



Atmospheric Radiation Measurement

ARM Surface Heat Flux Study Group – an Update

We shrunk the SGP EF Network!

ARM CMWG Fall 2009 Meeting

Ric Cederwall

Lawrence Livermore National Laboratory

Why Change the EF Network?



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- ***GCM grid resolution reduced since initial network designed***
 - **Cost of servicing large scale EF network exceeds scientific benefit**
 - **SGP faced with need to cut costs (i.e. staff)**
- ***More detailed, small scale models need finer resolution data***
- ***Ecological studies require more detailed sampling of land surface types within common meteorological regimes***
- ***Can use land surface modeling to estimate surface heat flux***
- ***Stimulus package allowed:***
 - **Upgrade of surface flux measurements at SGP**
 - **New surface flux systems at Barrow and Darwin**

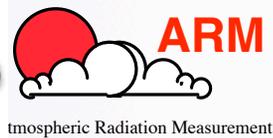
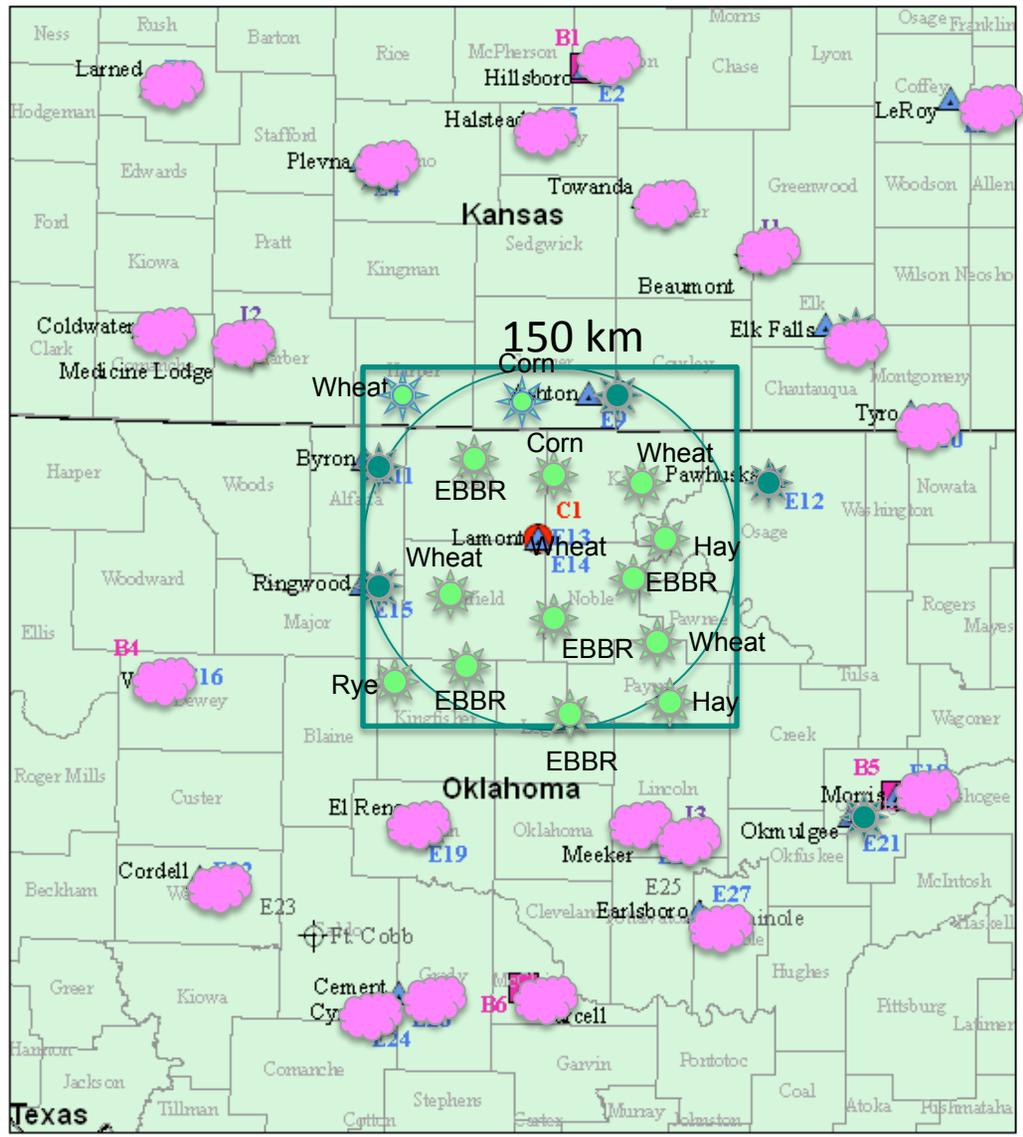
Study Group Recommendations for Stimulus Funds



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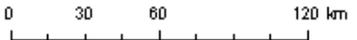
- ***Acquire more ECOR units for surface heat flux measurements***
 - **ARM has improved performance of ECORs since early days**
 - **Gives option to upgrade some units to AMERIFLUX standard**
- ***Use new units to upgrade resolution at SGP***
 - **Recommend 9 new units to improve land surface sampling**
 - **Assume that SGP network would be reduced in size**
- ***Add surface heat flux capability at NSA***
 - **Sample variation moving inland from coast – 3 new units**
- ***Add surface heat flux capability at TWP***
 - **Locate 3 new units in Darwin area, from harbor to inland**
 - **Locate 1 unit in Manus to sample source for cloud generation**

The New Network



-  Decommissioned EF
-  New EF
-  Existing EF

- Legend**
-  Boundary Facility
 -  Central Facility
 -  Extended Facility
 -  Intermediate Facility
 -  Retired



Source: ACRF GIS, October 2006



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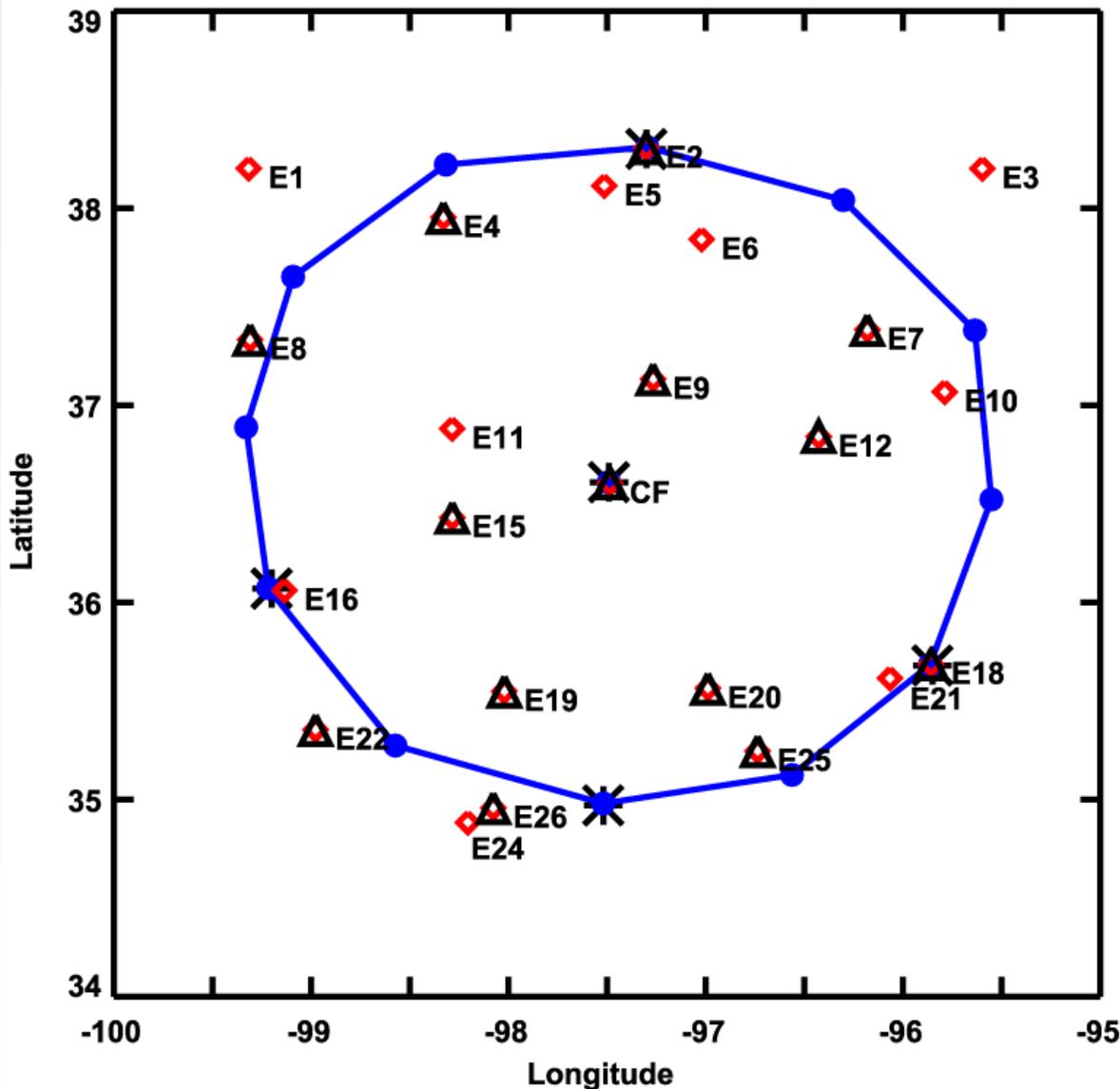
Is it possible to remove some of the EFs without significantly affecting the spatial variability resolved by the current surface network and the variational analysis products?

A Little Background



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ARM SGP Observation Network



~ 23 EFs

- Radiative fluxes
- SH, LH
- Precipitation
- Other Meteorology fields

~14 EFs equipped with EBBR

Field Mostly Affected

- Surface Radiative Fluxes
- Surface SH and LH Fluxes



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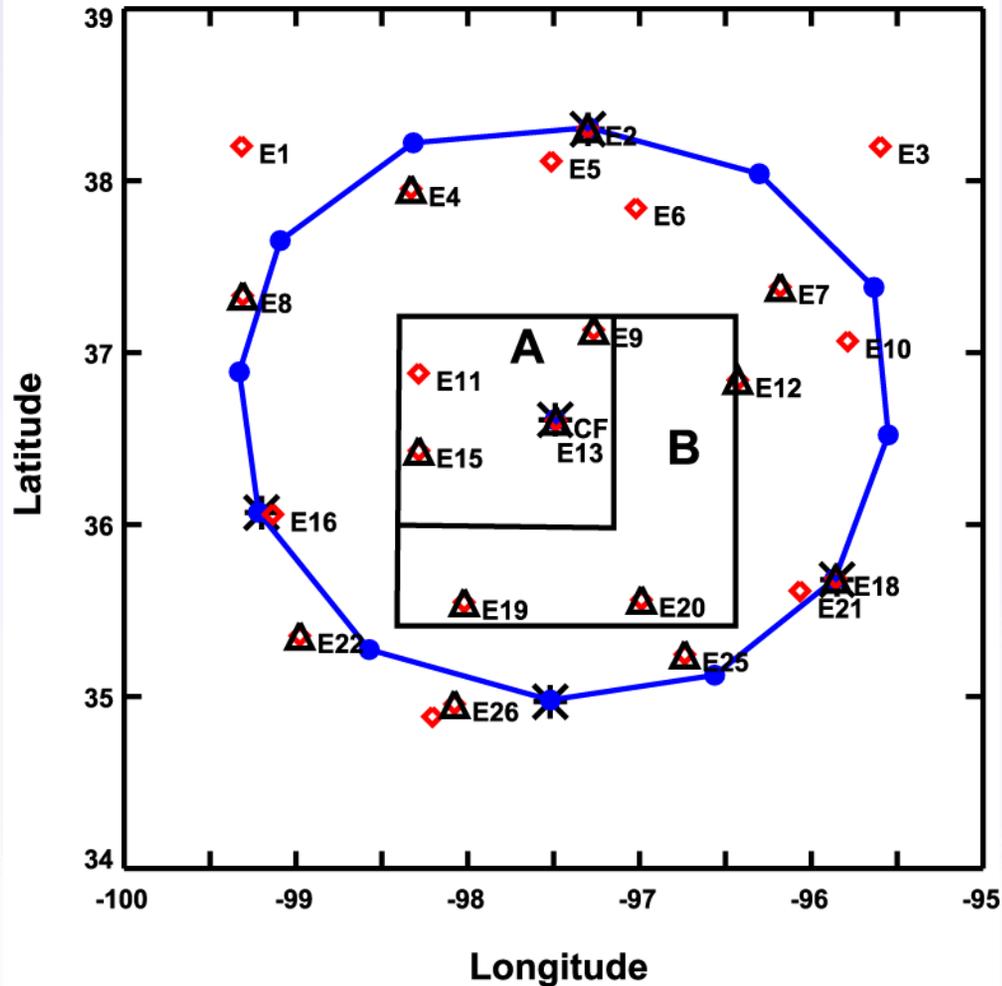
How does the spatial variability vary with the # of stations and the size of domains?

Four Potential Revised Surface Networks



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ARM SGP Observation Network



- R1: contains stations within Box A (4 EFs)**
- R2: contains stations within Box B (7 EFs)**
- R3: R2+4BFs (11 EFs)**
- R4: Stations with EBBR instruments (14 EFs)**
- ALL: the current network (23 EFs)**

Summary



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SH and LH → show larger spatial variability than SWSN and LWSN

Variability → could be largely underestimated when only a few stations close to CF are used

Variability → represented reasonably well when about 11-14 stations are more evenly distributed across the SGP ~ about 50% reduction in the number of total EFs

RMSE < 10 W/m² for SWSN and LWSN if only uses the EFs with EBBR instruments (14 EFs)

Small systematic biases might be introduced (e.g., overestimate of surface albedo)

Impact on the variational analysis is small