Correlation of Major Topographic Lineaments in the North Carolina Blue Ridge with Regional Fracture Zones

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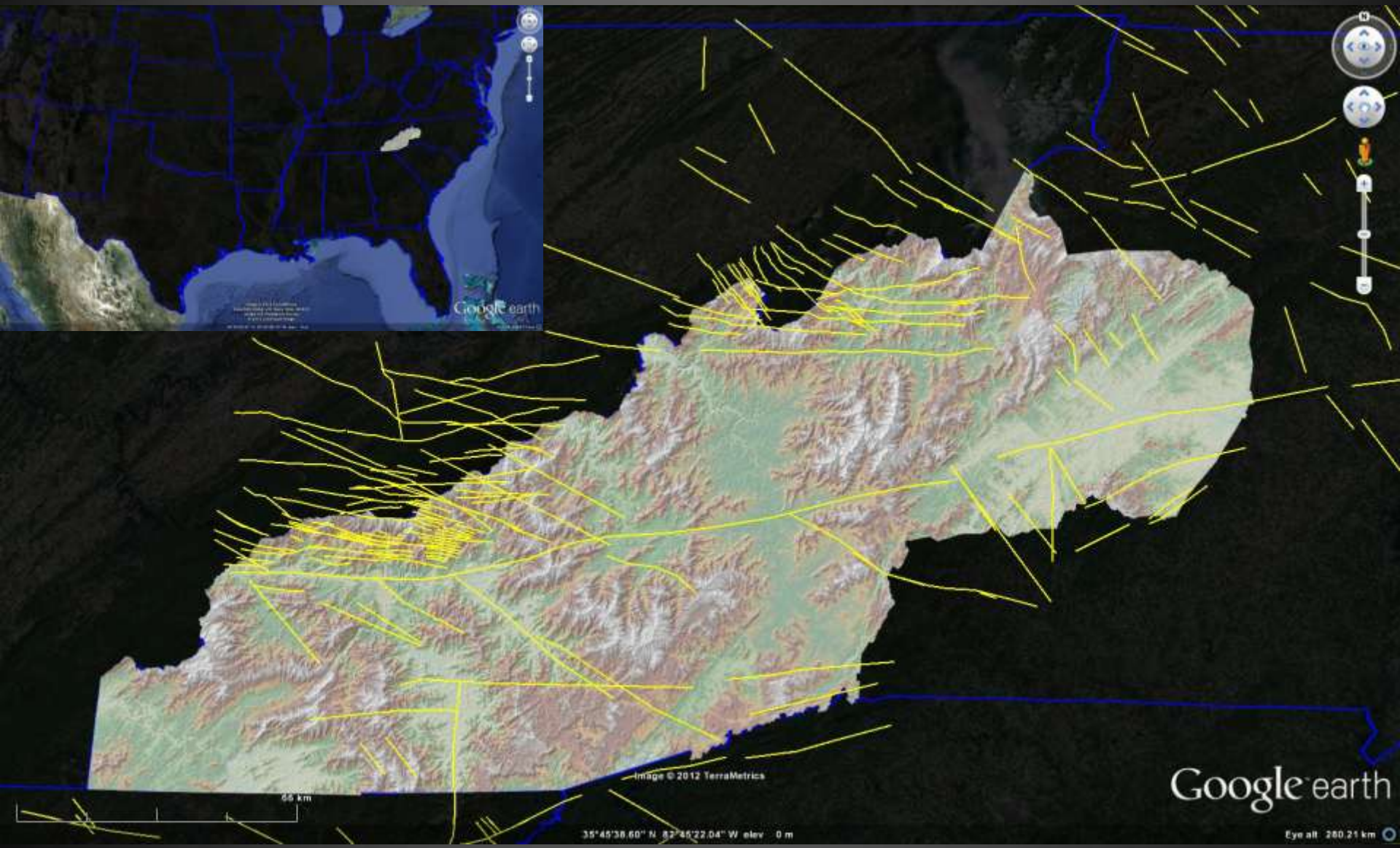
Study Area

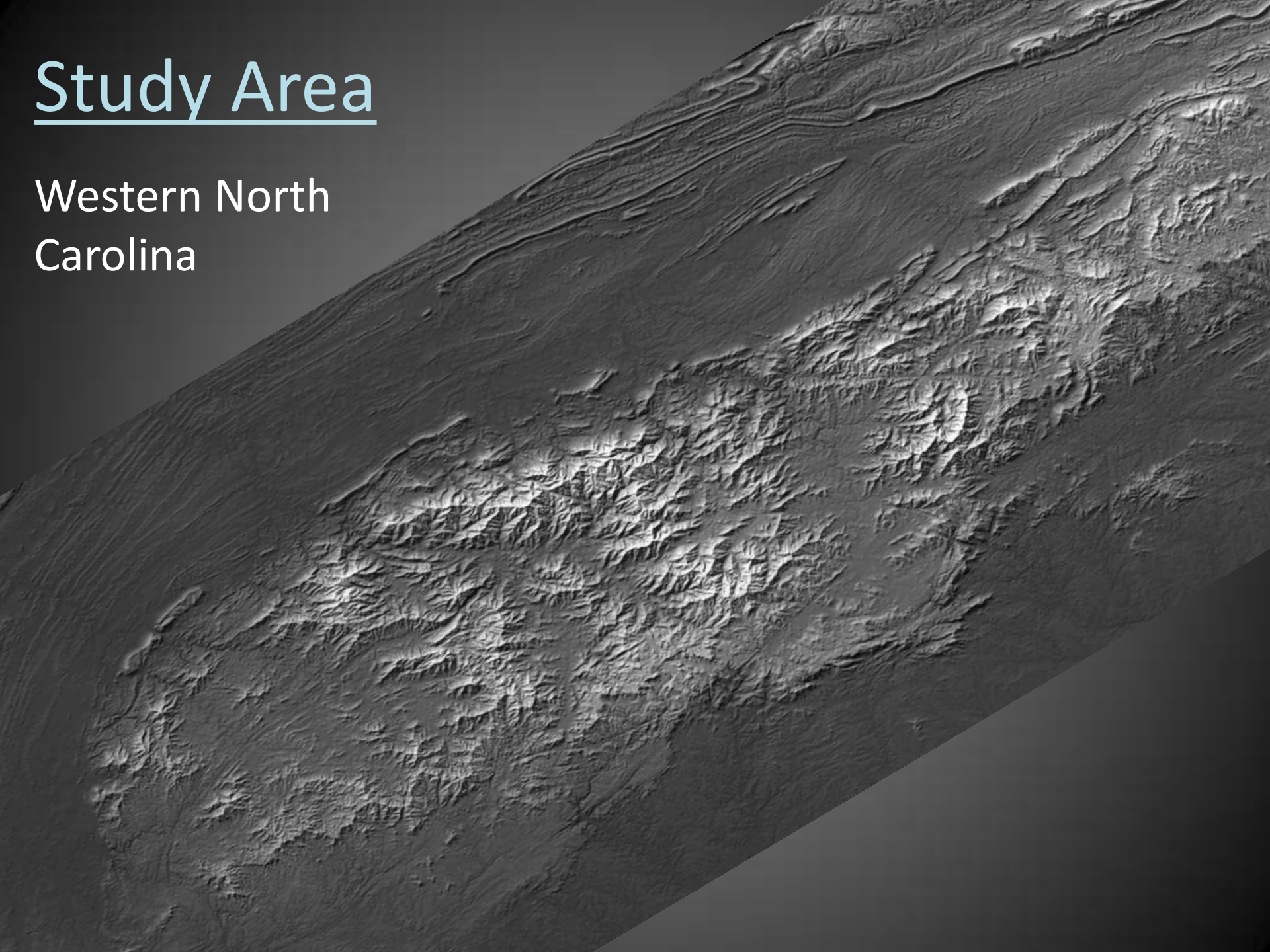

Image © 2012 TerraMetrics
65 km
35°45'38.60" N 82°45'22.04" W elev 0 m
Google earth
Eye alt 280.21 km

Study Area

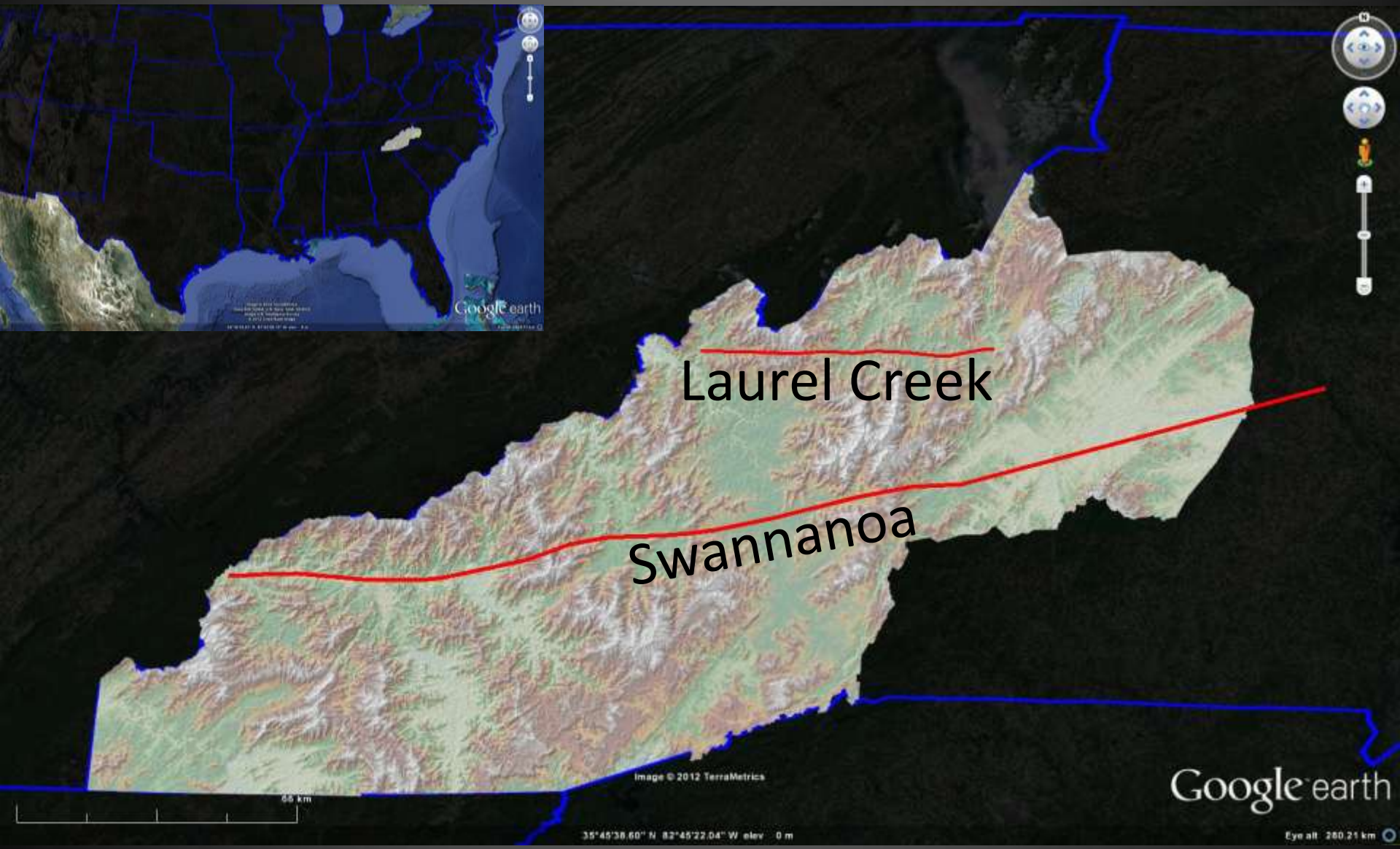


Study Area

Western North Carolina



Study Area

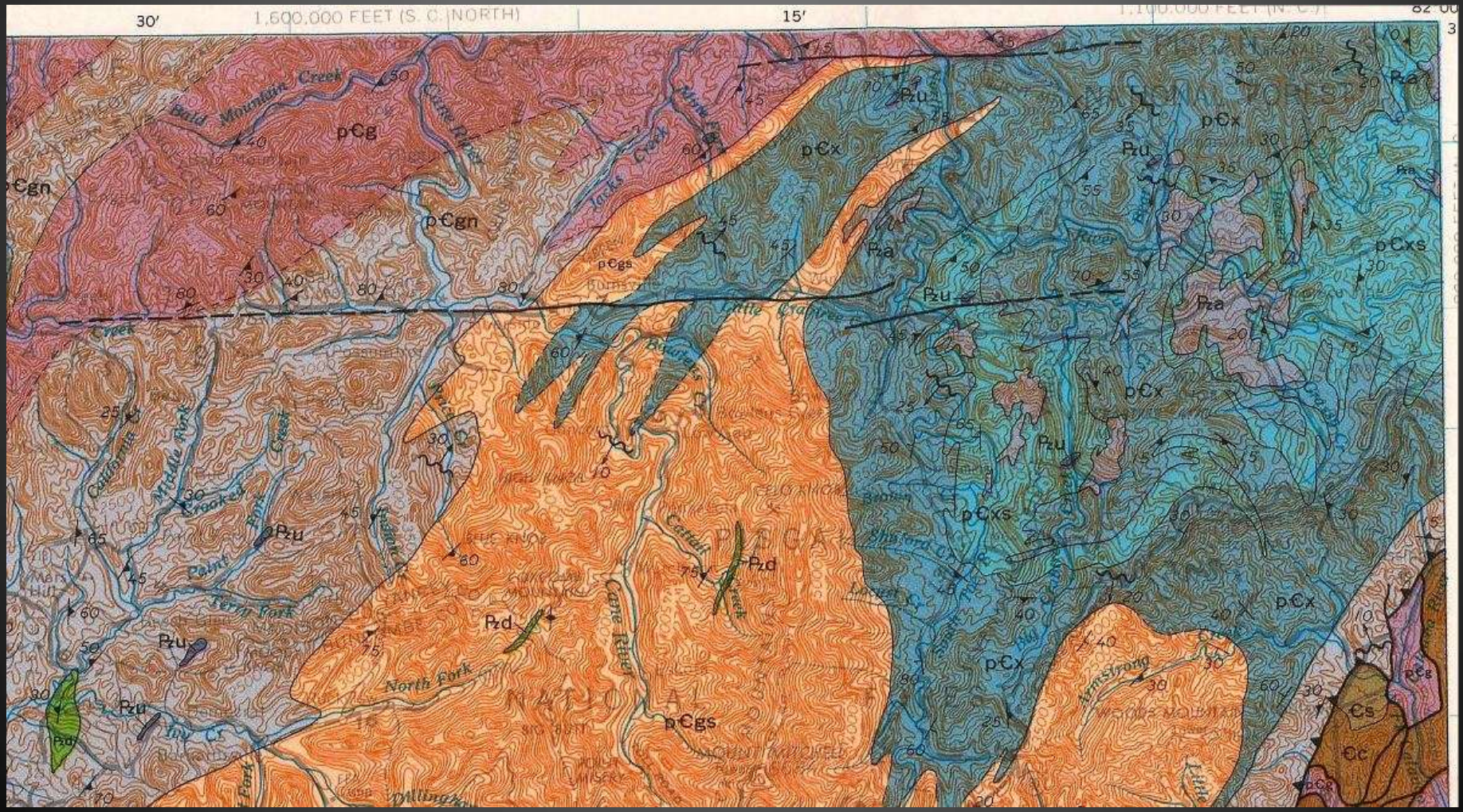

Laurel Creek
Swannanoa
Image © 2012 TerraMetrics
65 km
35°45'38.60" N 82°45'22.04" W elev 0 m
Eye alt 280.21 km
Google earth

Fracture zones, faults, or something else?

- structural origin of the topographic lineaments
  - type of structures?
  - connection to outcrop-scale fractures?
  - seismogenic?
  - how old?

Earlier work

- **Hadley and Nelson(1971)**
  - R-lateral fault
  - has been revised



Earlier work

- **Robinson et al. (1992)**
  - R-lateral fault has been removed

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Earlier work

- **Hack (1982)**
  - *Described and named several lineaments*
  - *"…differential erosion along brittle fracture zones associated with older faults."*

- **Merschat (1997)** *"…result of jointing, fracturing, and faulting across different rock types"*

Earlier work – Canton, NC

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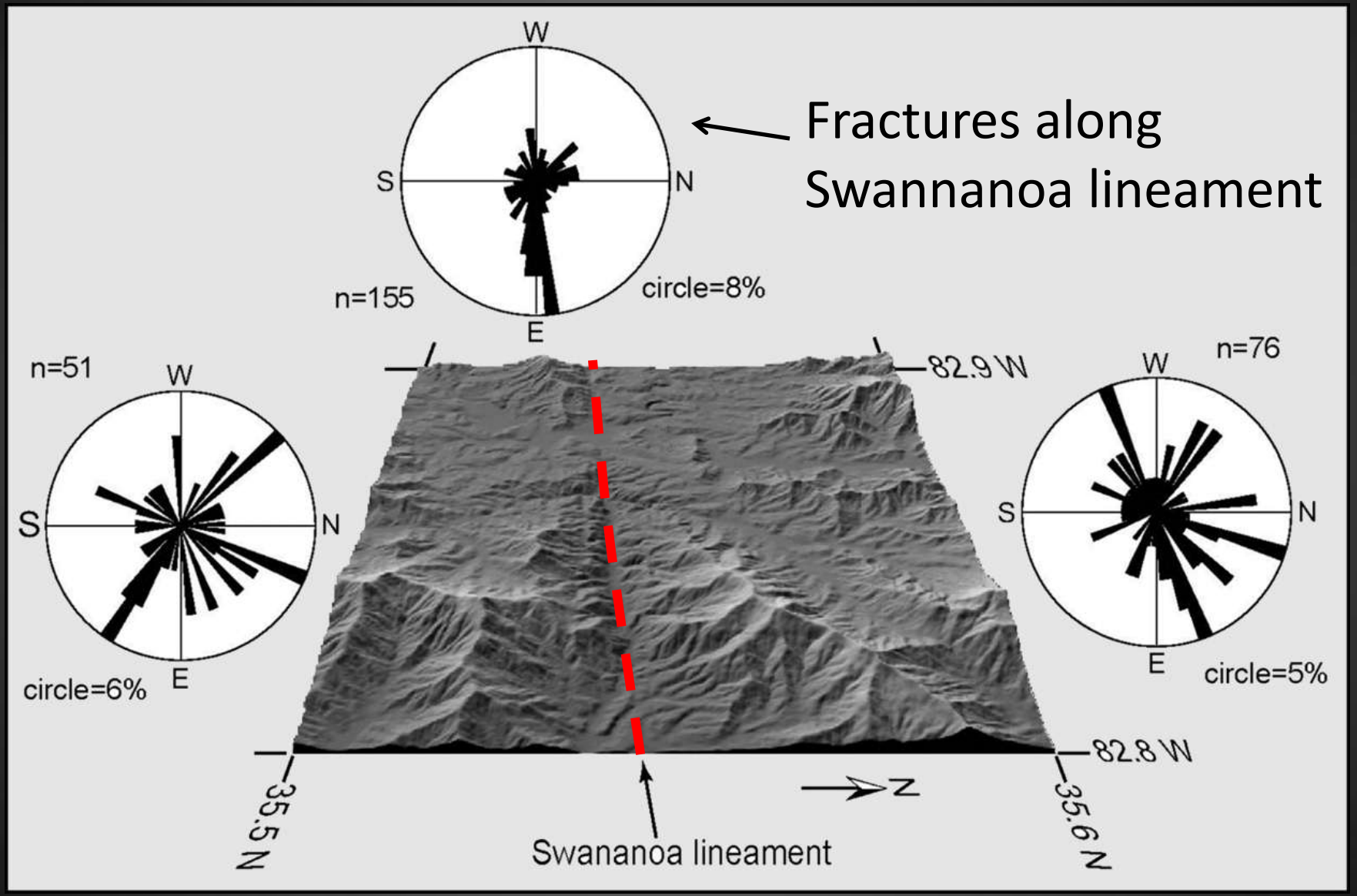
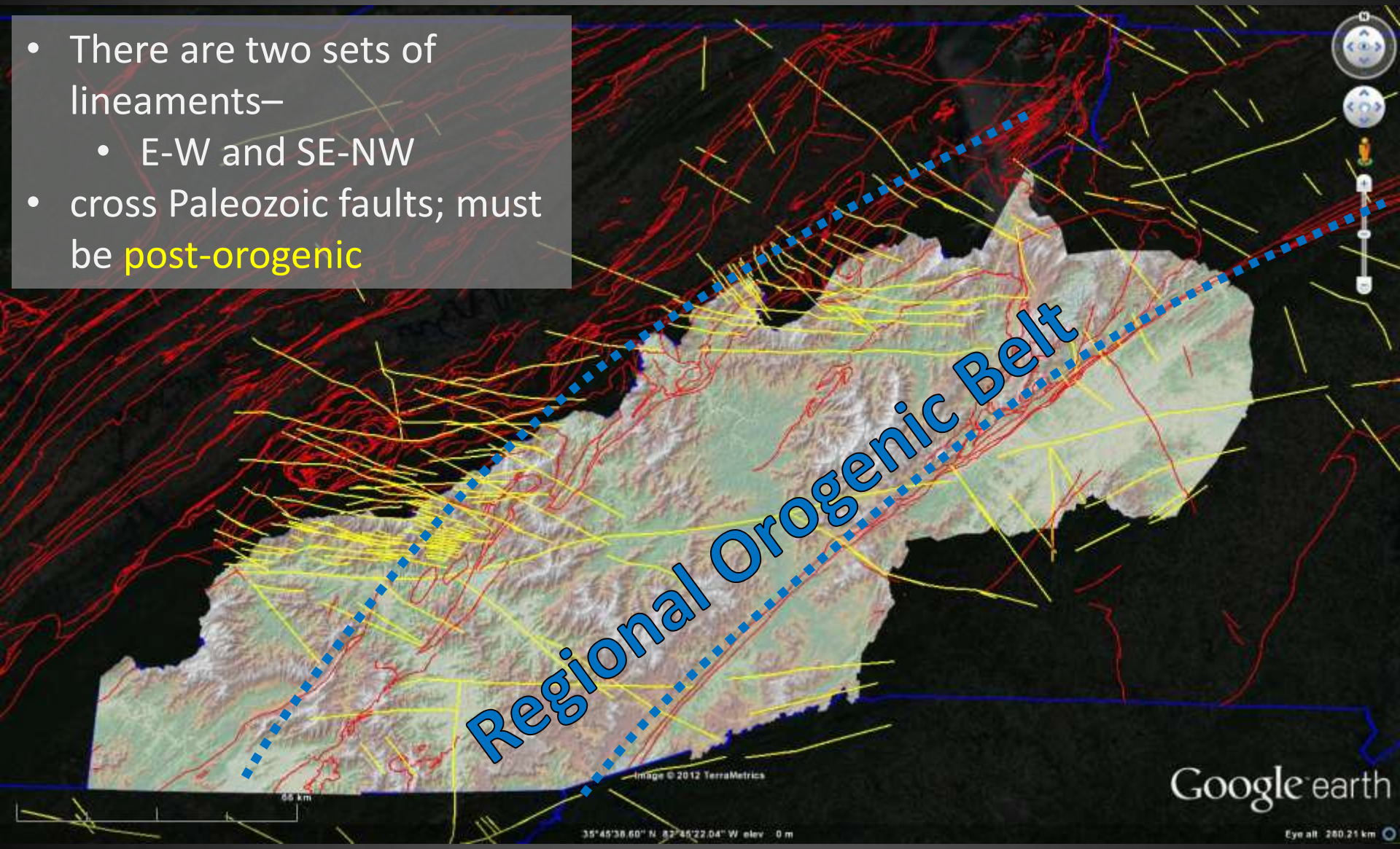


(Joint data from outside lineament from Merschat and Wiener, 1988)

Post-Orogenic Structures

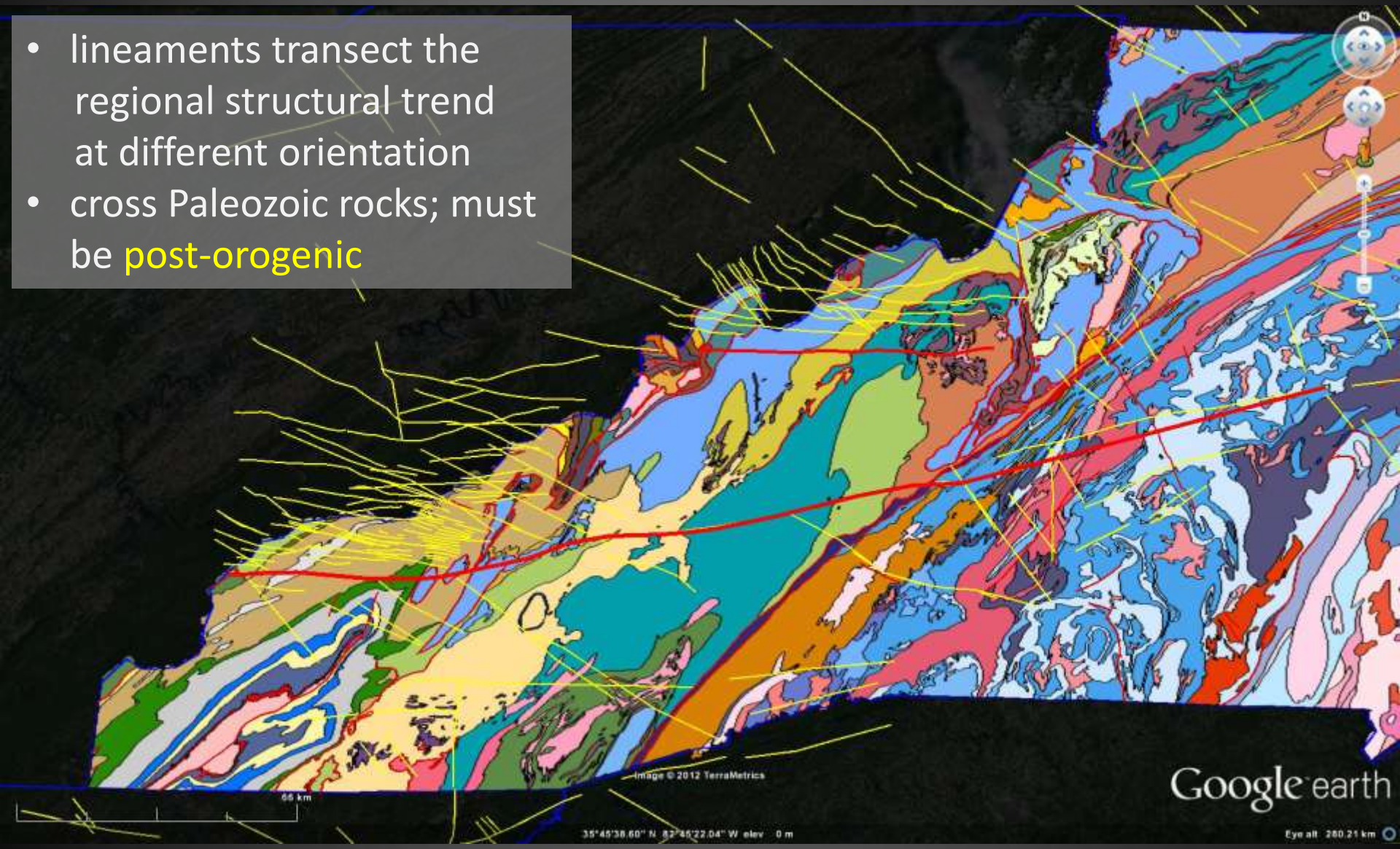
- There are two sets of lineaments–
  - E-W and SE-NW
- cross Paleozoic faults; must be post-orogenic



Source: USGS

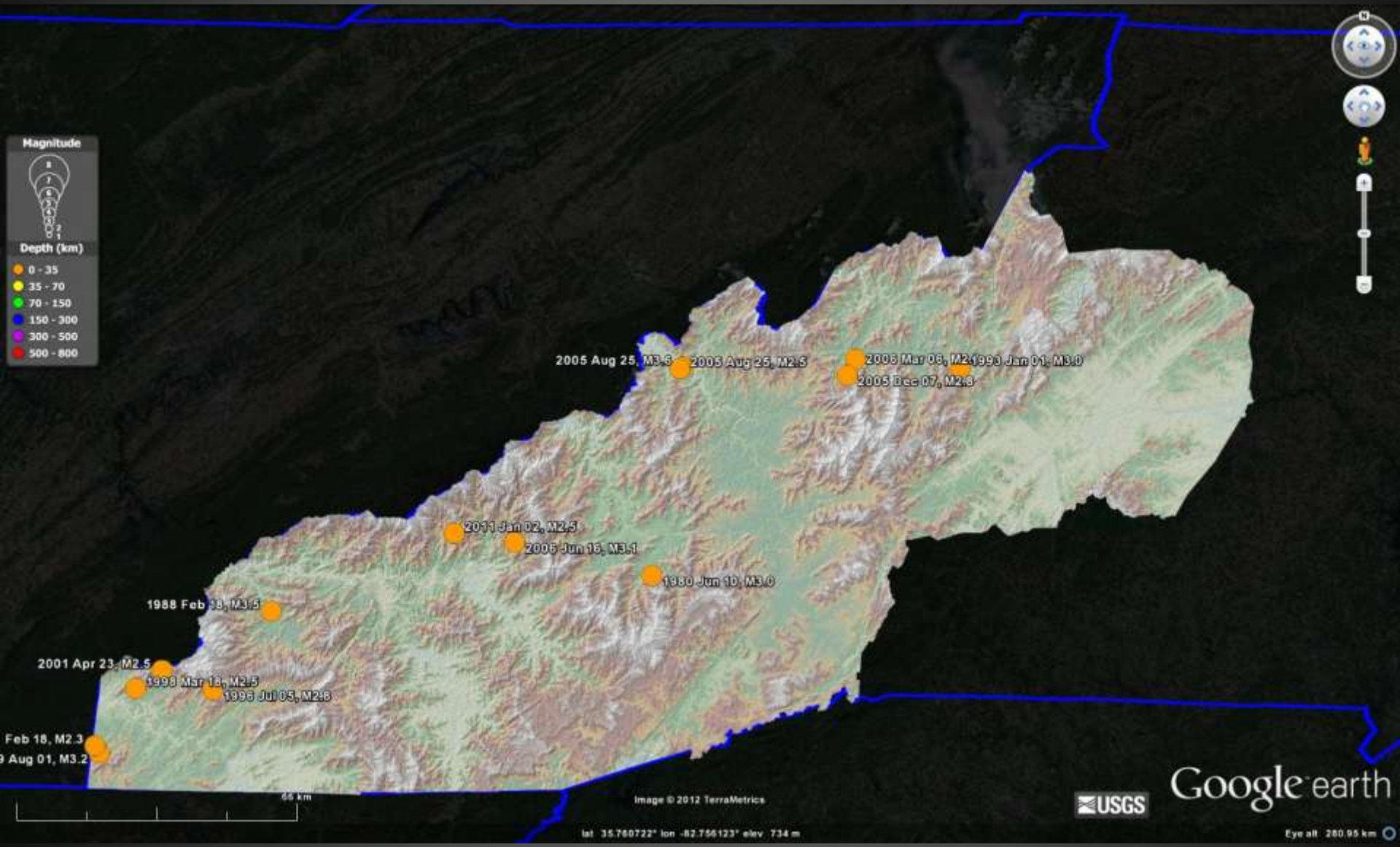
Post-Orogenic Structures

- lineaments transect the regional structural trend at different orientation
- cross Paleozoic rocks; must be post-orogenic



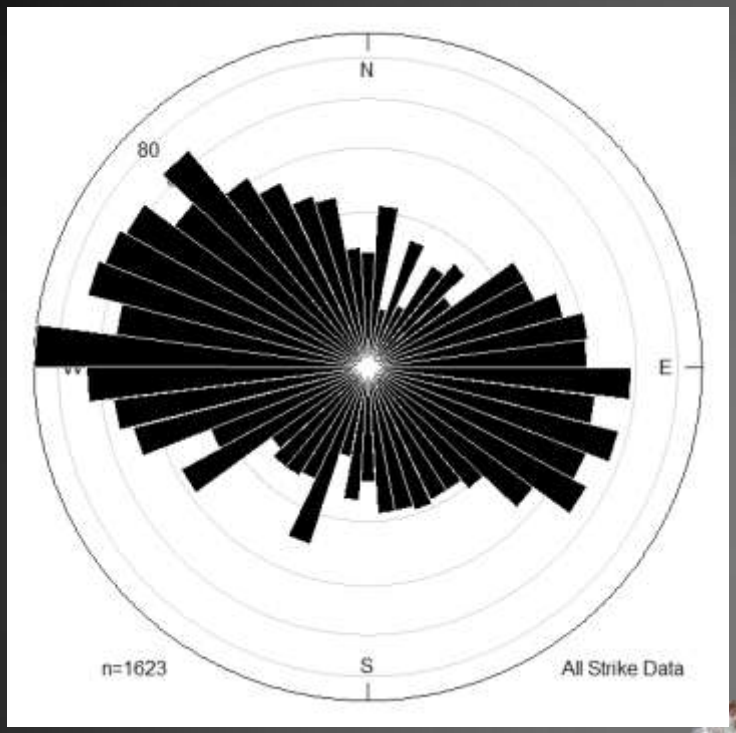
Source: NCGS, 2007

Recent earthquake activity: 1980 - 2012



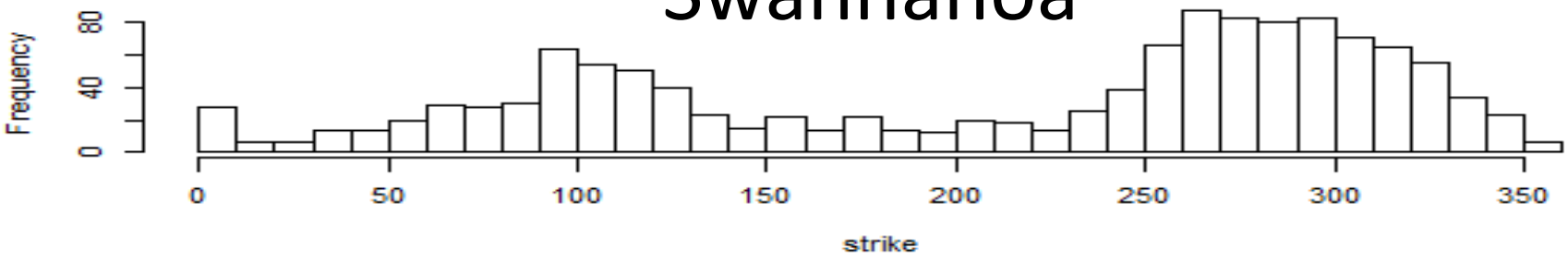
Source: USGS , 2007

Results 1623 fracture measurements from 98 outcrops within lineaments

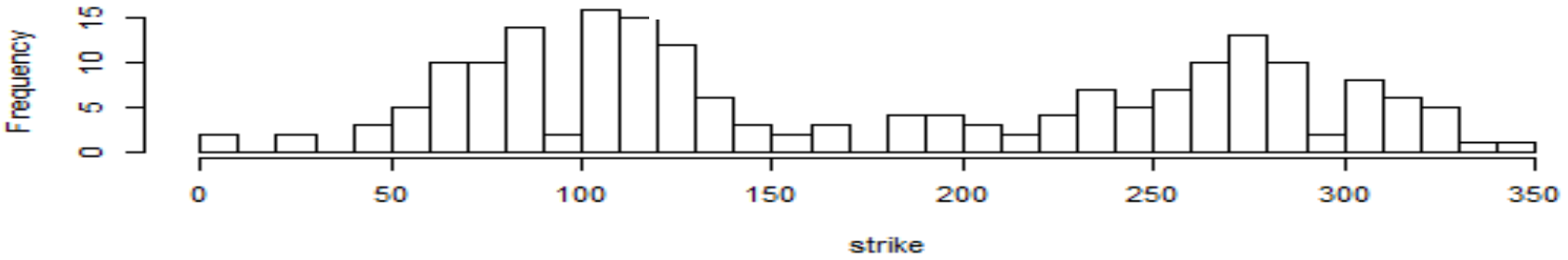


Results 1623 measurements from 98 outcrops within lineaments

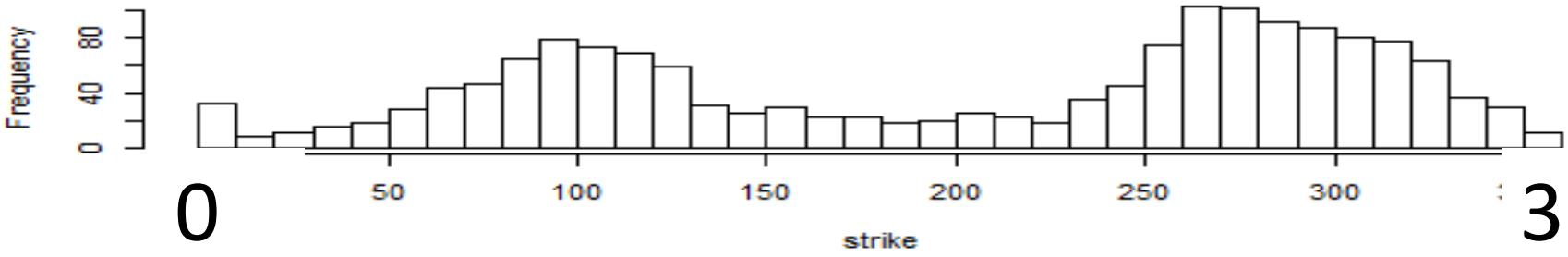
Swannanoa



Laurel Creek

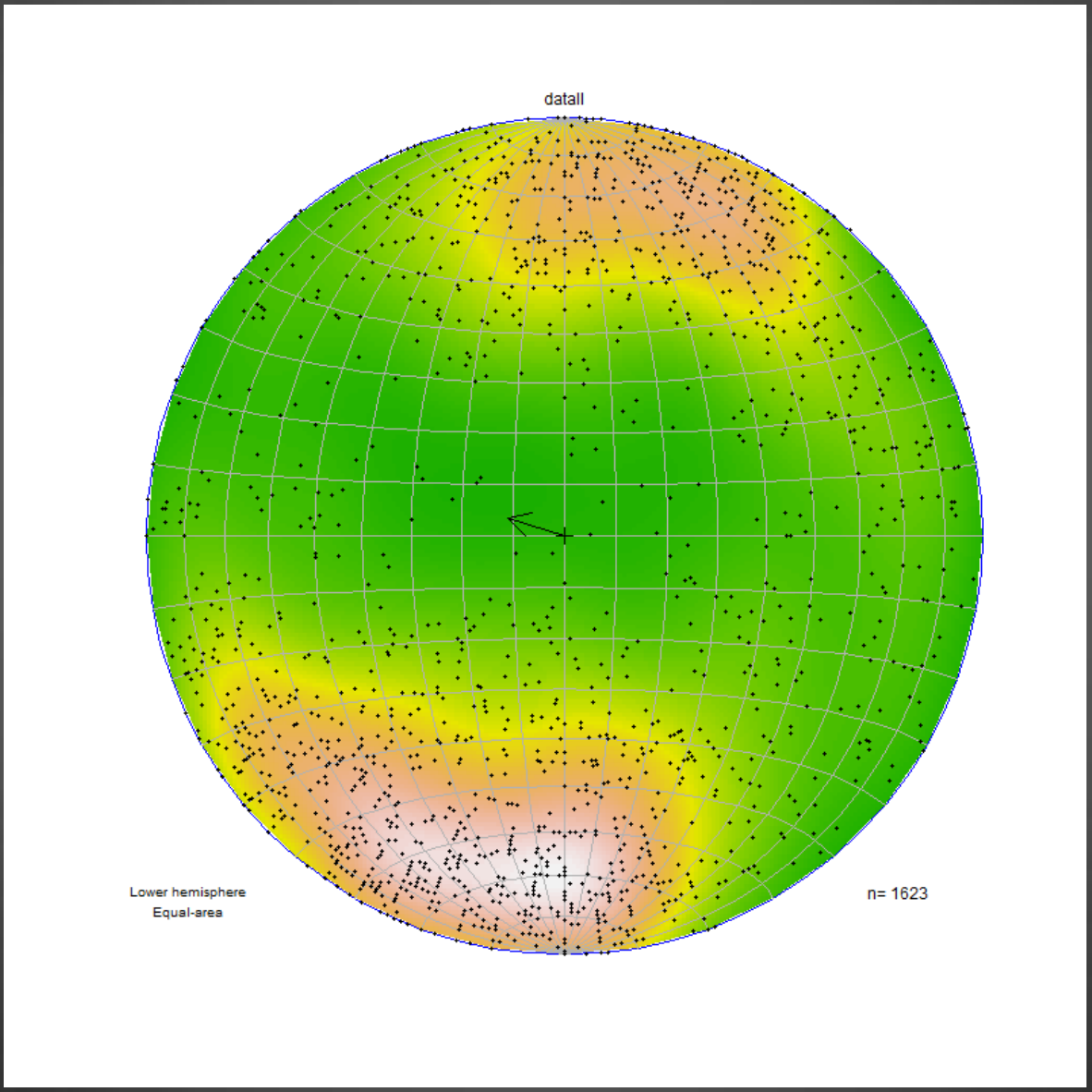


All lineament data



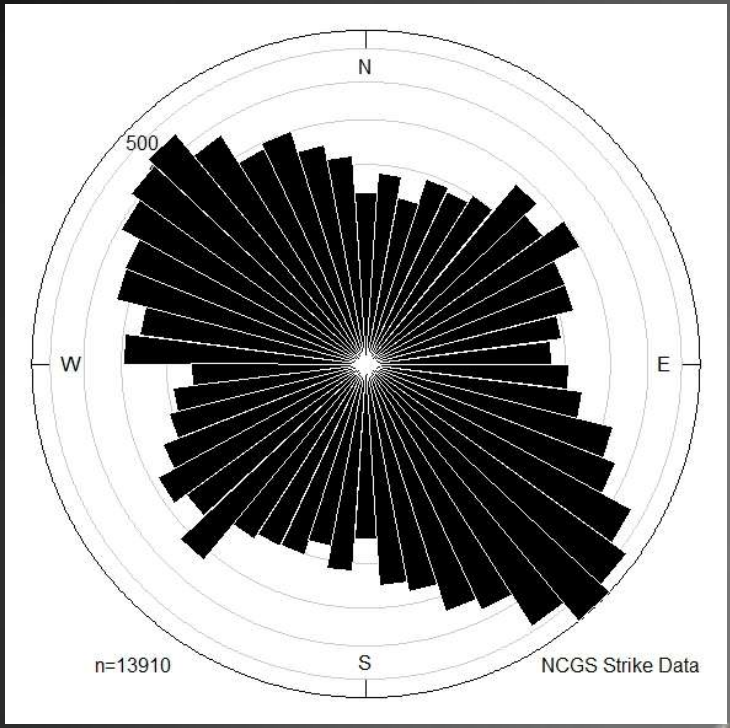
0 360

Results – all lineament data



n=1623

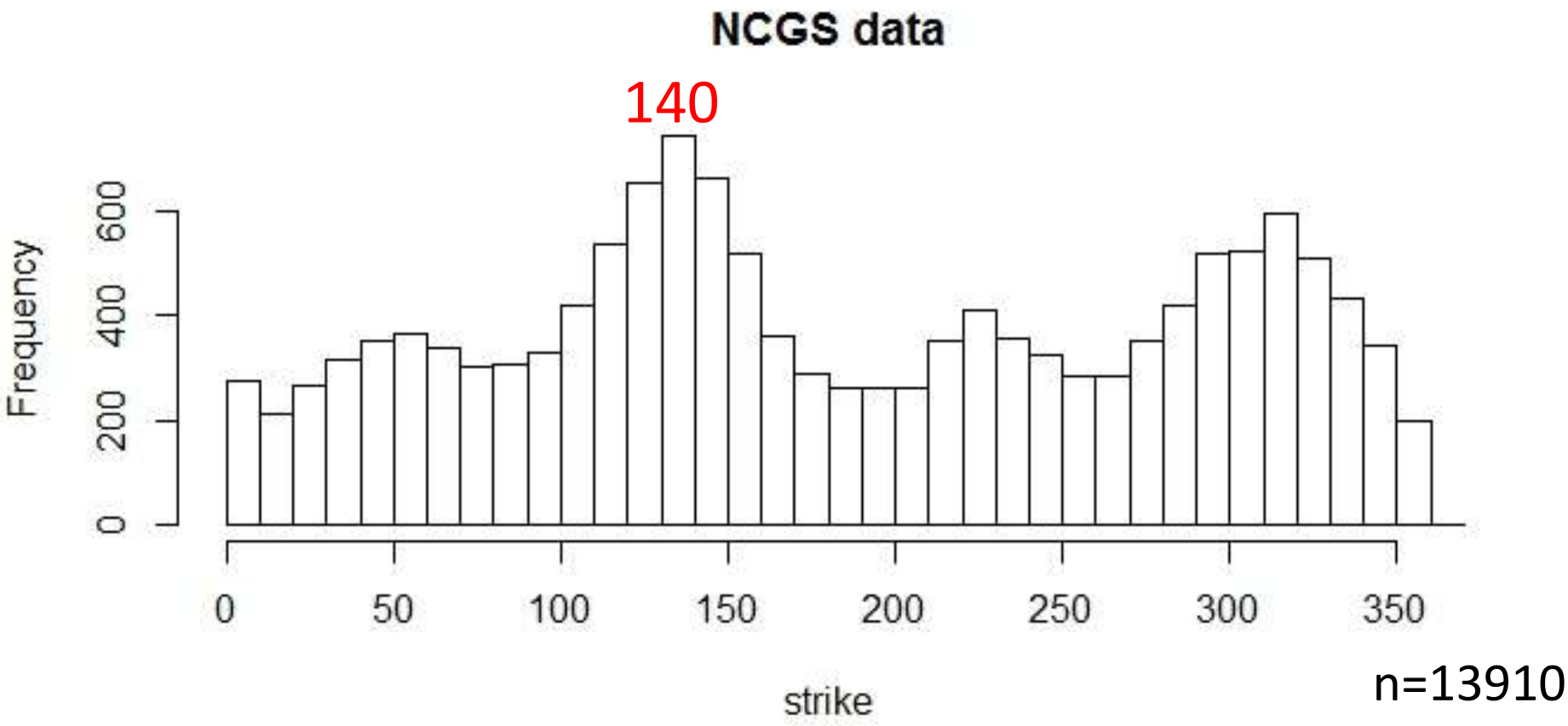
Results



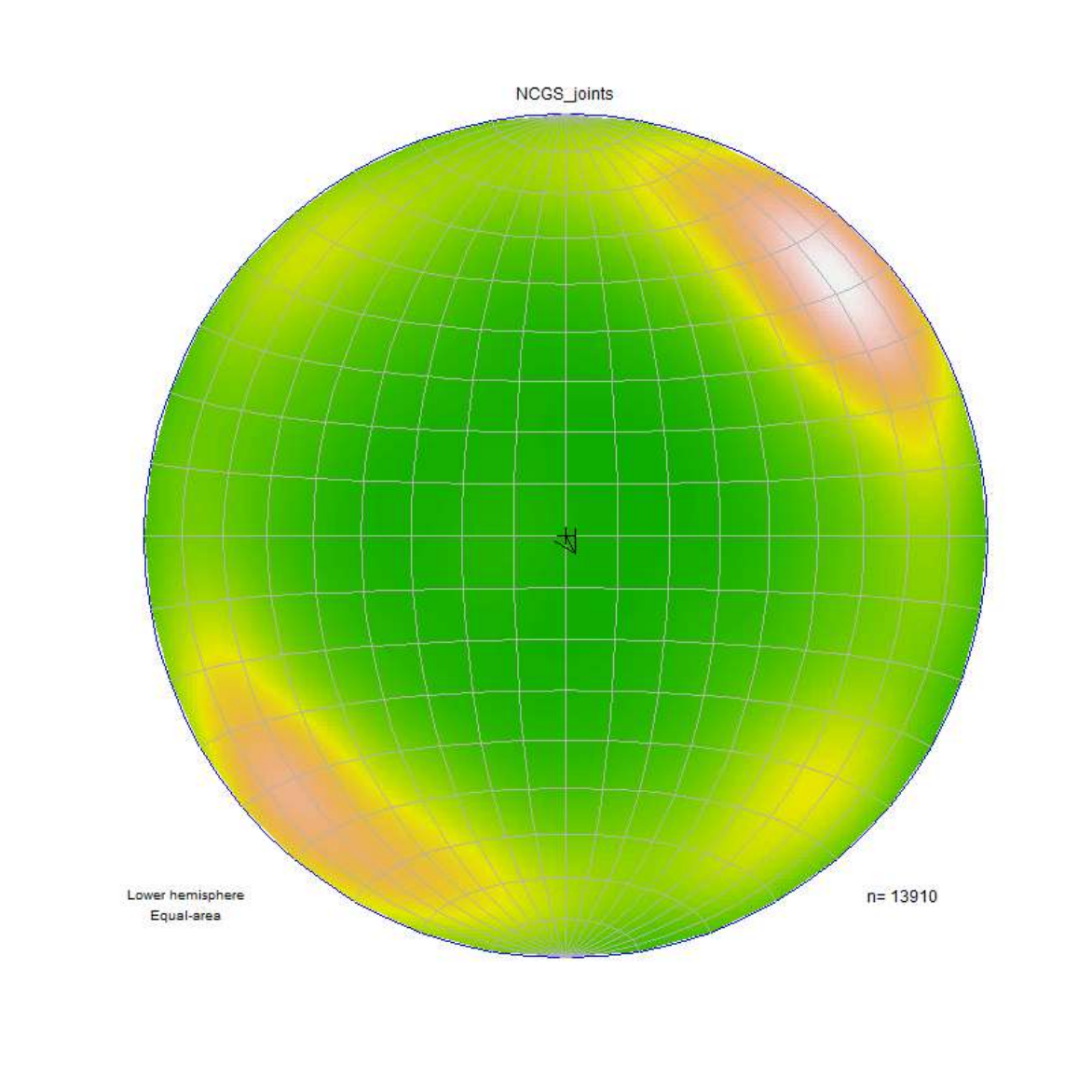
13910 NCGS fracture measurements from Blue Ridge of western NC

n=13910

Results – NCGS fracture data

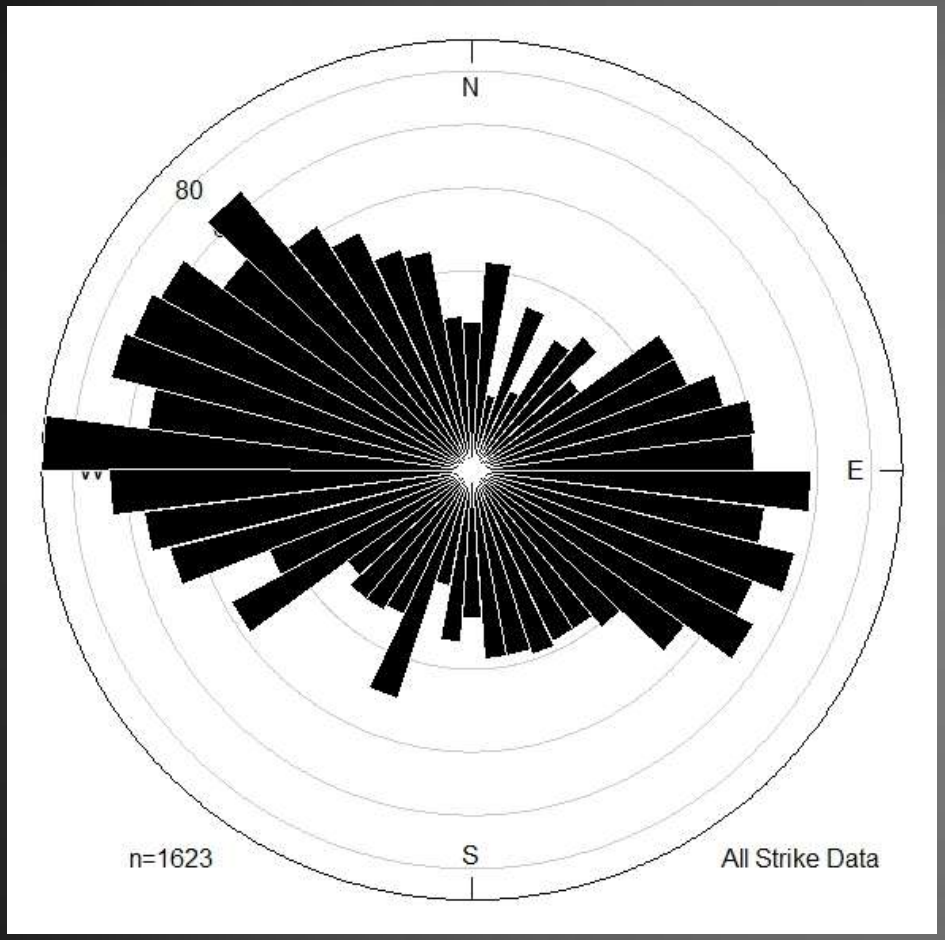


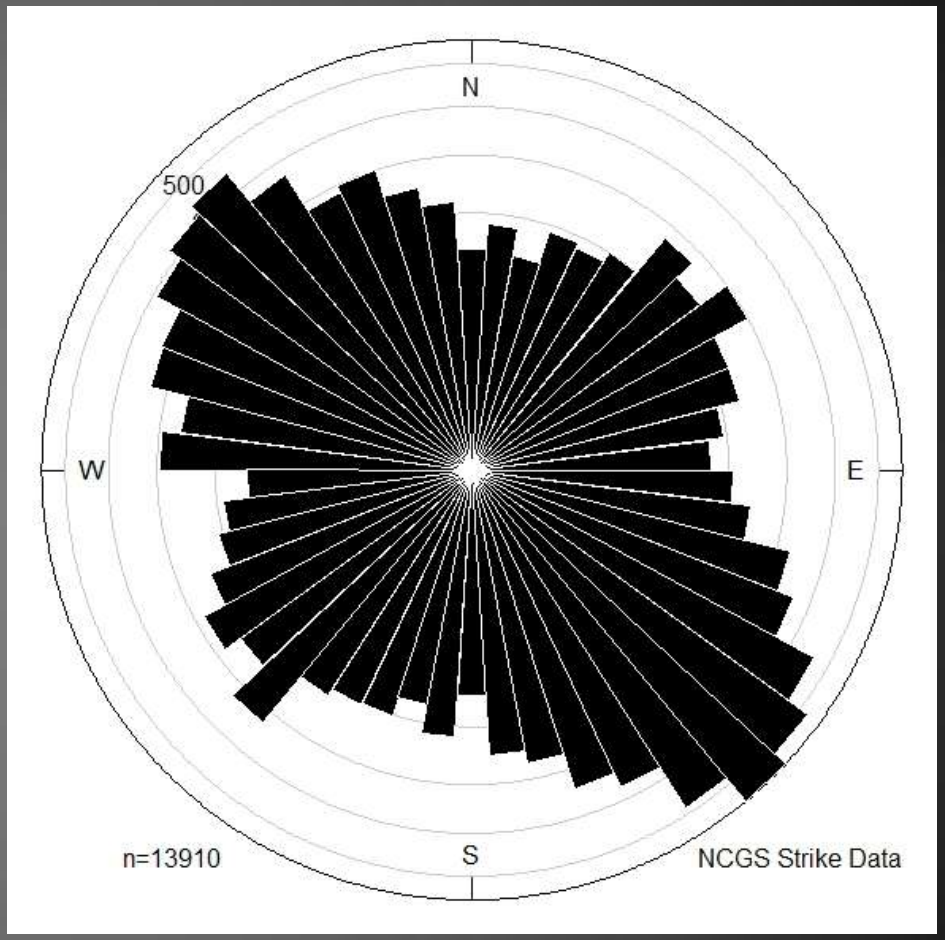
Results – NCGS fracture data



n=13910

Results – comparative analysis



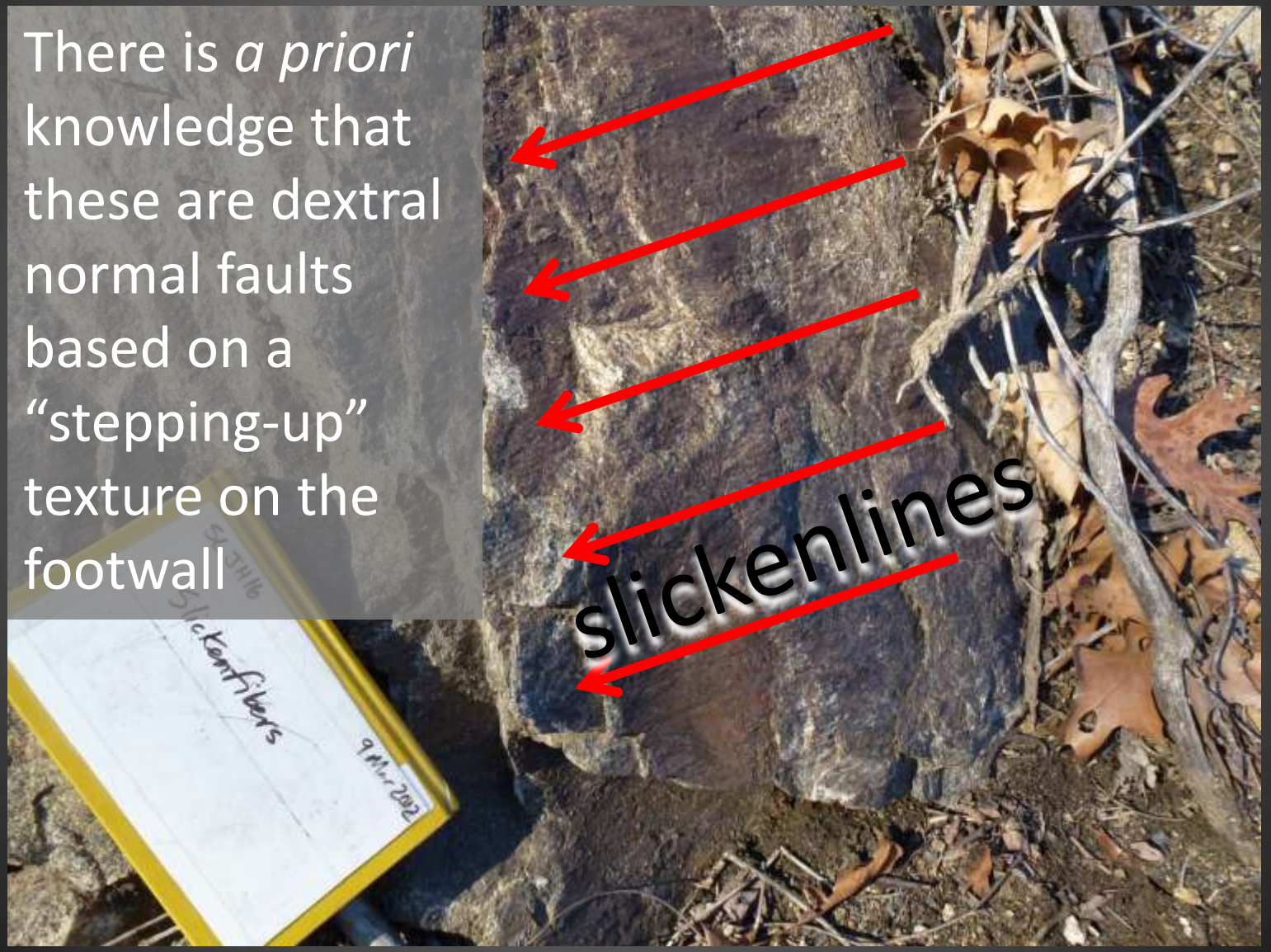


All new lineament data

NCGS data

Paleostress inversion – Canton, NC

There is *a priori* knowledge that these are dextral normal faults based on a "stepping-up" texture on the footwall



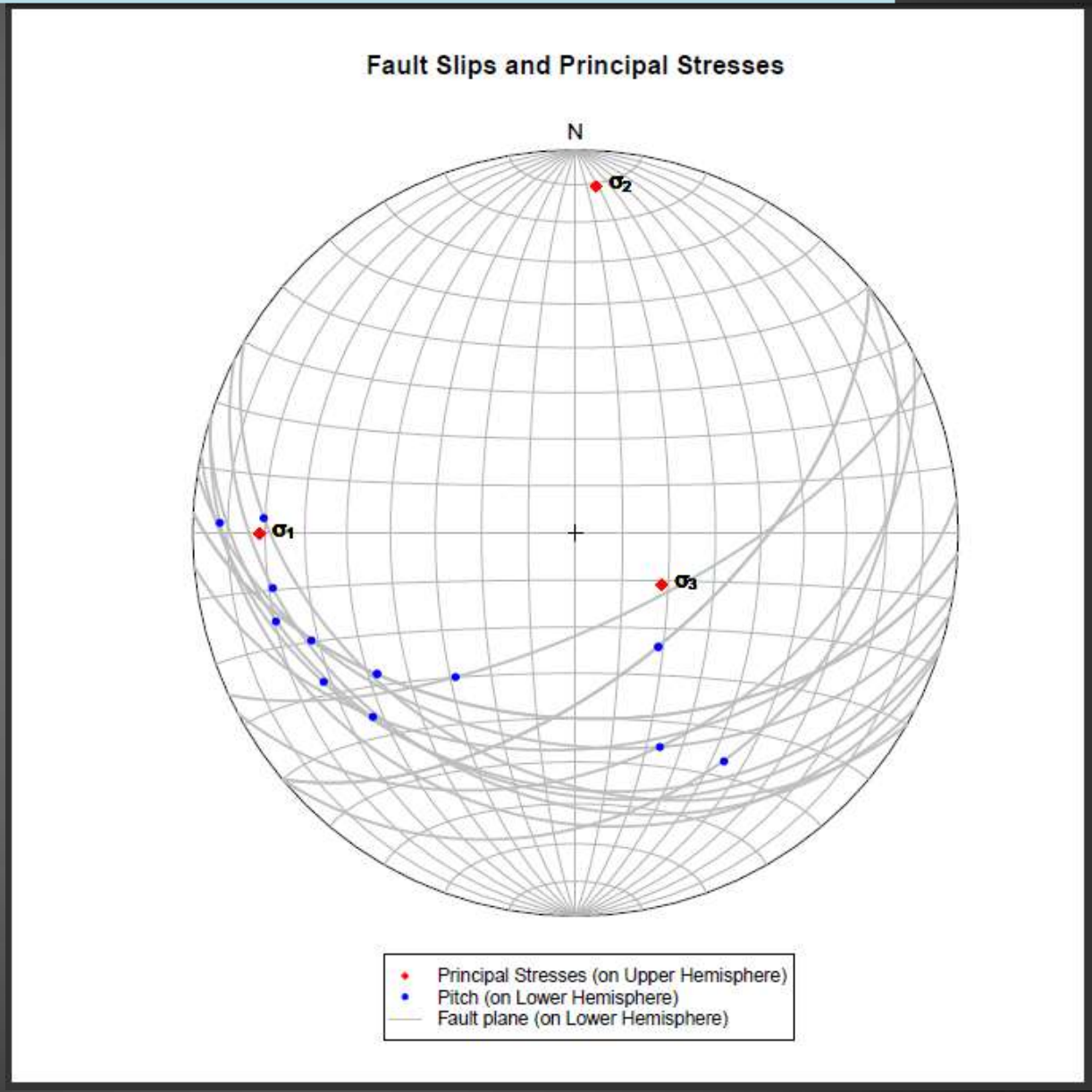
←West

East→

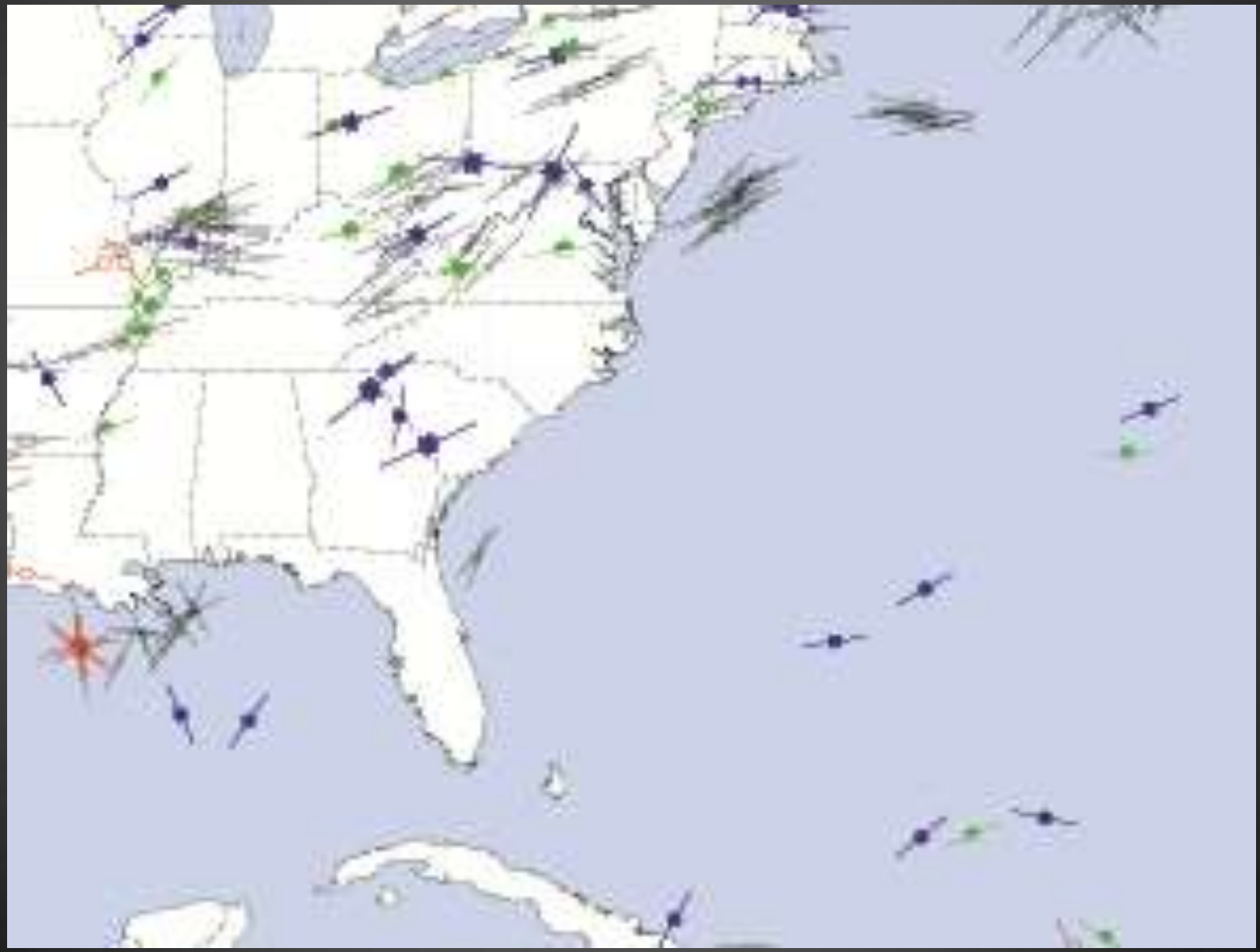
Paleostress inversion – Results

The best fit stress tensor has a max compressive stress that is close to vertical, which agrees with the *a priori* knowledge that these are dextral normal faults.

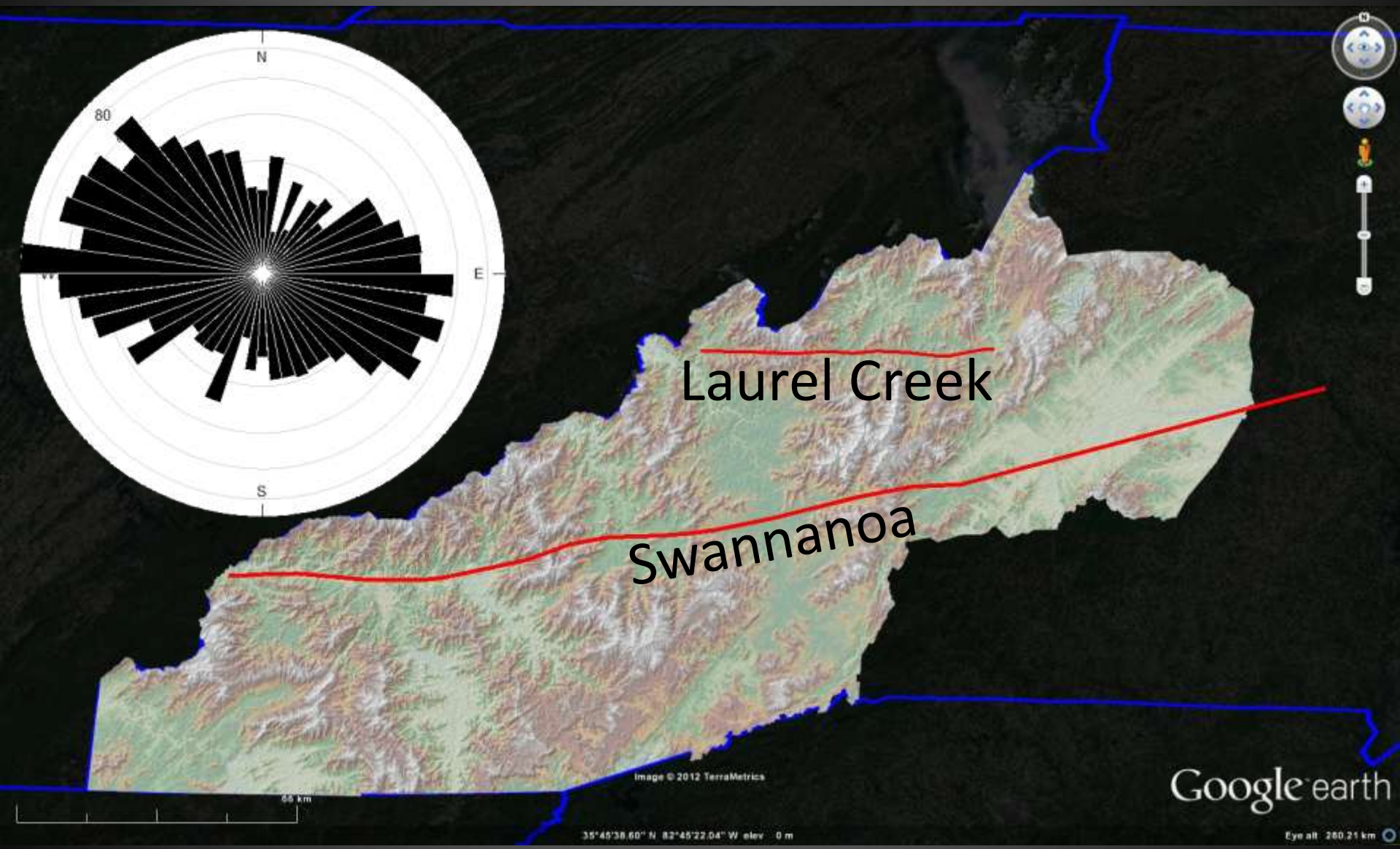
$\Phi = 0.244$



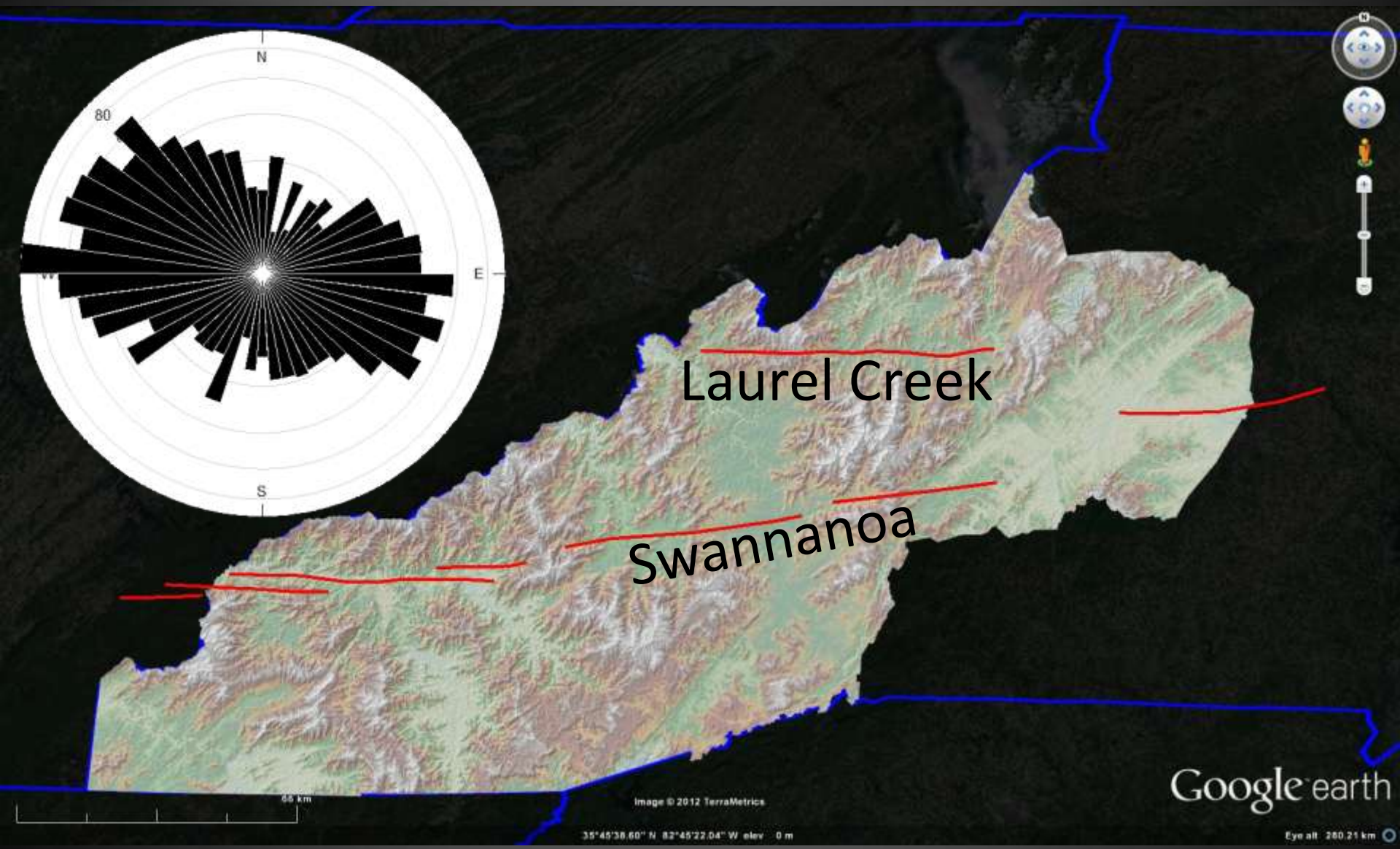
World stress map



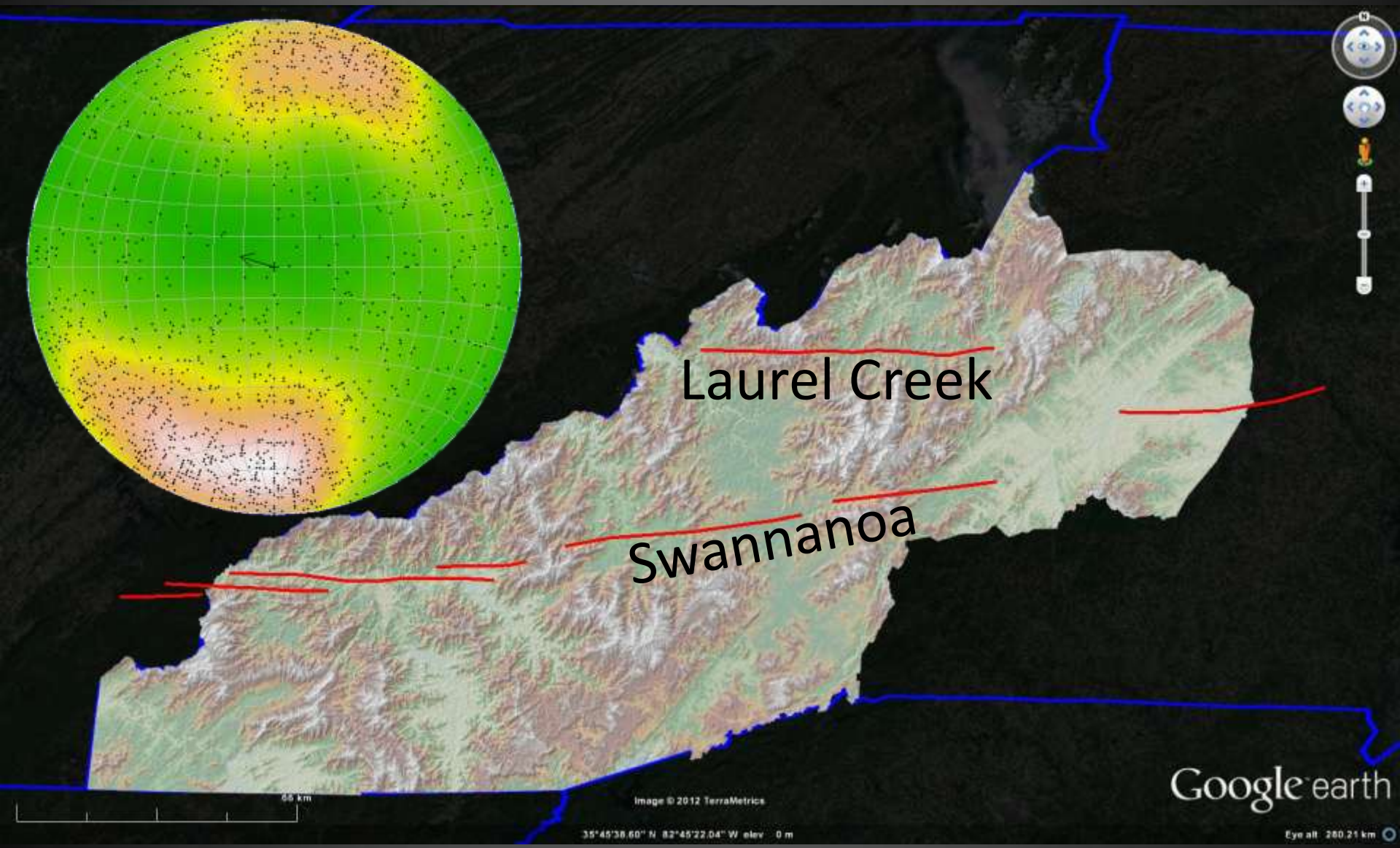
Regional- and outcrop-scale correlation



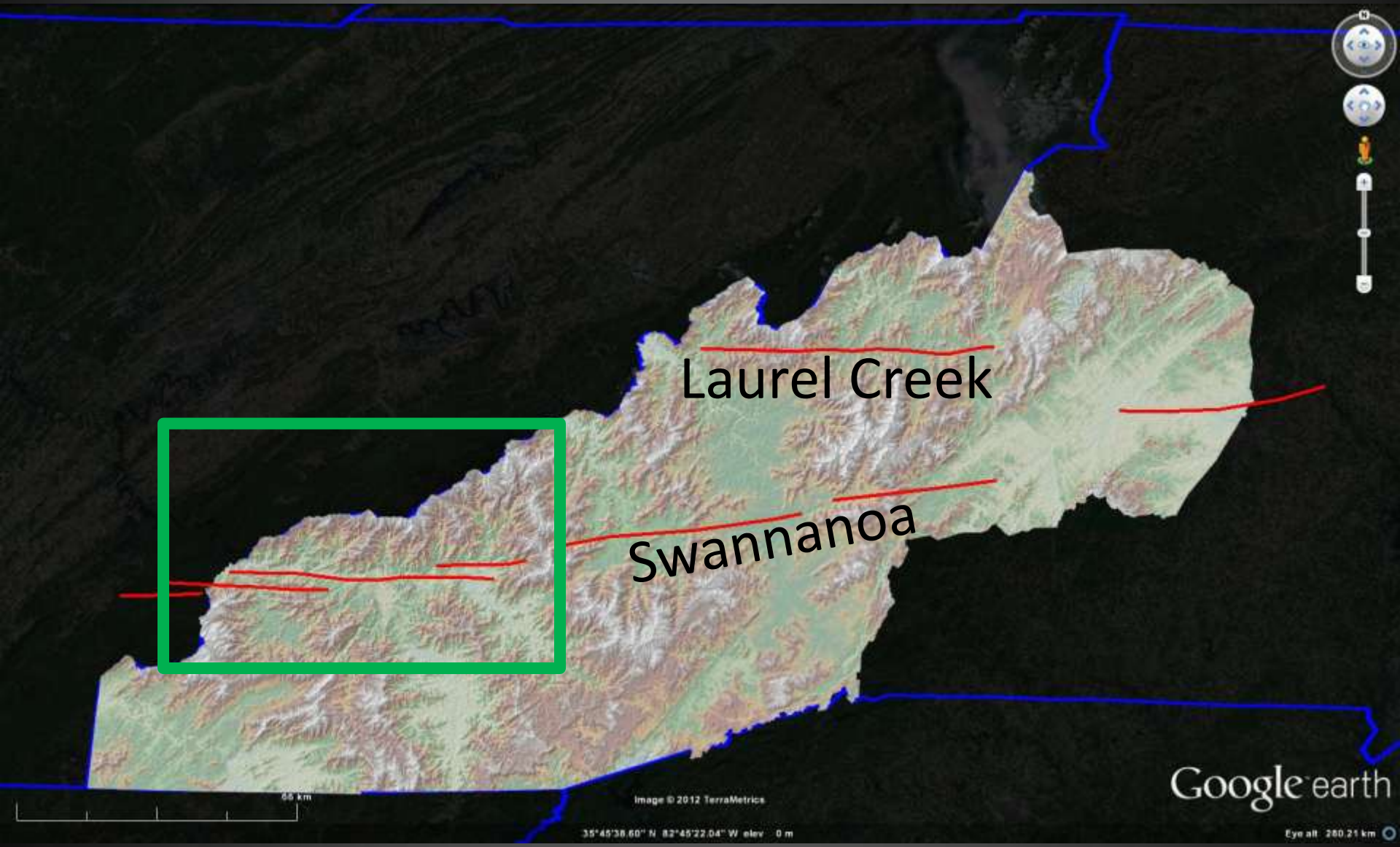
Regional- and outcrop-scale correlation



Regional- and outcrop-scale correlation



Regional- and outcrop-scale correlation



Regional- and outcrop-scale correlation

Conclusions:

- E-W topographic lineaments in western NC are associated with E-W outcrop-scale fractures and minor faults
- Outside the lineaments outcrop-scale fractures strike NW-SE and NE-SW
- Paleostress tensor from a minor fault set in the Swannanoa lineament is incompatible with modern-day stress field, although the lineaments appear to be seismogenic
- Doming and N-S extension due to isostatic rebound following erosion

Acknowledgements:

- UNC – CH Geological Sciences department
  - Martin Annual Research Fund
  - Robert Butler Memorial Scholarship
- Geological Society of America
  - Student Research Grant
- Dr. Kevin Stewart – advisor
- Dr. Jonathan Lees, Dr. Jason Barnes, and Kehoon Kim