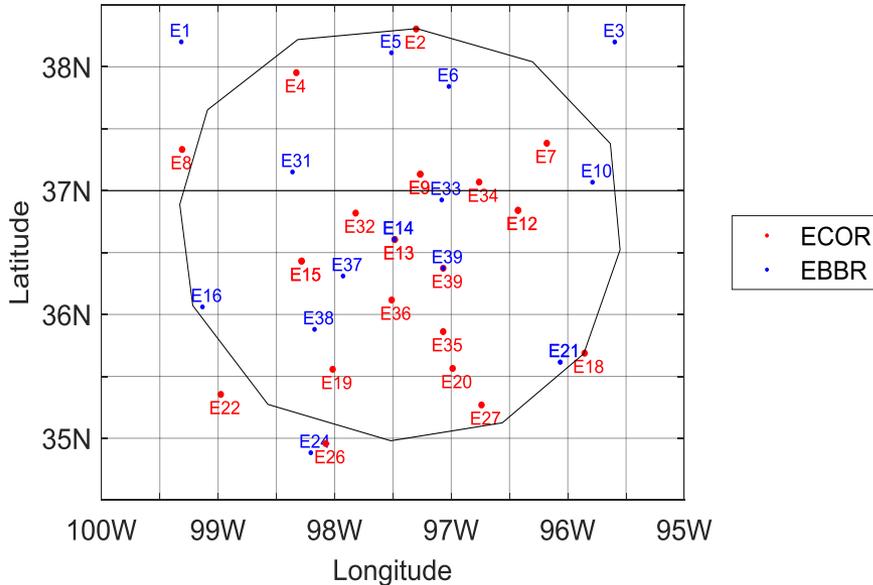
Same surface type: grassland

different surface types: grassland, cropland

Different surface types have different seasonality



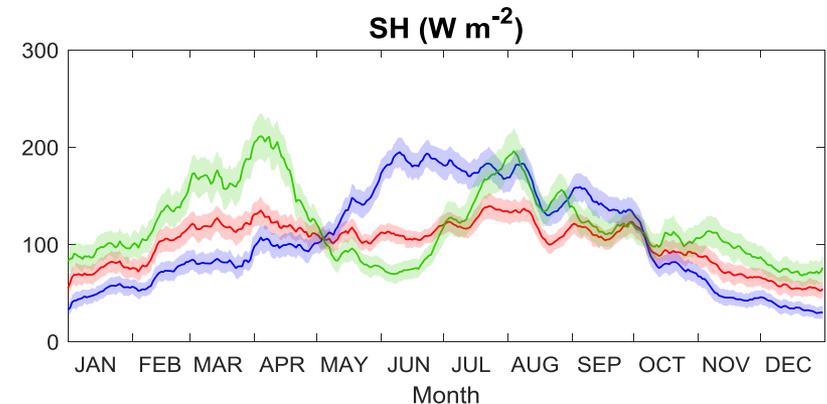
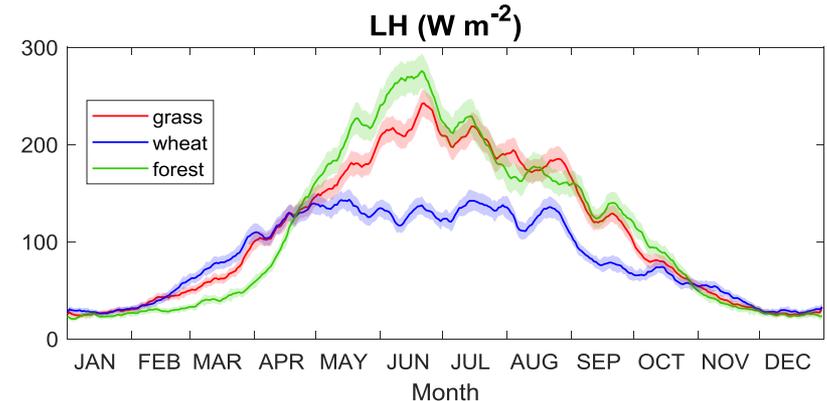
(a) The ARM SGP Domain



Grassland/pasture: 26

Winter wheat: 8 (may overlap with grassland/pasture in different wind directions)

Forest: 1



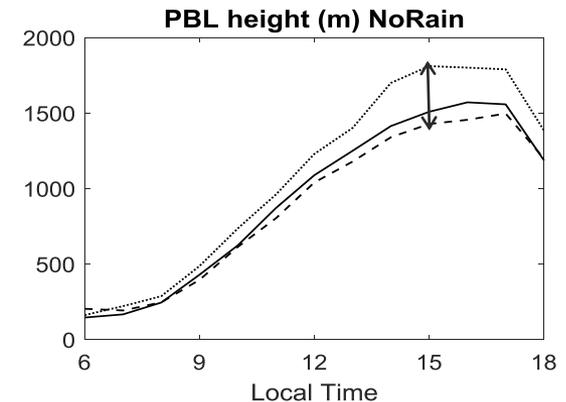
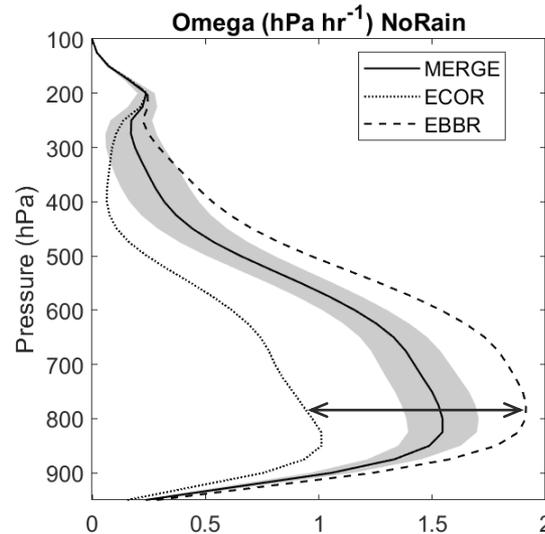
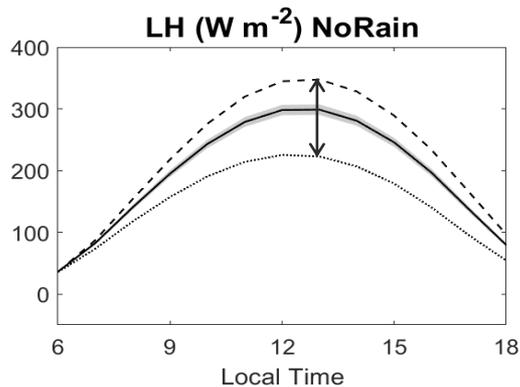
Grass (red)
Winter wheat (blue)
Forest (green)

All EBBR systems are over grassland.

ECOR systems can be over grassland, cropland or forest

Impact to the derived large-scale forcing and SCM simulation

Non-precipitating days during May-August, 2004-2015



- The differences between ECOR and EBBR fluxes may impact derivation of large-scale forcing fields, simulations of boundary layer development and shallow-cumulus properties (e.g., cloud base height)
- The impact is more prominent for non-precipitating summer days

Summary



- Large differences found in ECOR and EBBR measured surface turbulent fluxes at SGP are partly attributed to **different surface types** that the instrument systems represent.
- At SGP, **winter wheat** has different growth cycle than the native vegetation. Surface energy partitioning differs significantly for winter wheat and grass surfaces.
- The differences in turbulent fluxes have considerable impacts on the derived large-scale forcing, and further impacts the simulation of boundary layer development and shallow cumulus clouds, especially during **summertime non-precipitating days**.

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