A radar-based climatology of tropopause folds and deep convection

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Tropopause folding Stratospheric Intrusions and Deep Convection

From the perspective of the ingredients based methodology

tropopause folds can affect all three ingredients

Tropopause folds

dry air

warm moist air
in the boundary layer
(Danielsen 1968)
Roberts 2000
Griffiths et al. 2000)

potential
instability

static stability

characteristic of
the stratosphere
(Danielsen 1968)

capping
environment

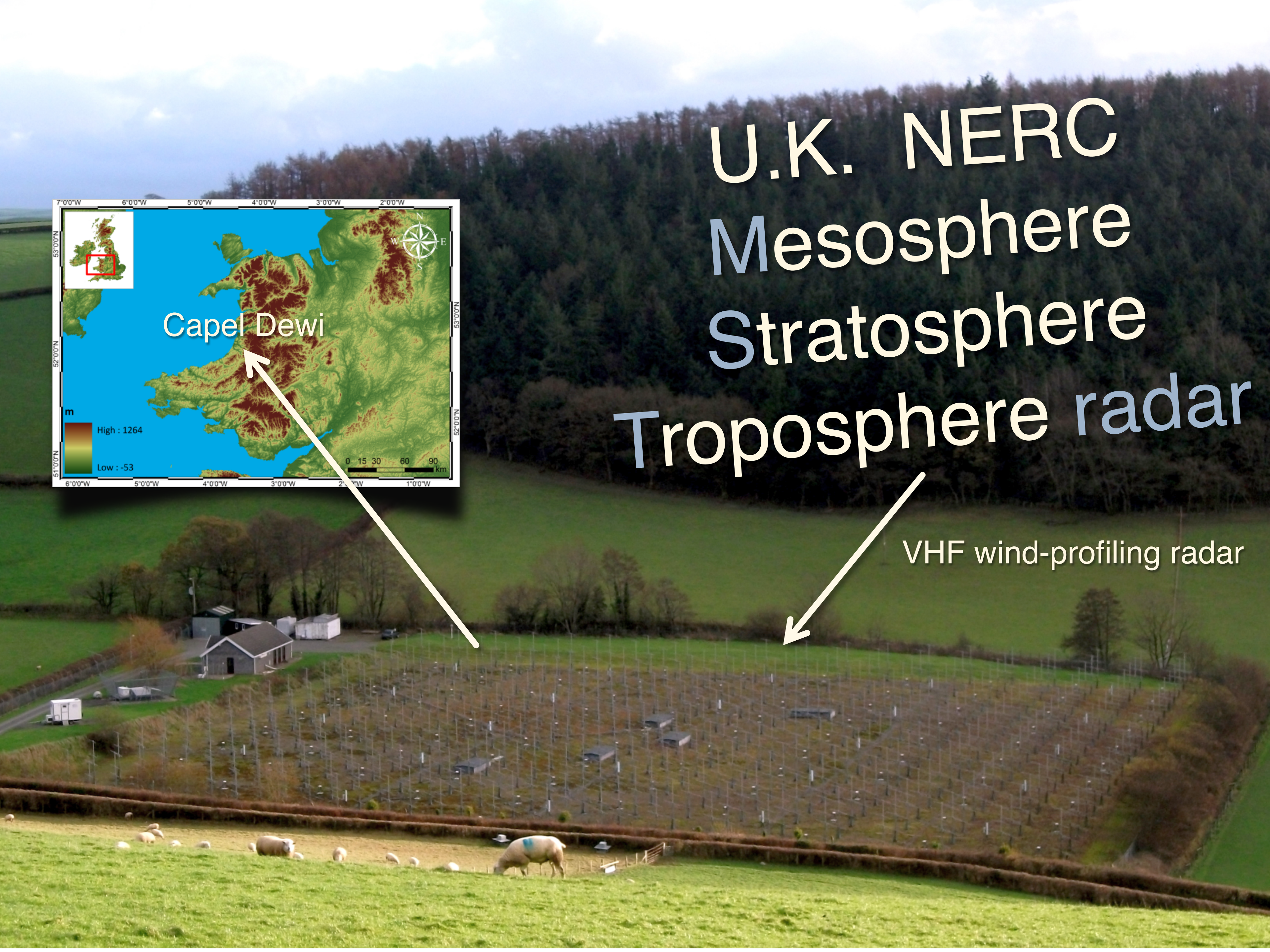
Convective storms

How is deep convection modulated by tropopause folds?

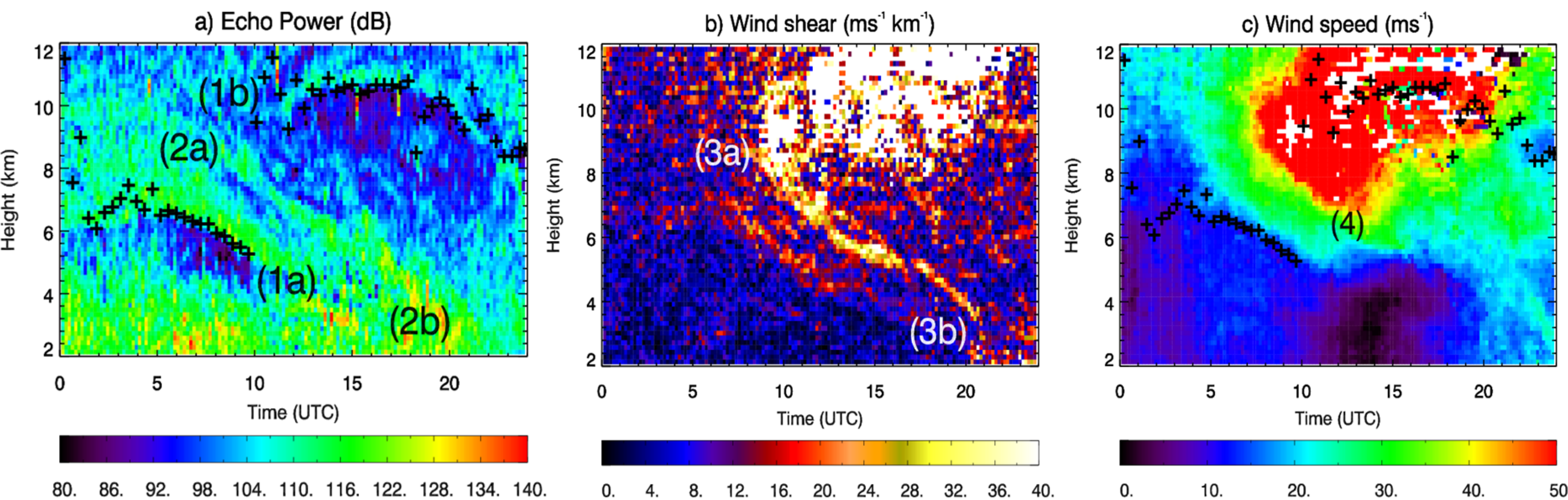
How the structure of tropopause folds affect the location, intensity and morphology of the resulting convection?

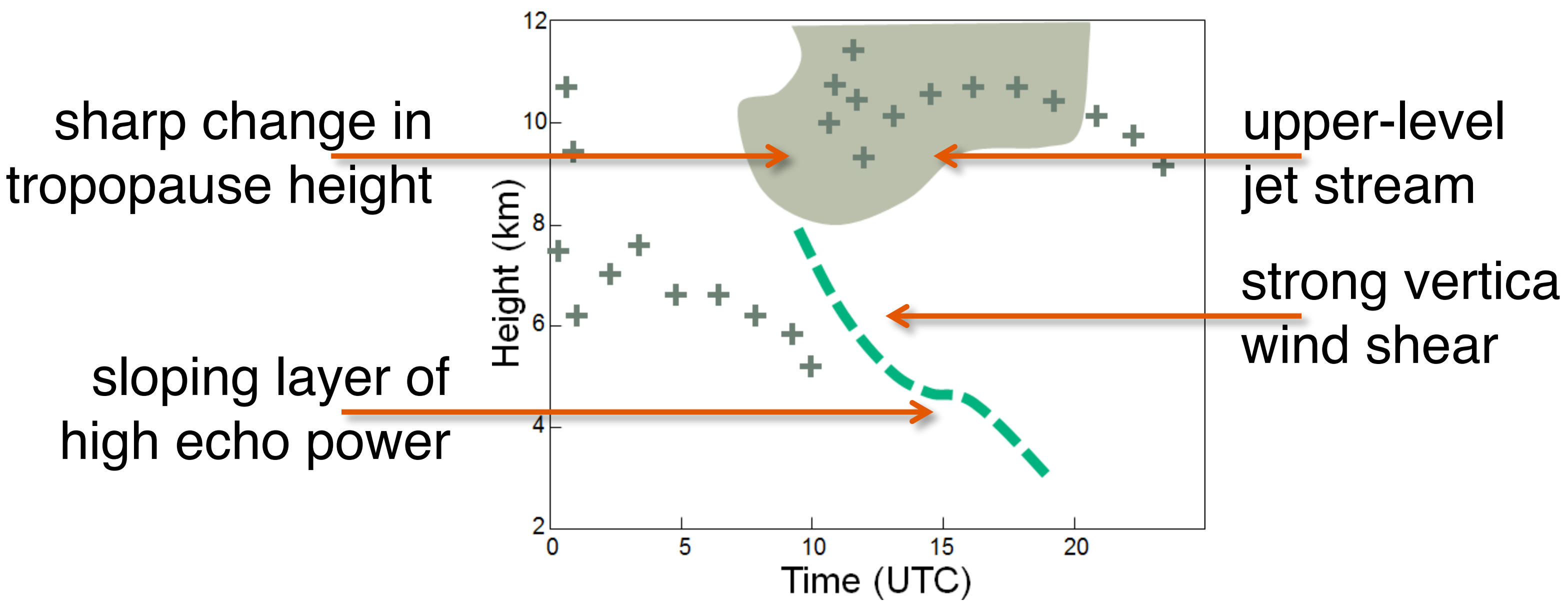
Radar-based climatology of tropopause folds and deep convection

MST radar and tropopause folds

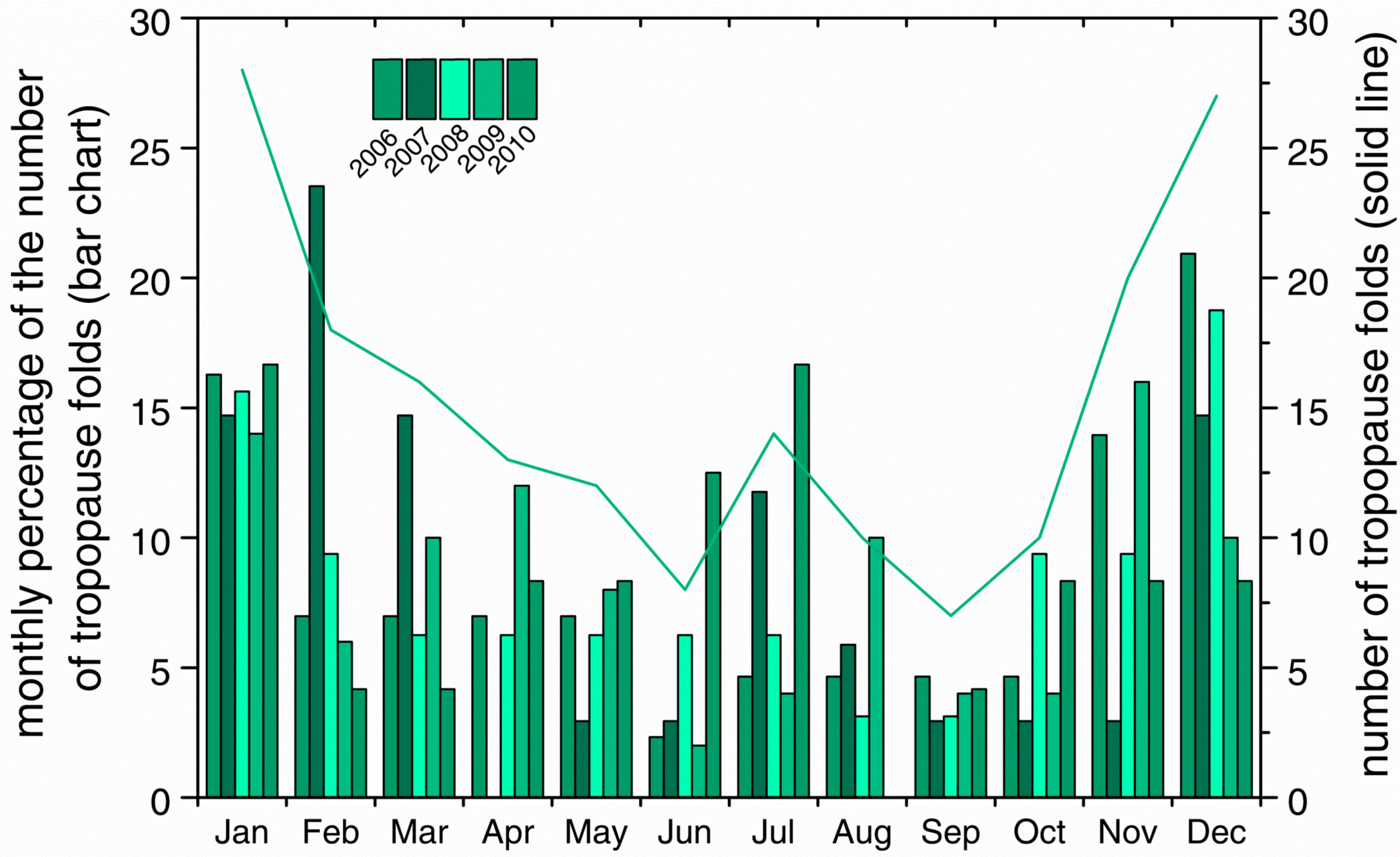

U.K. NERC
Mesosphere
Stratosphere
Troposphere radar
Capel Dewi
m
High : 1264
Low : -53
0 15 30 60 90
km
VHF wind-profiling radar

Tropopause fold detection





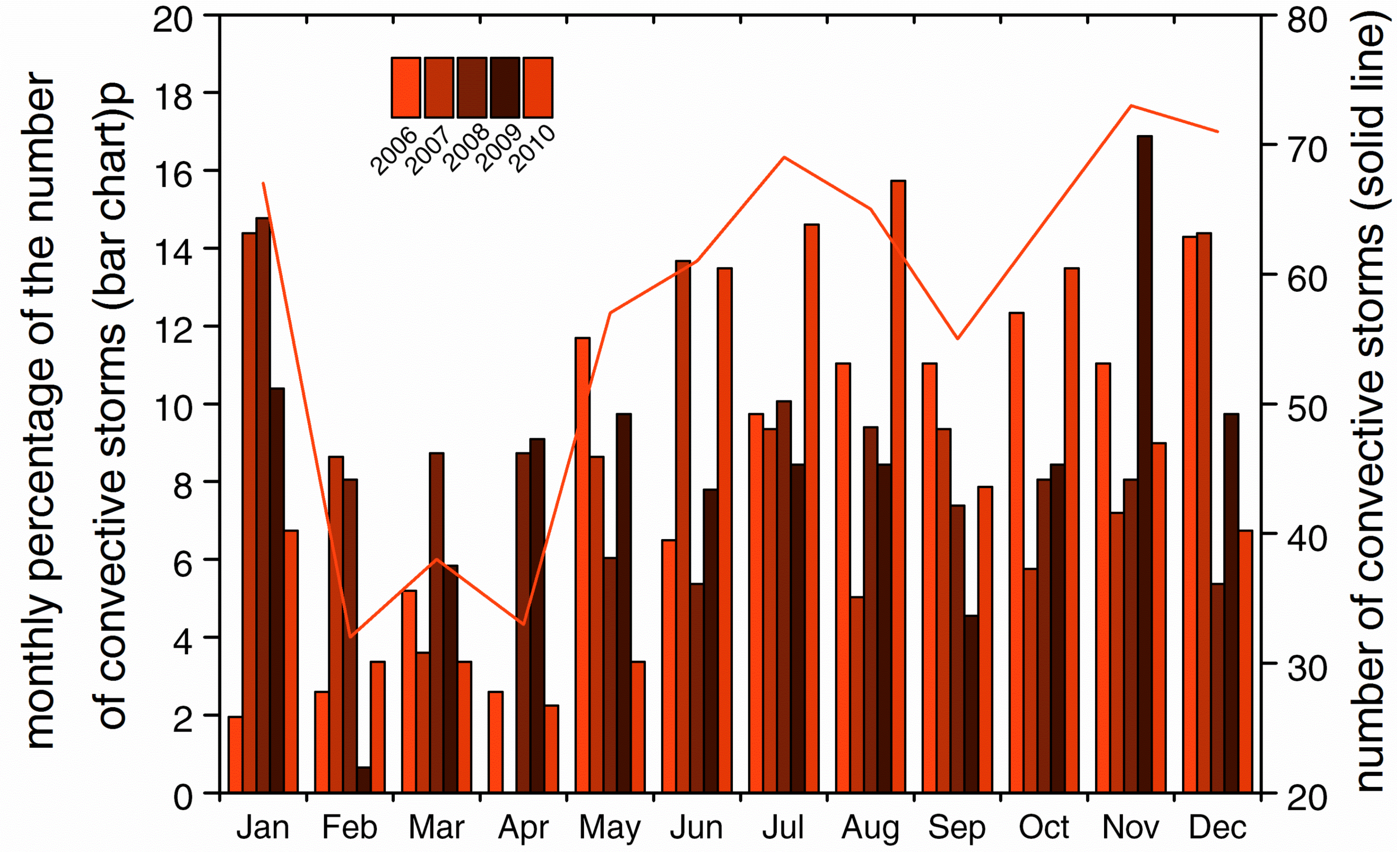
183 tropopause folds were identified in MST data between 2006–2011



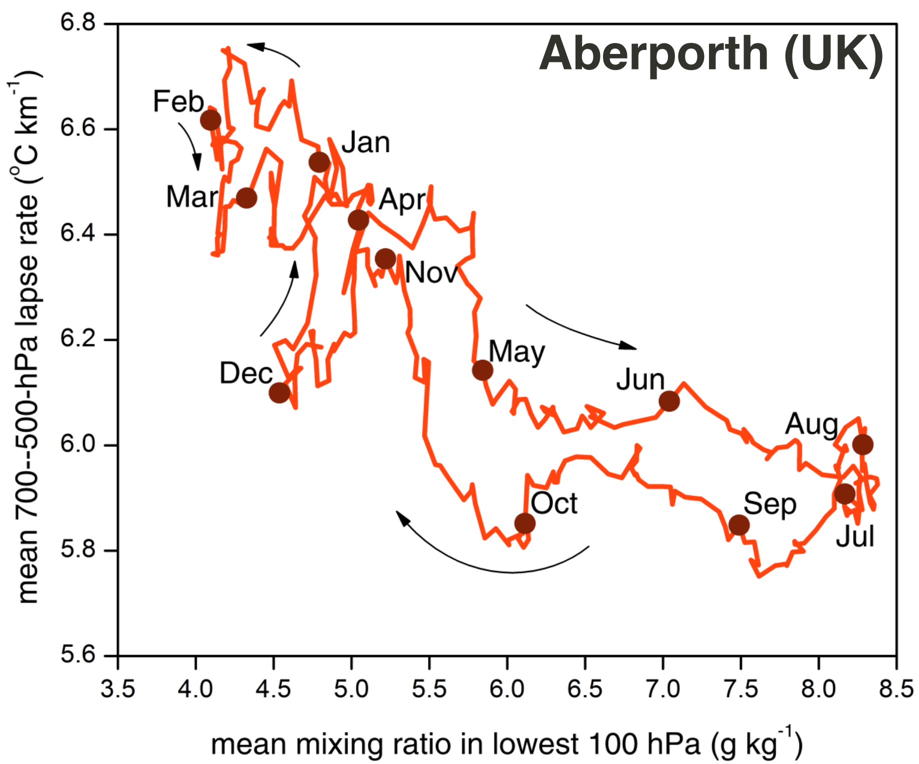
Radar-based climatology of tropopause folds and deep convection

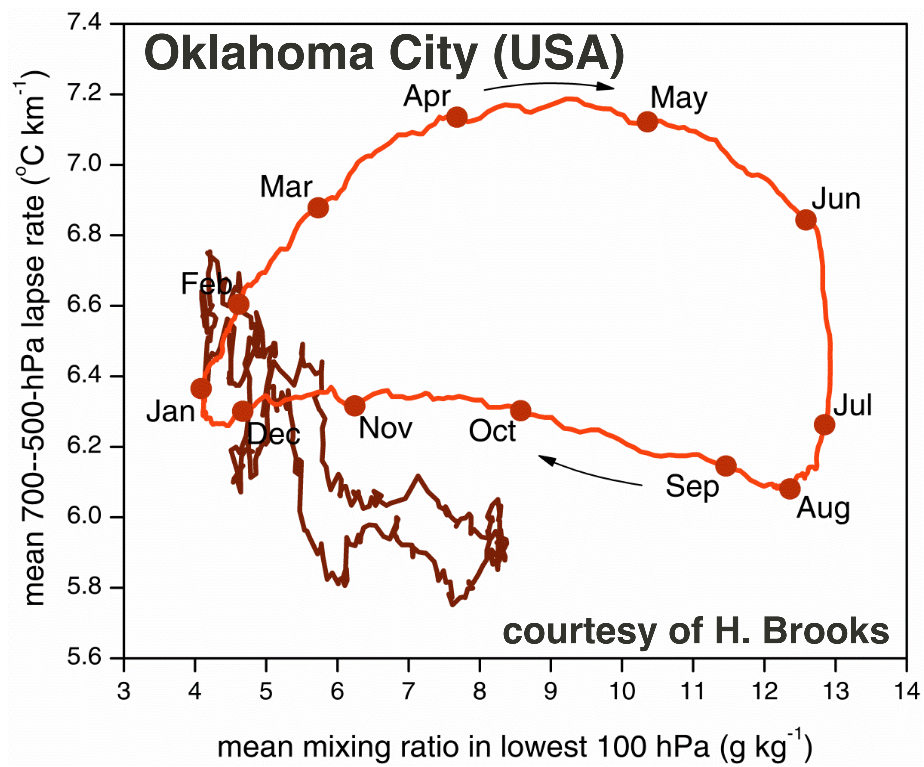
RADARNET and convective storms

695 convective storms were identified in RADARNET data between 2006–2011



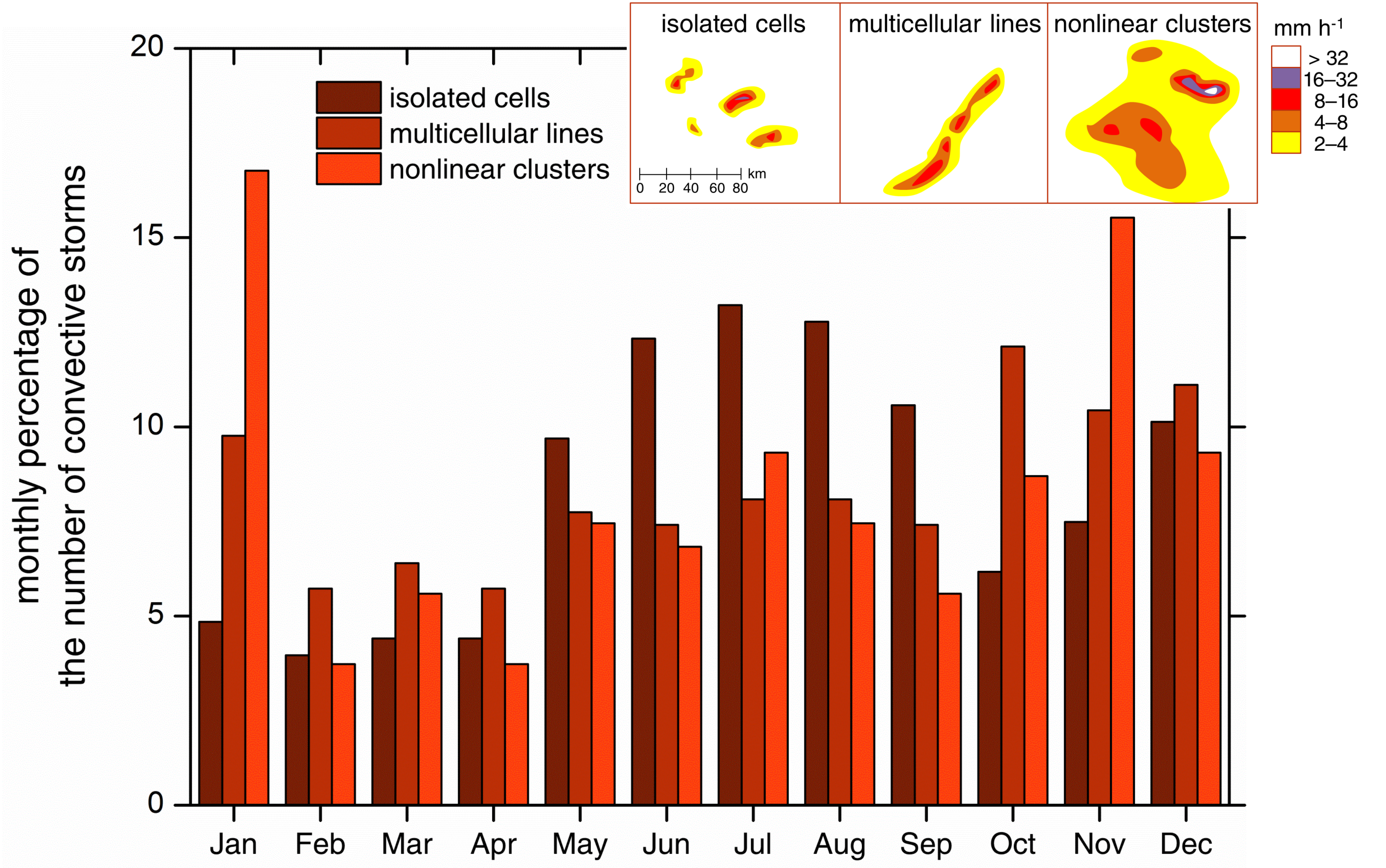
The annual cycle does not appear to provide an explanation for the minimum in convective storms in February–April, since the sounding characteristics are not substantially different from the more active period in November–January





Multicellular lines were most prevalent

with 298 cases(43.5% of all convective storms), followed by 227 isolated cells (31.1%)



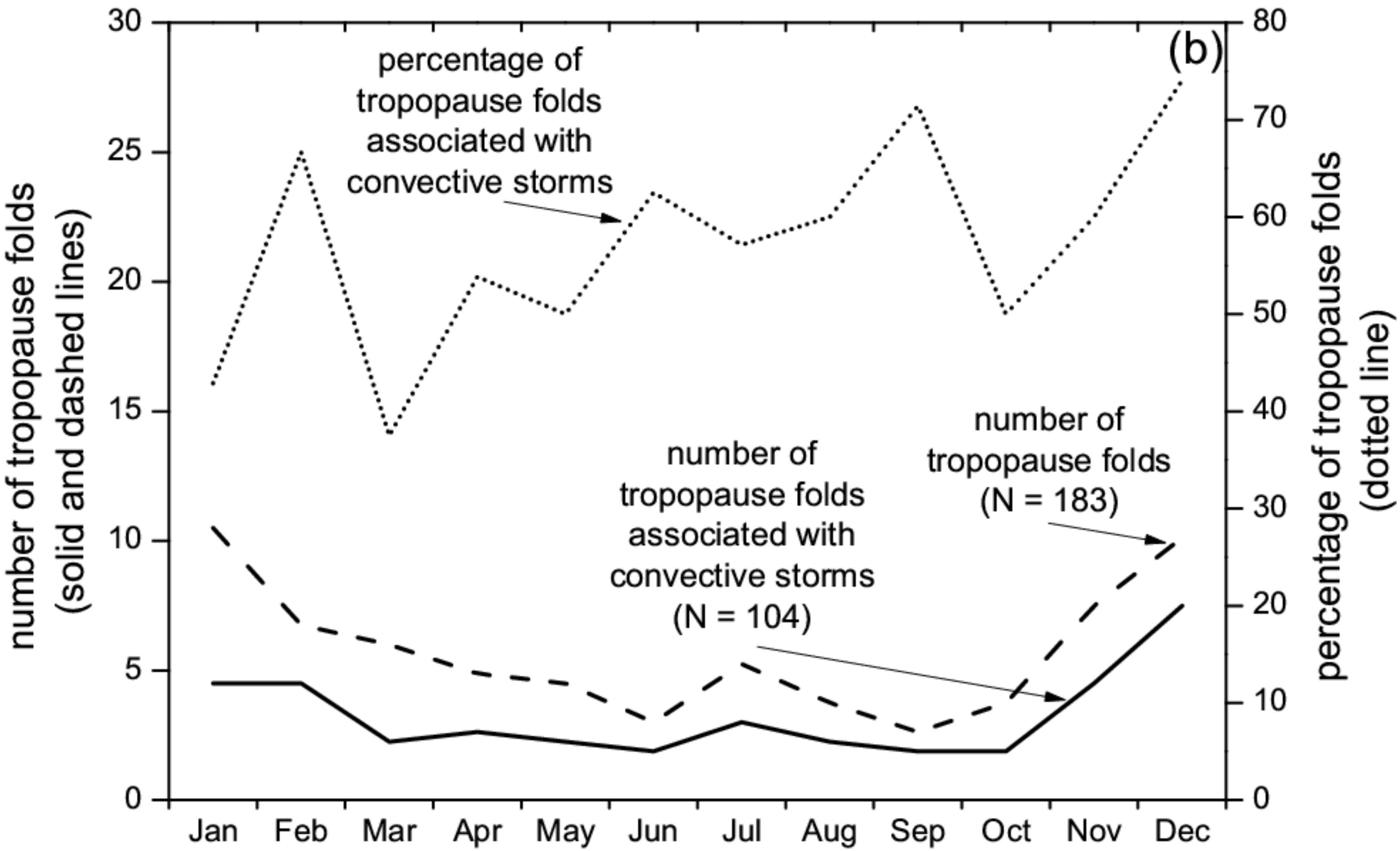
Tropopause folding, Stratospheric Intrusions And Deep convection

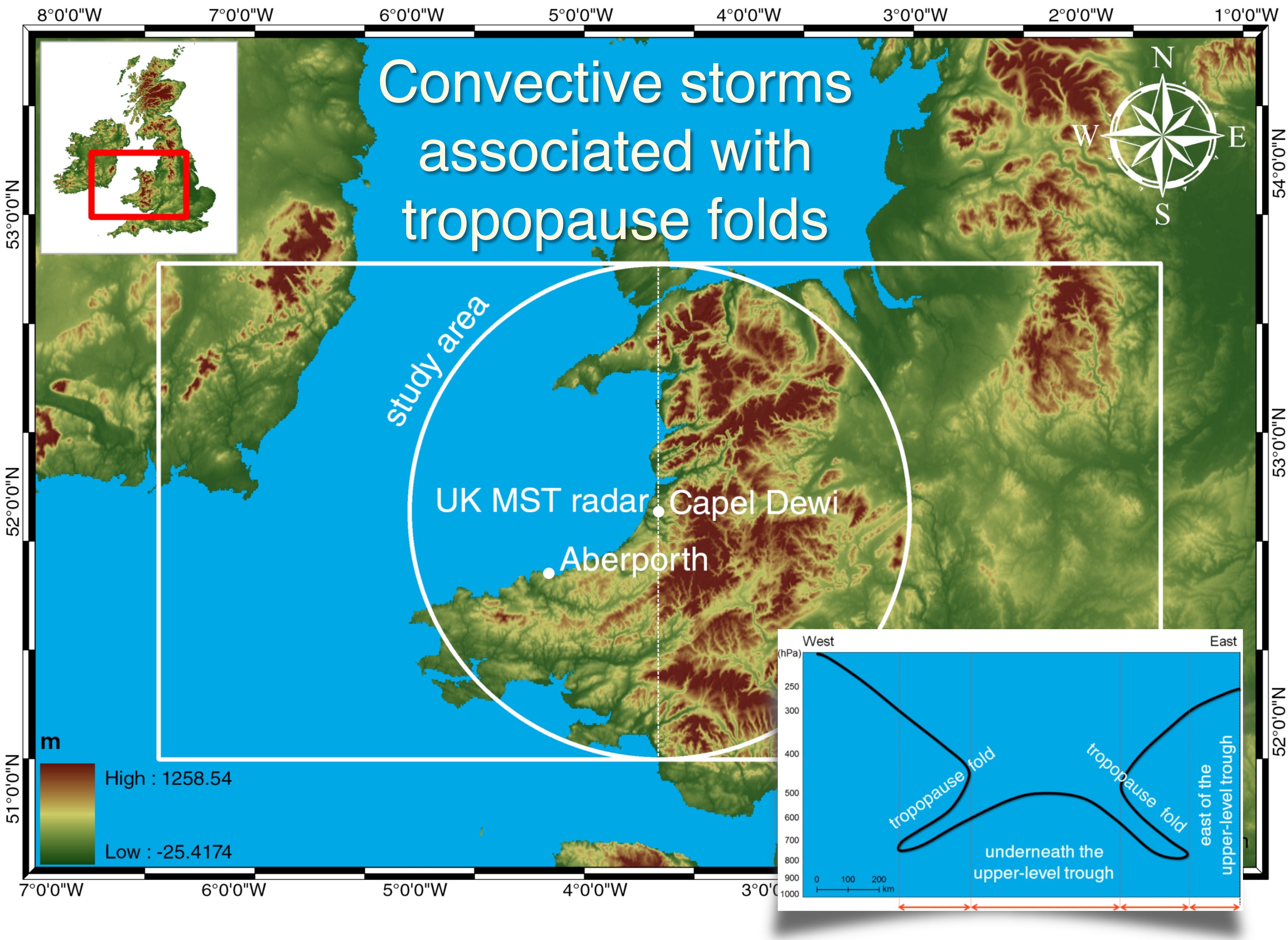
TROSIAD

Radar-based climatology of tropopause folds and deep convection

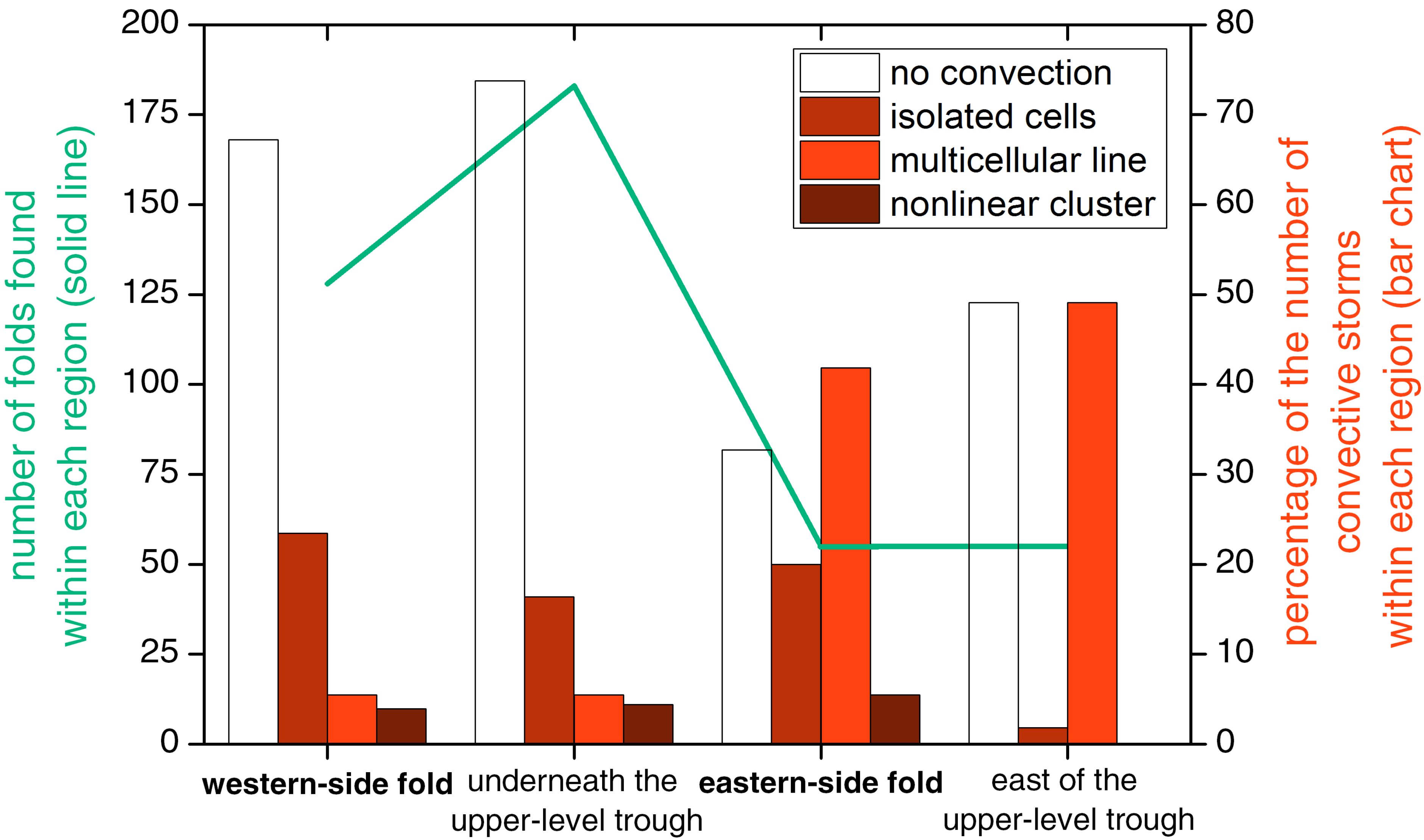
Tropopause folds and convective storms

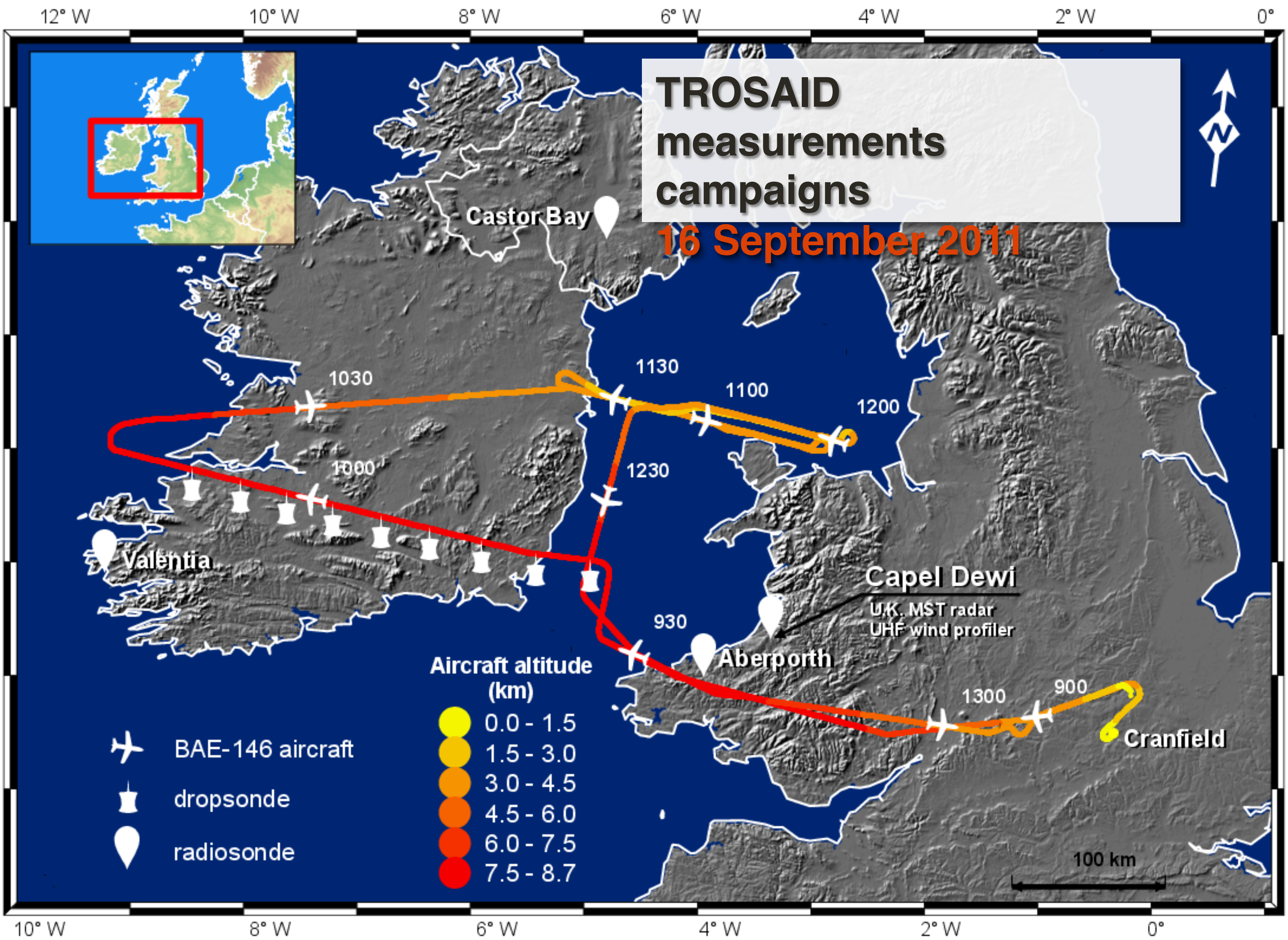
Main maximum in December and a secondary one in September, with a minimum in March




Convective storms
associated with
tropopause folds
study area
UK MST radar
Capel Dewi
Aberporth
N
S
W
E
m
High : 1258.54
Low : -25.4174
8°0'0"W
7°0'0"W
6°0'0"W
5°0'0"W
4°0'0"W
3°0'0"W
2°0'0"W
1°0'0"W
54°0'0"N
53°0'0"N
52°0'0"N
51°0'0"N
West
East
(hPa)
250
300
400
500
600
700
800
900
1000
0
100
200
km
tropopause fold
tropopause fold
underneath the
upper-level trough
east of the
upper-level trough

Conclusion: more organized storms tend to form in environments favorable for synoptic-scale ascent




TROSAID
measurements
campaigns
16 September 2011
12° W
10° W
8° W
6° W
4° W
2° W
0°
54° N
52° N
50° N
56° N
N
Castor Bay
Valentia
Capel Dewi
U.K. MST radar
UHF wind profiler
Aberporth
Cranfield
1030
1130
1100
1200
1000
1230
930
1300
900
Aircraft altitude
(km)
0.0 - 1.5
1.5 - 3.0
3.0 - 4.5
4.5 - 6.0
6.0 - 7.5
7.5 - 8.7
BAE-146 aircraft
dropsonde
radiosonde
100 km