

European COST Action P18  
*Third International Symposium on*  
Lightning Physics and Effects

**Using IMPACT sensors to study Lightning  
Climatology in Portugal  
(2003-2007)**

Ramos R., Amorim L., Correia S., Prior V.,

Instituto de Meteorologia  
Rua C do Aeroporto  
1749-077 LISBOA - PORTUGAL

# Lightning Network



## Lightning Network

4 - IMPACT 141T - ESP

- Braga
- Castelo Branco
- Alverca (Lisboa)
- Olhão (Faro)

1 - LP2000

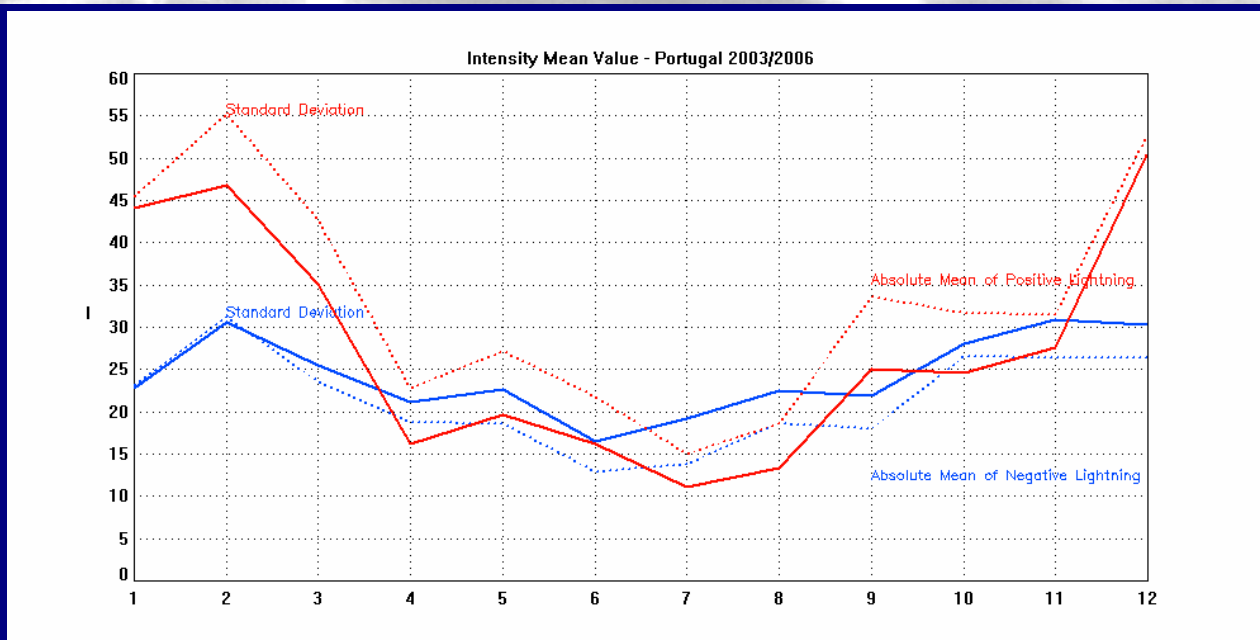
1 - CATS

5 - JOBS



15 April 2008

# Intensity 2003/2006

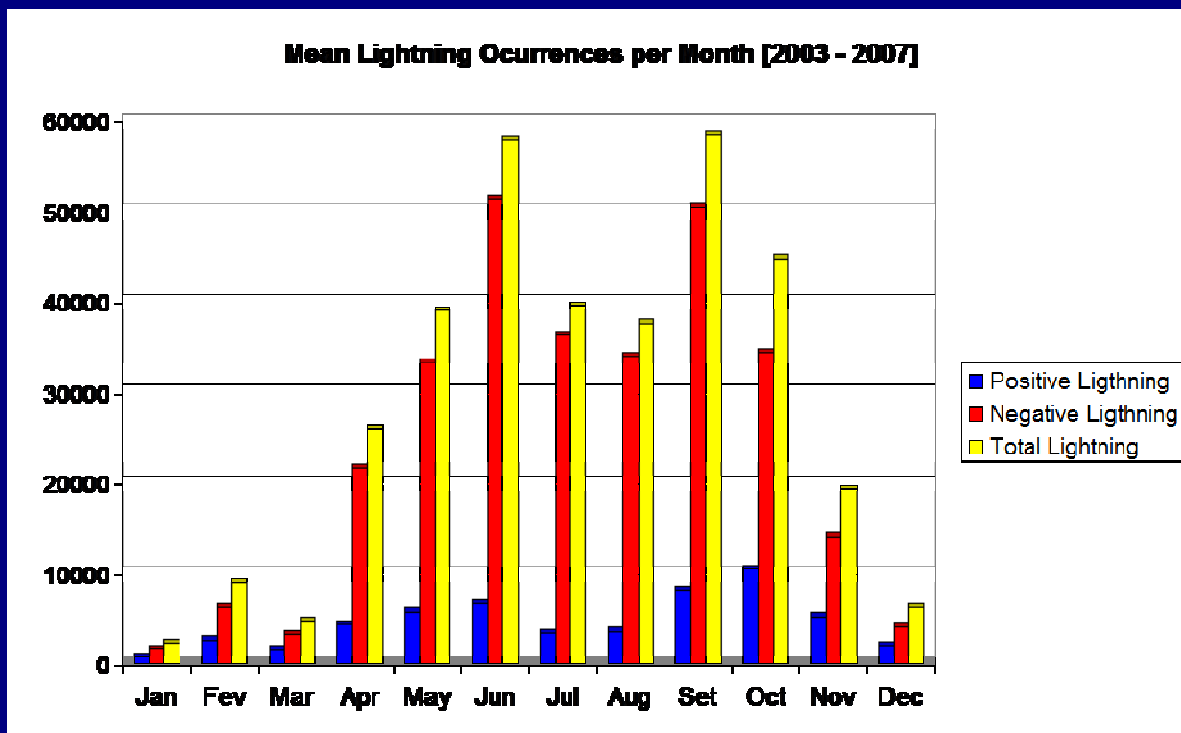


Lightning intensity mean value distribution over Portugal per month for 2003/2006:

- Maximum intensity mean value of **positive** lightning at February »  $46.7 \pm 55.3$  kA
- Minimum intensity mean value of **positive** lightning at July »  $11.0 \pm 15.0$  kA
- Maximum intensity absolute mean value of **negative** lightning at November »  $30.9 \pm 26.4$  kA
- Minimum intensity absolute mean value of **negative** lightning at June »  $16.5 \pm 12.9$  kA

15 April 2008

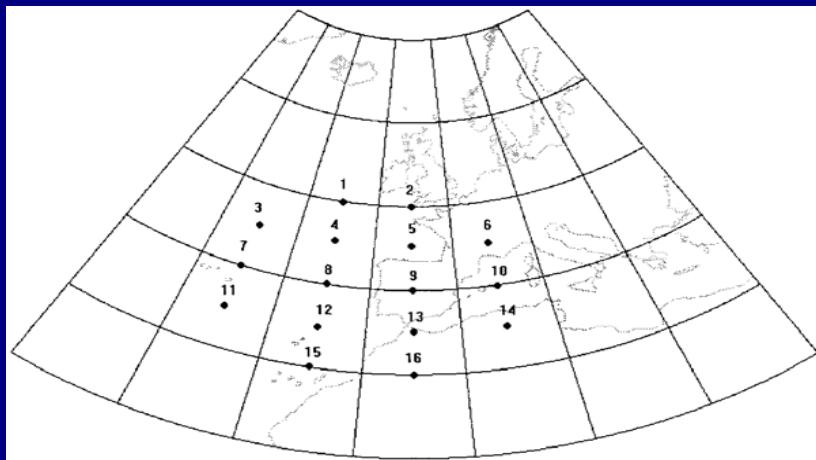
## Mean Lightning Occurrences per Month [2003 - 2007]



- Maximum occurrences: June and September
- Minimum occurrences: January and March
- Maximum occurrence in a day: 13357 lightning occurrences

15 April 2008

# Classification of weather types of circulation.



An objective classification scheme of the atmospheric circulation is characterized through the use of a set of indices associated with the direction and vorticity of the geostrophic flow (Trigo and DaCamara, 2000).

Grid points used to compute the vorticity (ZS, ZW) and flow (SF, WF) indices.

Directional types

Anticyclonic types

Cyclonic types

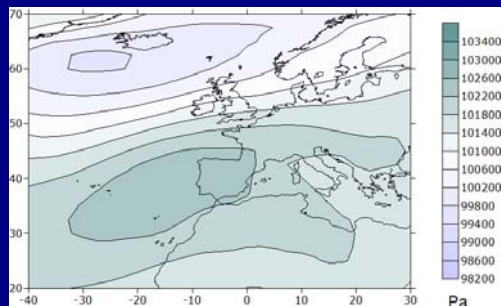
NE  
E  
SE  
S  
SW  
W  
NW  
N

ANE  
AE  
ASE  
AS  
ASW  
AW  
ANW  
AN  
A

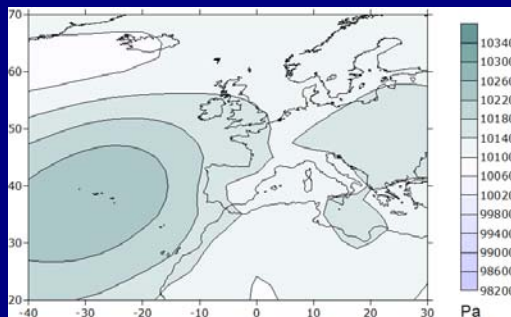
CNE  
CE  
CSE  
CS  
CSW  
CW  
CNW  
CN  
C

15 April 2008

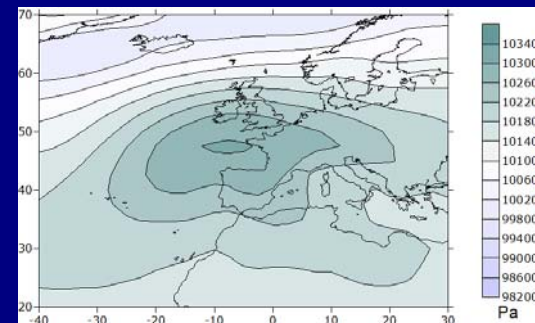
# Weather Types of Circulation



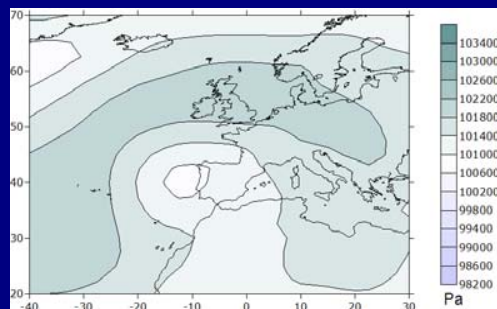
Weather circulation type - A



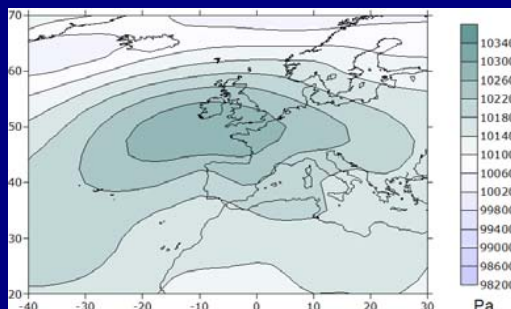
Weather circulation type - N



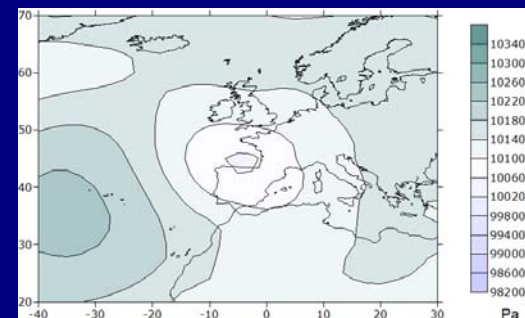
Weather circulation type - AE



Weather circulation type - C



Weather circulation type - E



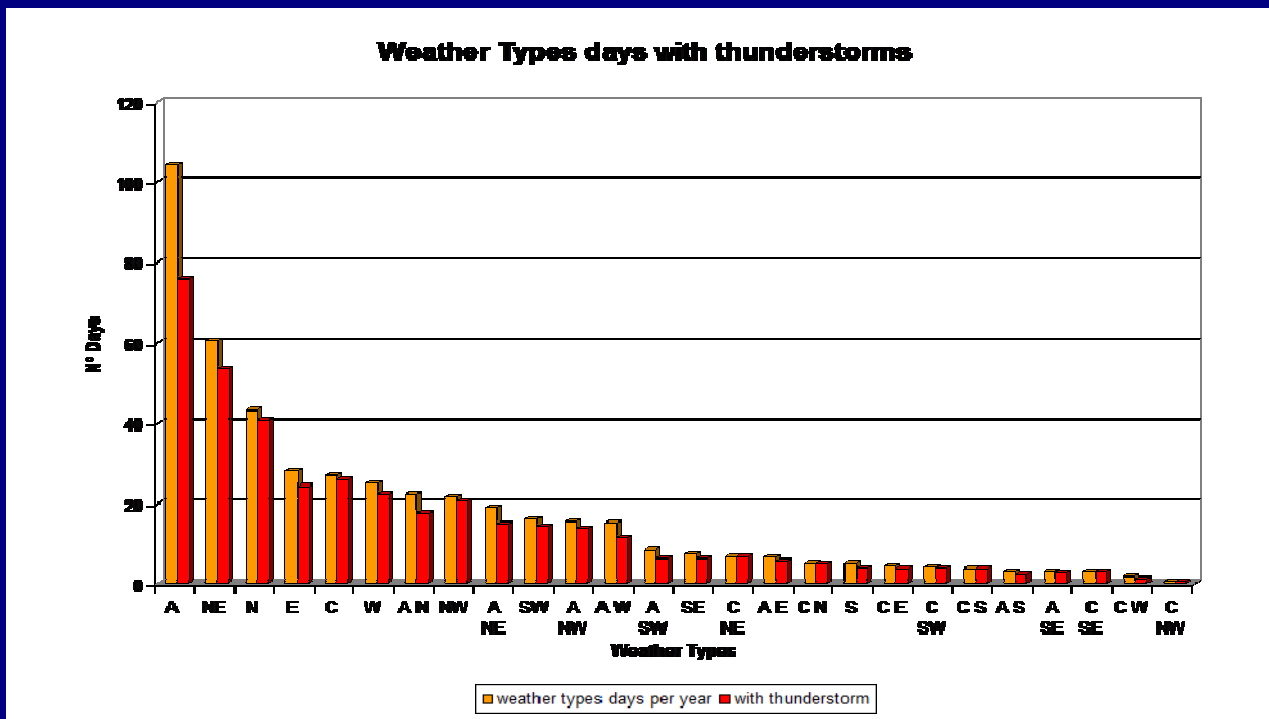
Weather circulation type - CNW

Mean Pressure fields from NCAR

15 April 2008

# Weather types days with thunderstorms

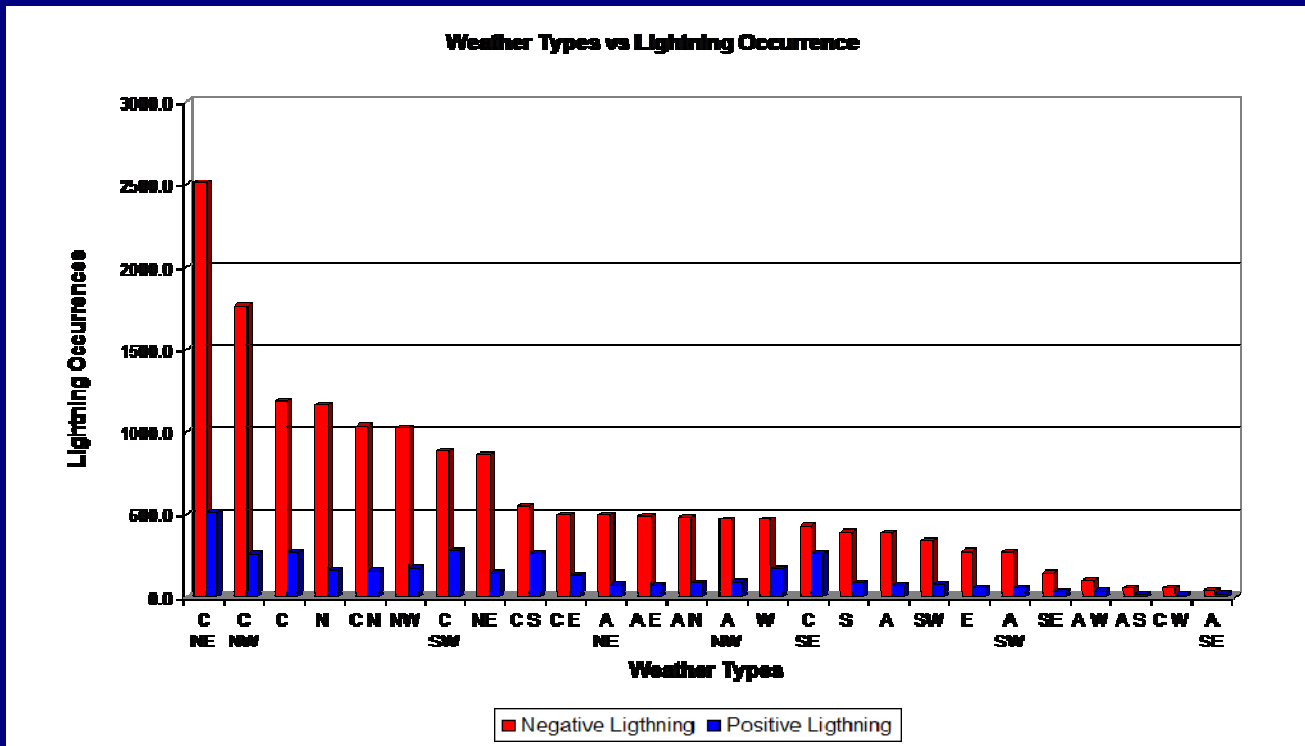
The circulation patterns were calculated with pressure data from the Analysis and Reanalysis of ECMWF. (Mendes M. 2002. IM)



- Most frequently type of circulation is: A – but the least percentage days with thunderstorm: 74 %
- Least frequently type of circulation is: C NW
- C NW, C SE, C S, C NE had 100% days with thunderstorm.

15 April 2008

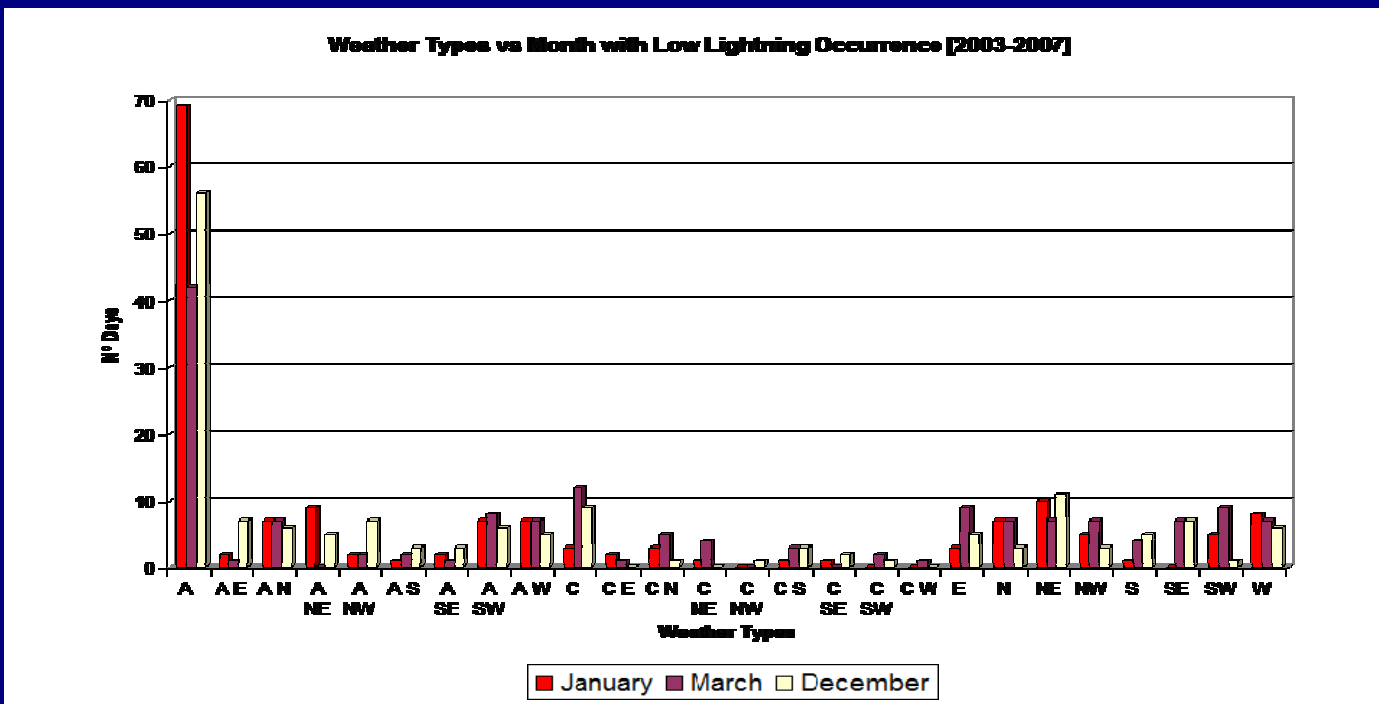
# Weather Types vs Lightning Occurrences



- Higher mean of lightning occurrences per day: C NE
- N is the highest directional weather type
- A NE is the highest Anti-Cyclonic weather type

15 April 2008

## Weather Types in Month with Low occurrences



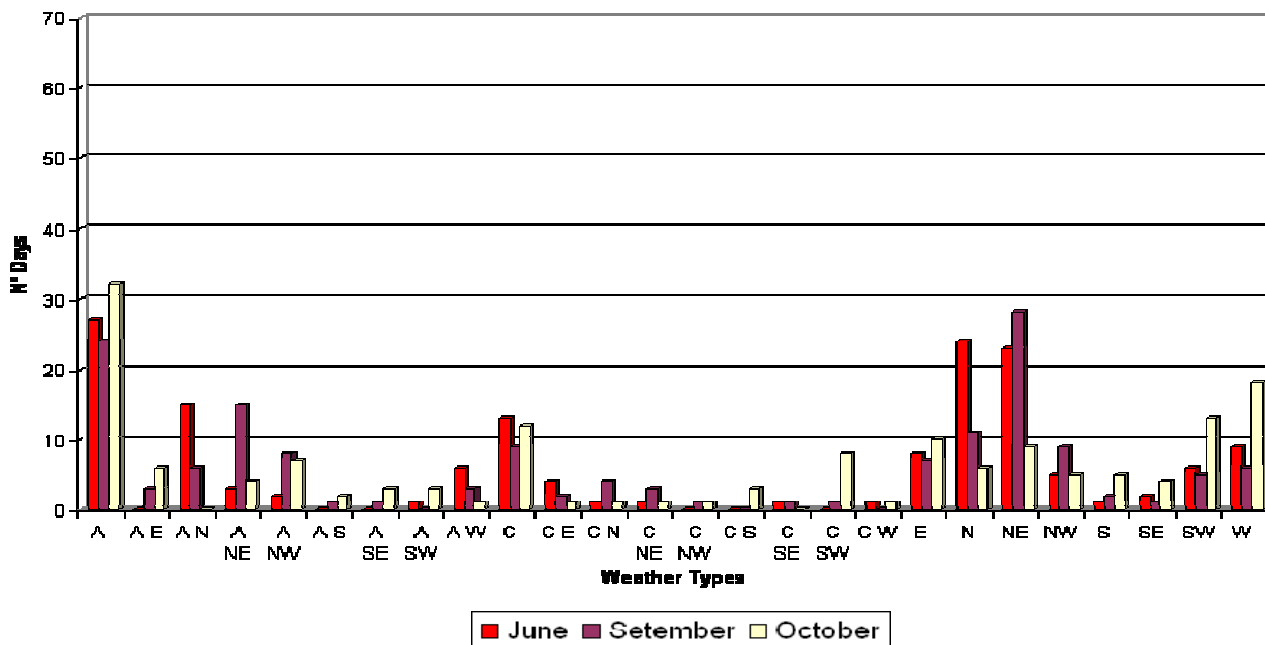
The months with low lightning occurrences (JAN, MAR, DEC) are characterized by:

- High major frequency of A weather type.
- All the rest lower or near to 10 days.
- Very low frequency of Cyclonic hybrids weather types.

15 April 2008

# Weather Types in Month with High occurrences

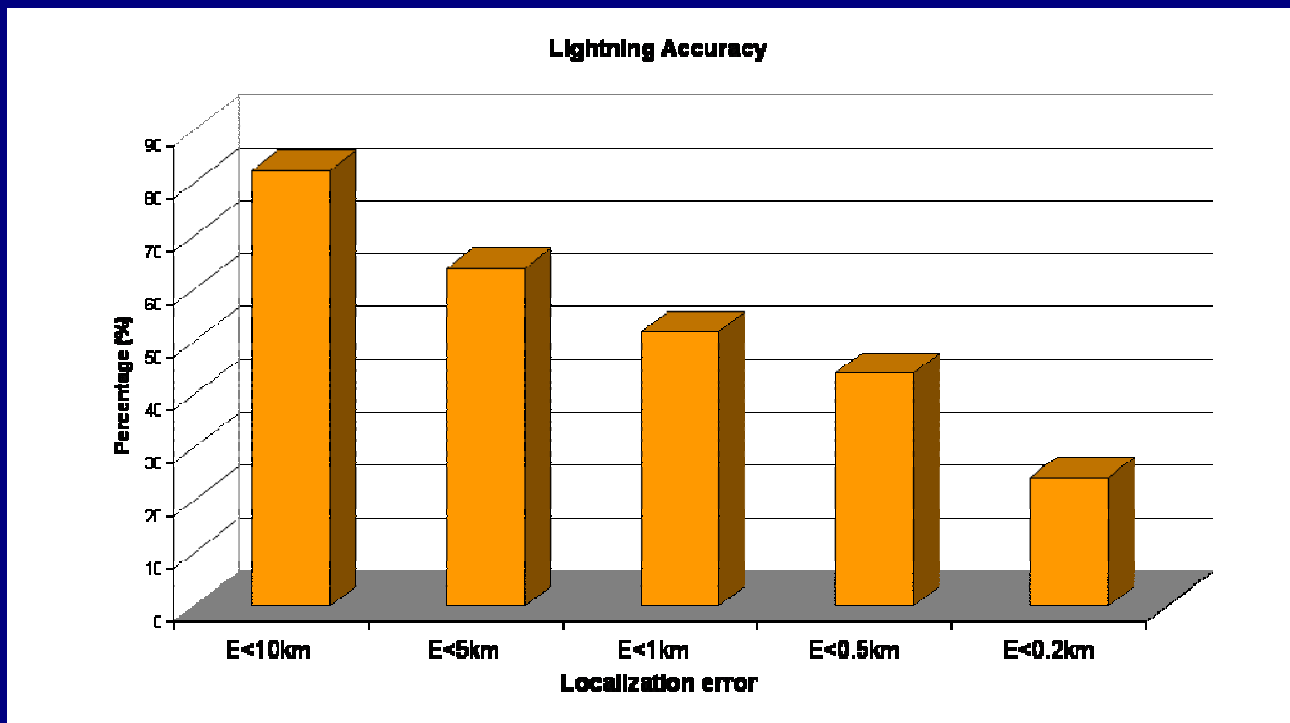
Weather Types vs Months with High Lightning Occurrence [2003-2007]



The months with high lightning occurrences (JUN, SET, OCT) are characterized by:

- Strong frequency of A, N, NE weather types.
- Medium frequency of AN, A NE, C, SW, W.
- Very low frequency of some Cyclonics hybrids weather types.

15 April 2008



Maximum error – 94 km.

0.026% with error > 50 km

Minimum error – 0.1 km.

Mean error – 5.04 km

15 April 2008

**Thank you!**

15 April 2008

*Third International Symposium on  
Lightning Physics and Effects*