5th International Conference on Meteorology and Climatology of the Mediterranean
Istanbul (Turkey), 2-4 March 2015

EXTENSION OF MEDITERRANEAN SUMMER TOWARDS SPRING

Jansa, A.[1], Homar, V.[1], Romero, R.[1], Alonso, S.[1,2], Guijarro, J. A.[3], Ramis, C.[1]

[1]UIB, [2]IMEDEA, [3]AEMET, Palma (Mallorca), Spain

agusti.jansa@gmail.com

5th International Conference on Meteorology and Climatology of the Mediterranean
Istanbul (Turkey), 2-4 March 2015

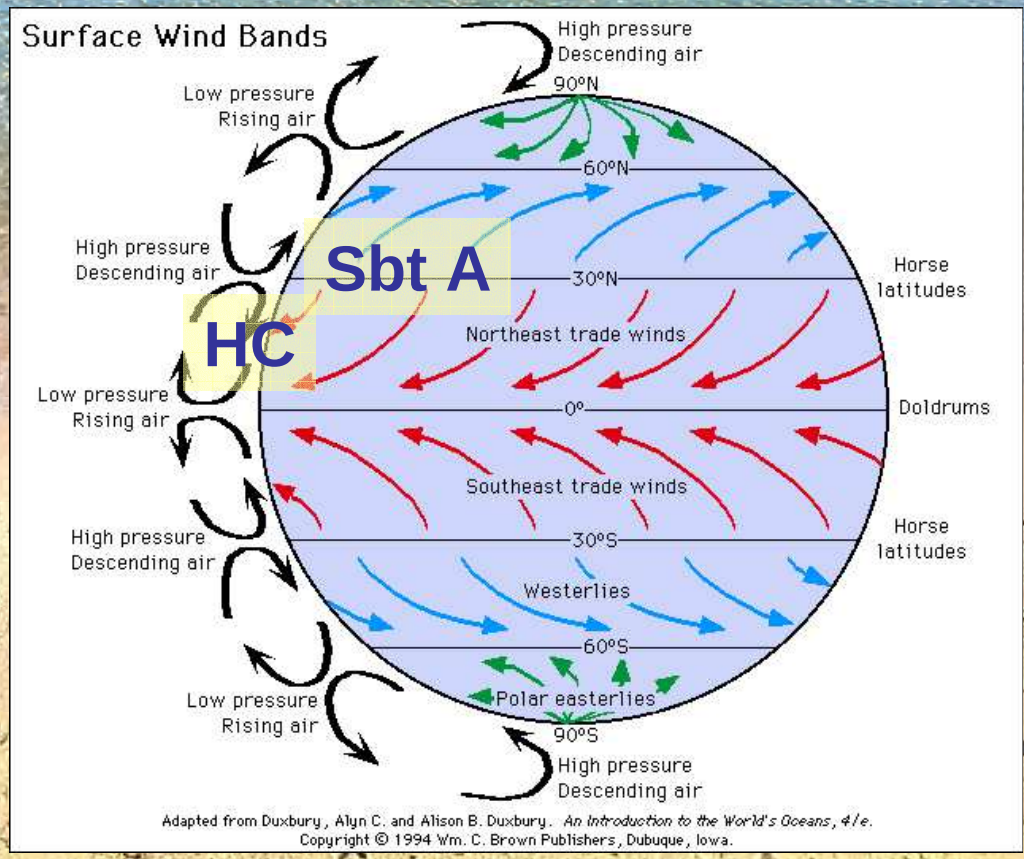
- Mediterranean climate ↔ dry summer↔ tropical circulation in summer?
- Near surface warming in the Iberian-West-Mediterranean area
  - Singularity of May-June (MJ) → expansion of summer towards spring
- Relationship between local near surface temperature & 500-GH
  - Singularity of MJ
- Regional distribution of the 500-GH tendencies
- 500-GH main structures in MJ,
  - their tendencies,
  - attribution to near surface temperature trend
- Are the observed MJ Iberian-Western-Mediterranean singularities compatible or manifestation of an expansion of the tropical belt in this region, this season?

AEMet Agencia Estatal de Meteorología
IMEDEA Institut Mediterrani d'Estudis Avancats
UIB Universitat de les Illes Balears

5th International Conference on Meteorology and Climatology of the Mediterranean
Istanbul (Turkey), 2-4 March 2015

Mediterranean climate ↔ Köppen Cs type ↔ temperate, not arid, with dry summer

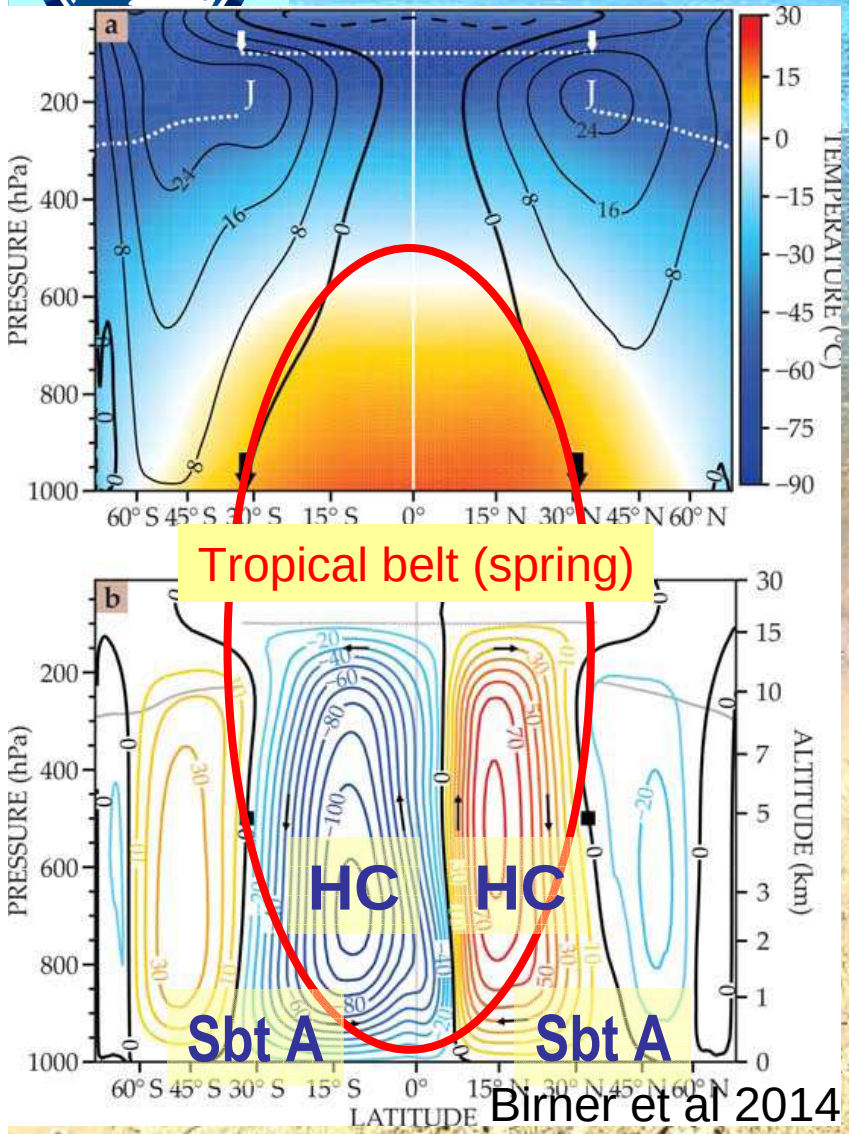
Is the seasonal polar wards shifting of the tropical circulation (HC, Sbt A) the Mediterranean summer key?

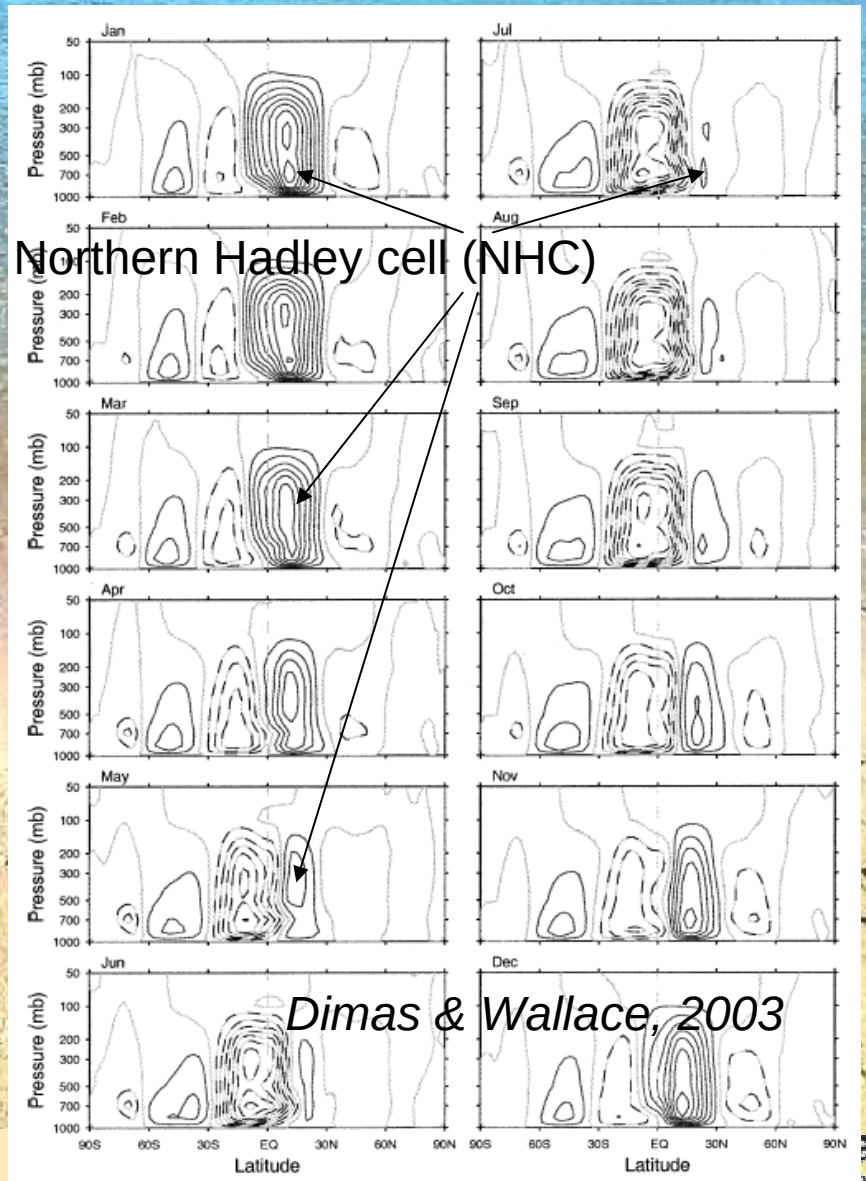


AEMet Agencia Estatal de Meteorología
IMEDEA Institut Mediterrani d'Estudis Avancats
UIB Universitat de les Illes Balears

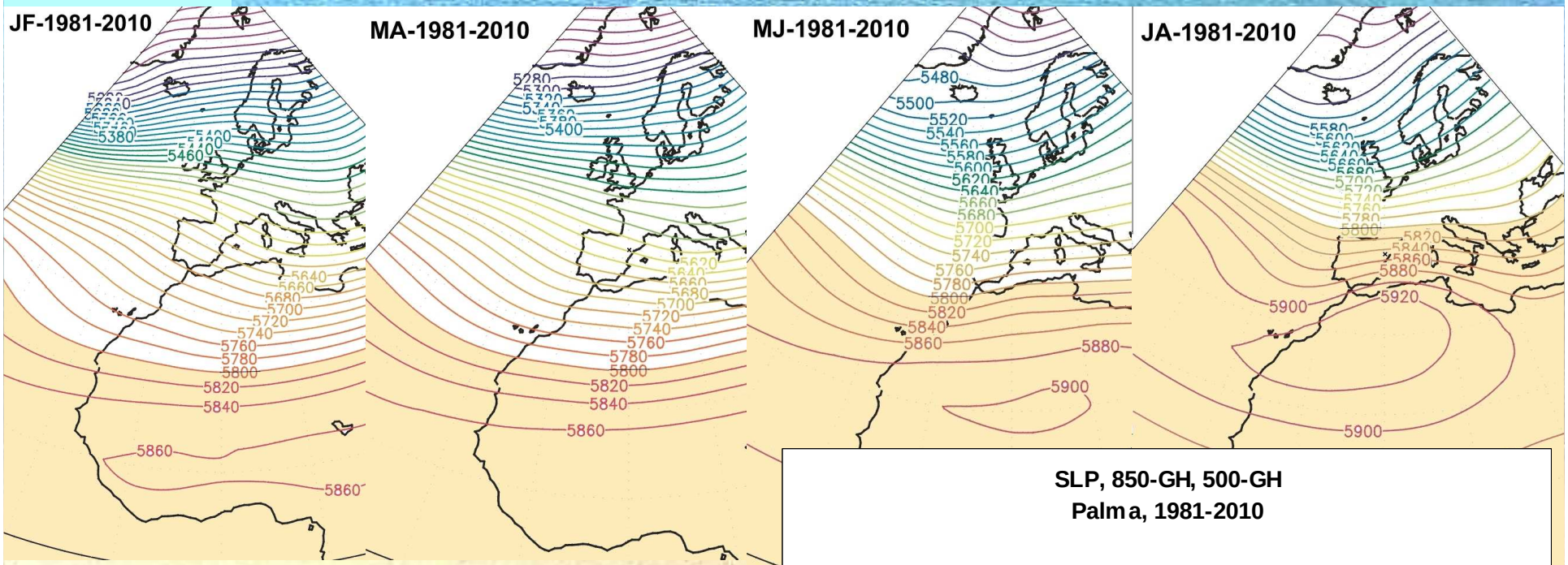
5th International Conference on Meteorology and Climatology of the Mediterranean
Istanbul (Turkey), 2-4 March 2015

HC / low level Sbt A: vanish in summer as planetary belt features

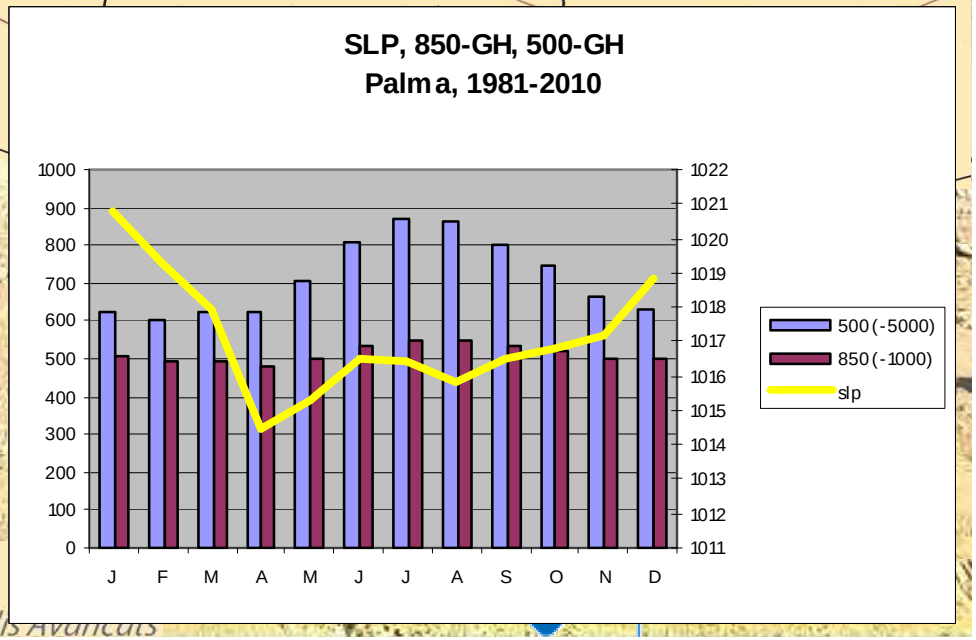




5th International Conference on Meteorology and Climatology of the Mediterranean
Istanbul (Turkey), 2-4 March 2015



500 hPa geopotential height -500-GH- could become an indicator of Mediterranean summer and tropical belt presence -5800 m?

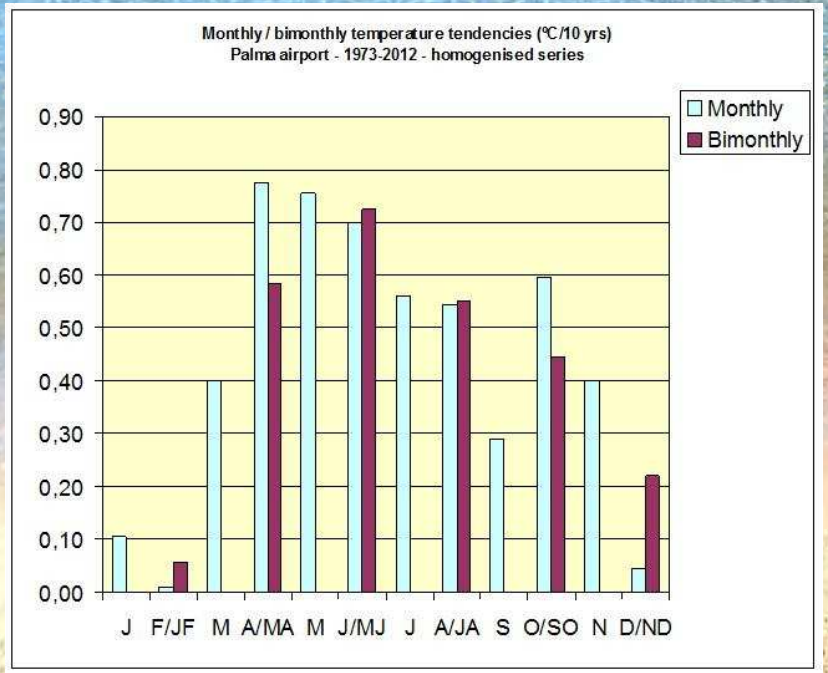


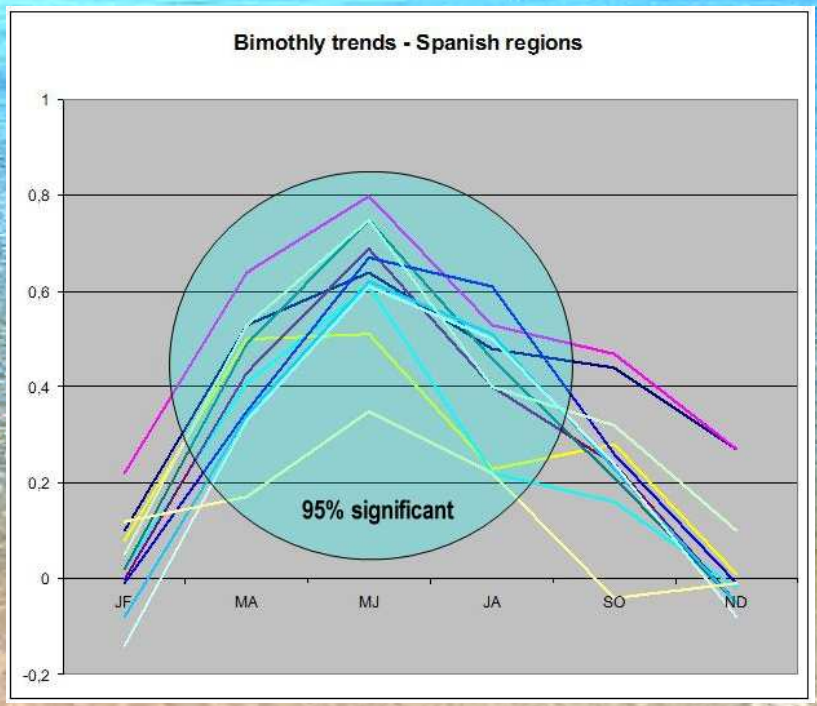
Agencia Estatal de Meteorología

Institut Mediterrani d'Estudis Avançats

5th International Conference on Meteorology and Climatology of the Mediterranean
Istanbul (Turkey), 2-4 March 2015

Near surface warming

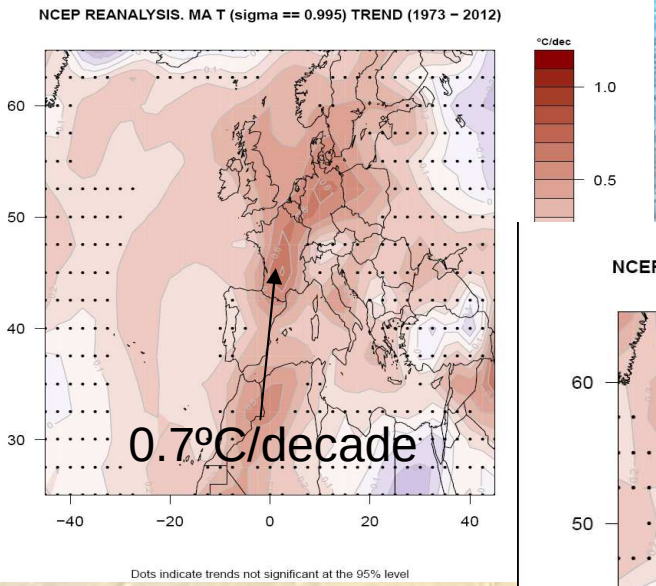


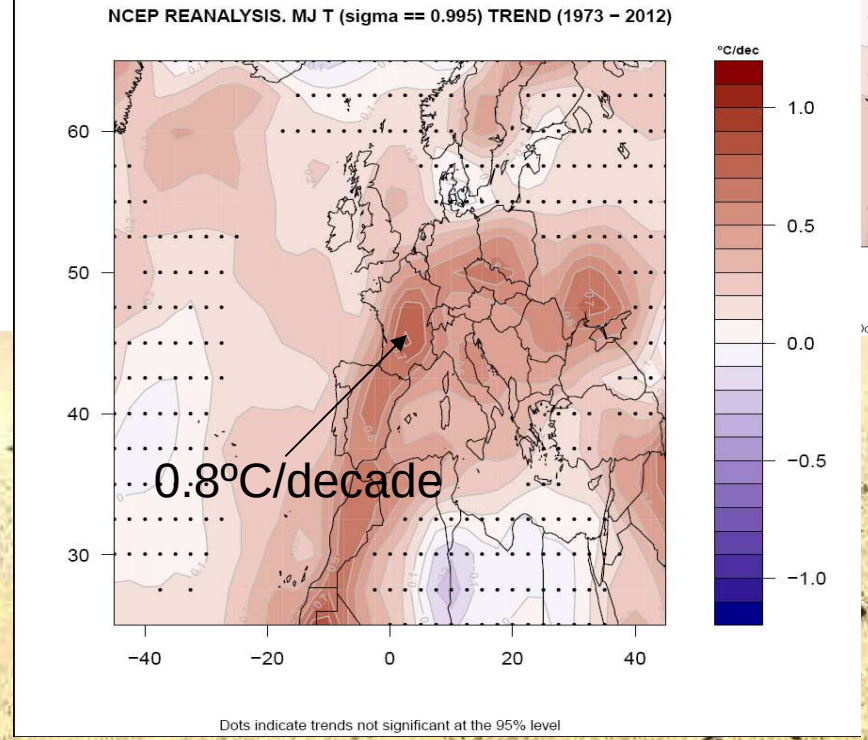


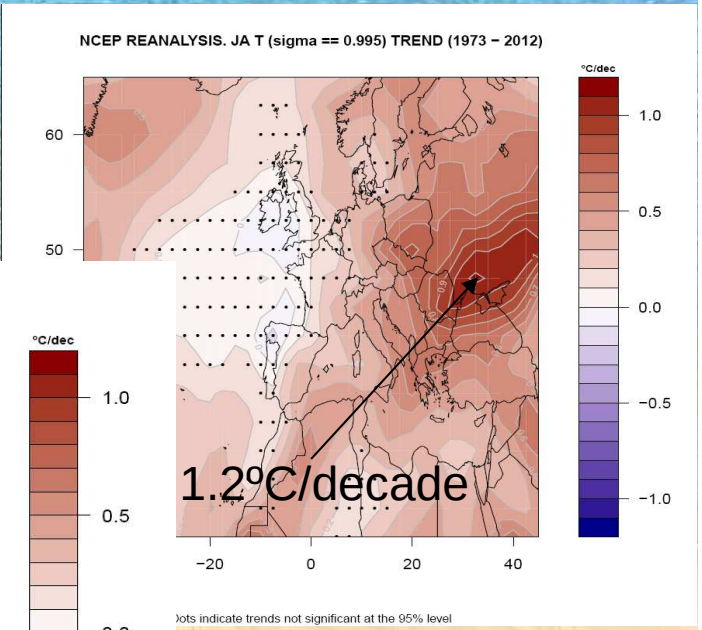
AEMet Agencia Estatal de Meteorología
IMEDEA Institut Mediterrani d'Estudis Avancats
UIB Universitat de les Illes Balears

5th International Conference on Meteorology and Climatology of the Mediterranean
Istanbul (Turkey), 2-4 March 2015

Near surface warming (NCEP/NCAR reanalysis)







AEMet Agencia Estatal de Meteorología

IMEDEA Institut Mediterrani d'Estudis Avancats

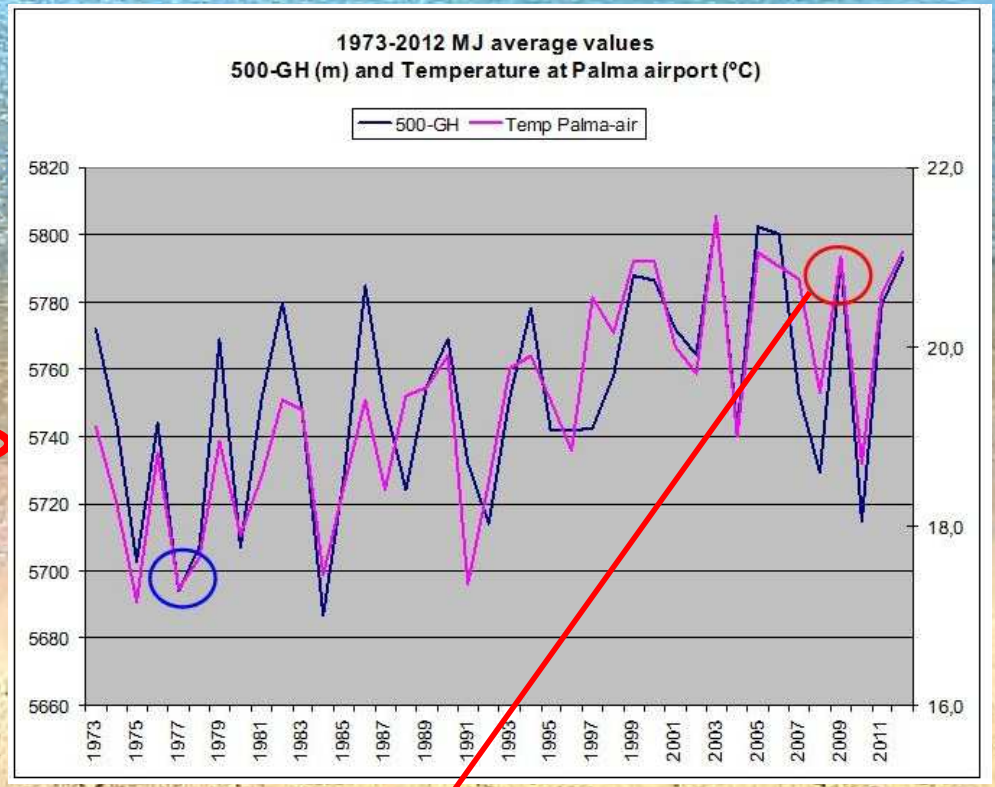
UIB Universitat de les Illes Balears

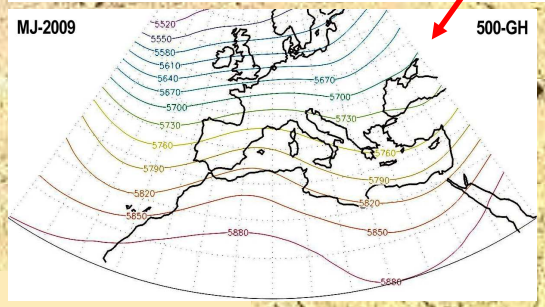
5th International Conference on Meteorology and Climatology of the Mediterranean
Istanbul (Turkey), 2-4 March 2015

Relationship between local near surface temperature & 500-GH

	TMP TND	500-GH TND	R
JF	0,06	3,7	0,30
MA	0,58	11,9	0,63
MJ	0,72	12,2	0,84
JA	0,55	6,5	0,69
SO	0,45	2,6	0,66
ND	0,22	-5,1	0,34
Year	0,43	5,3	0,77

95% level of confidence





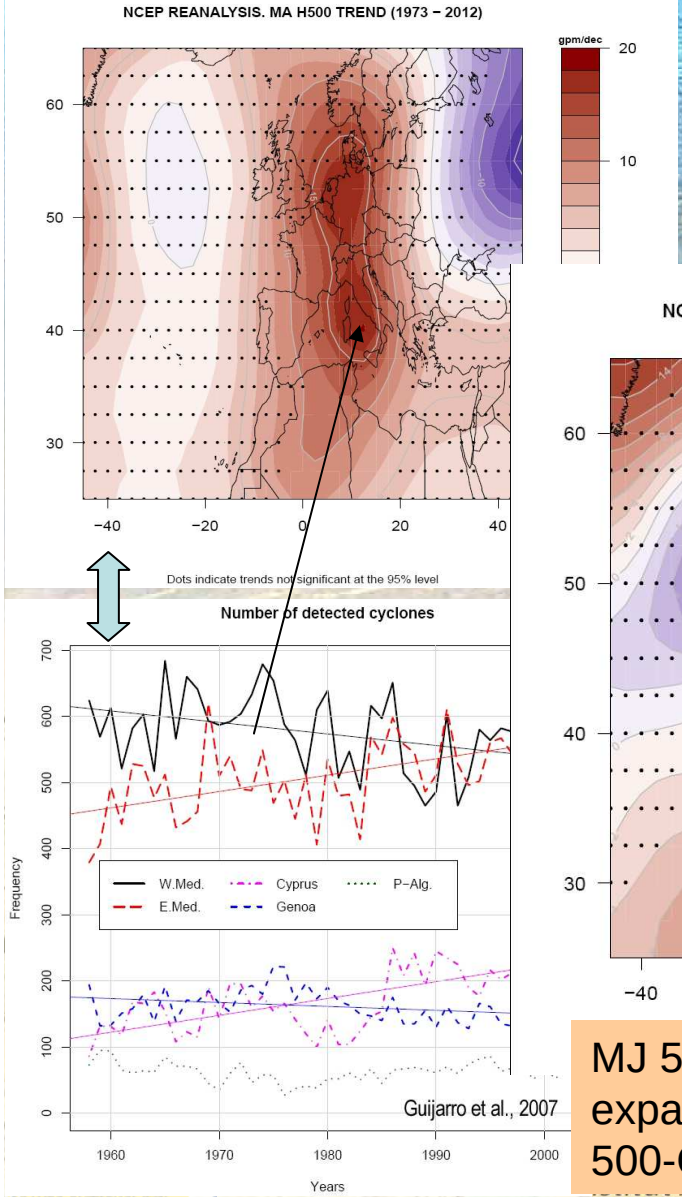
AEMet Agencia Estatal de Meteorología

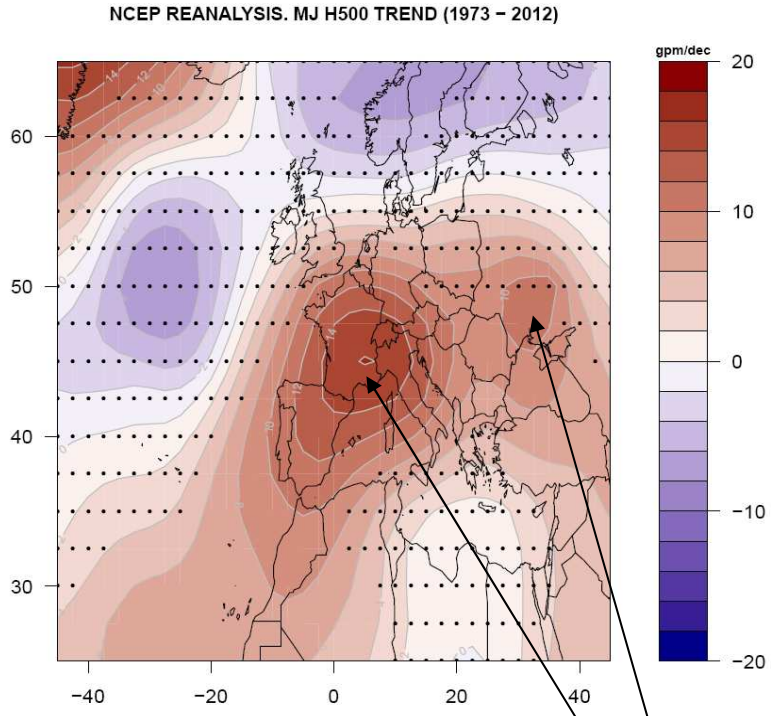
IMEDEA Institut Mediterrani d'Estudis Avancats

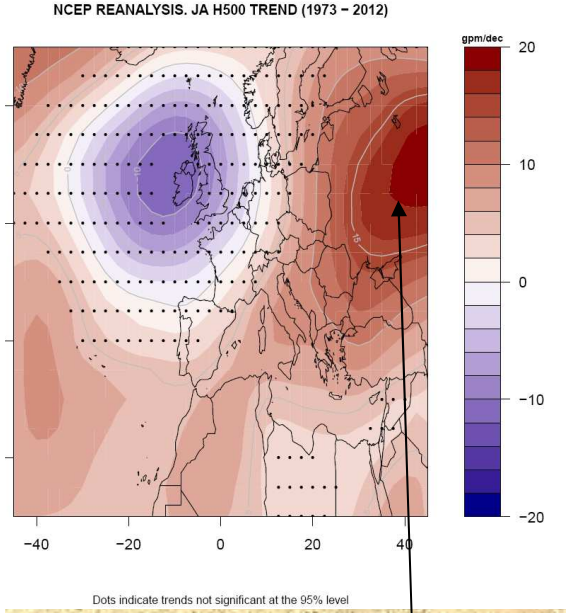
UIB Universitat de les Illes Balears

5th International Conference on Meteorology and Climatology of the Mediterranean
Istanbul (Turkey), 2-4 March 2015

Regional distribution of the 500-GH tendencies







The second ridge strongly reinforces in JA

MJ 500-GH increasing could be seen as expansion towards N of the tropical high 500-GH area – Ridge-shaped (or 2 ridges)

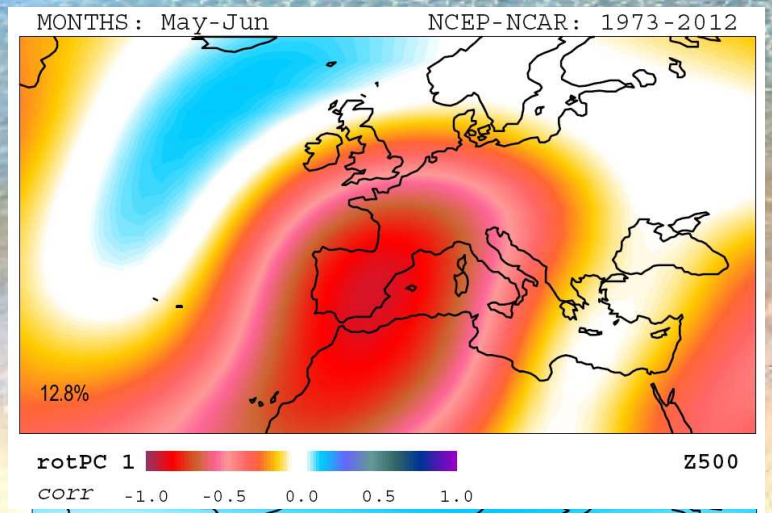
UIB Universitat de les Illes Balears

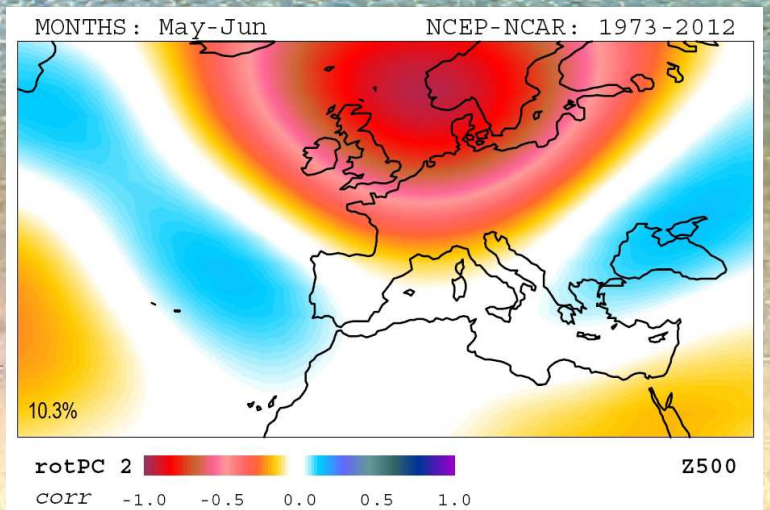
5th International Conference on Meteorology and Climatology of the Mediterranean
Istanbul (Turkey), 2-4 March 2015

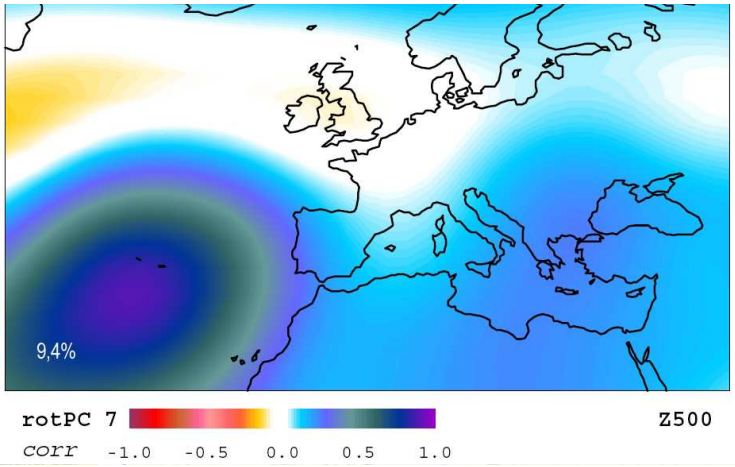
500-GH main structures in MJ,

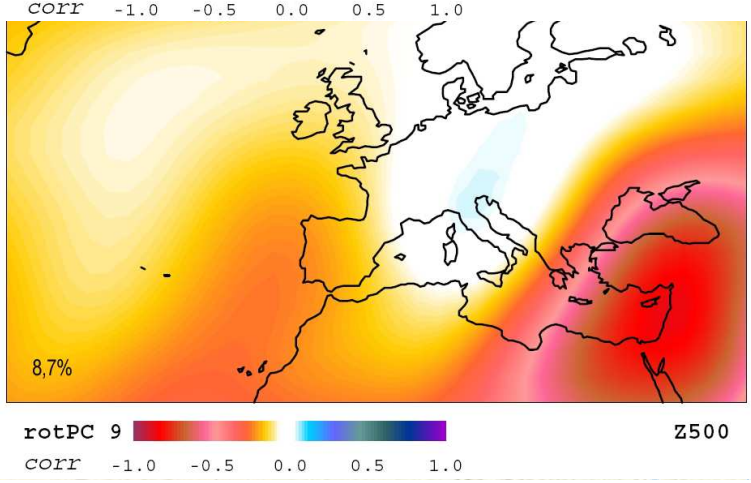
- their tendencies,
- attribution to near surface temperature trend

Identifying main 500-HG patterns, in MJ, through PC analysis (rotated PCs)
10 PCs explain 83% of the variance. First four PCs, by variance explained:







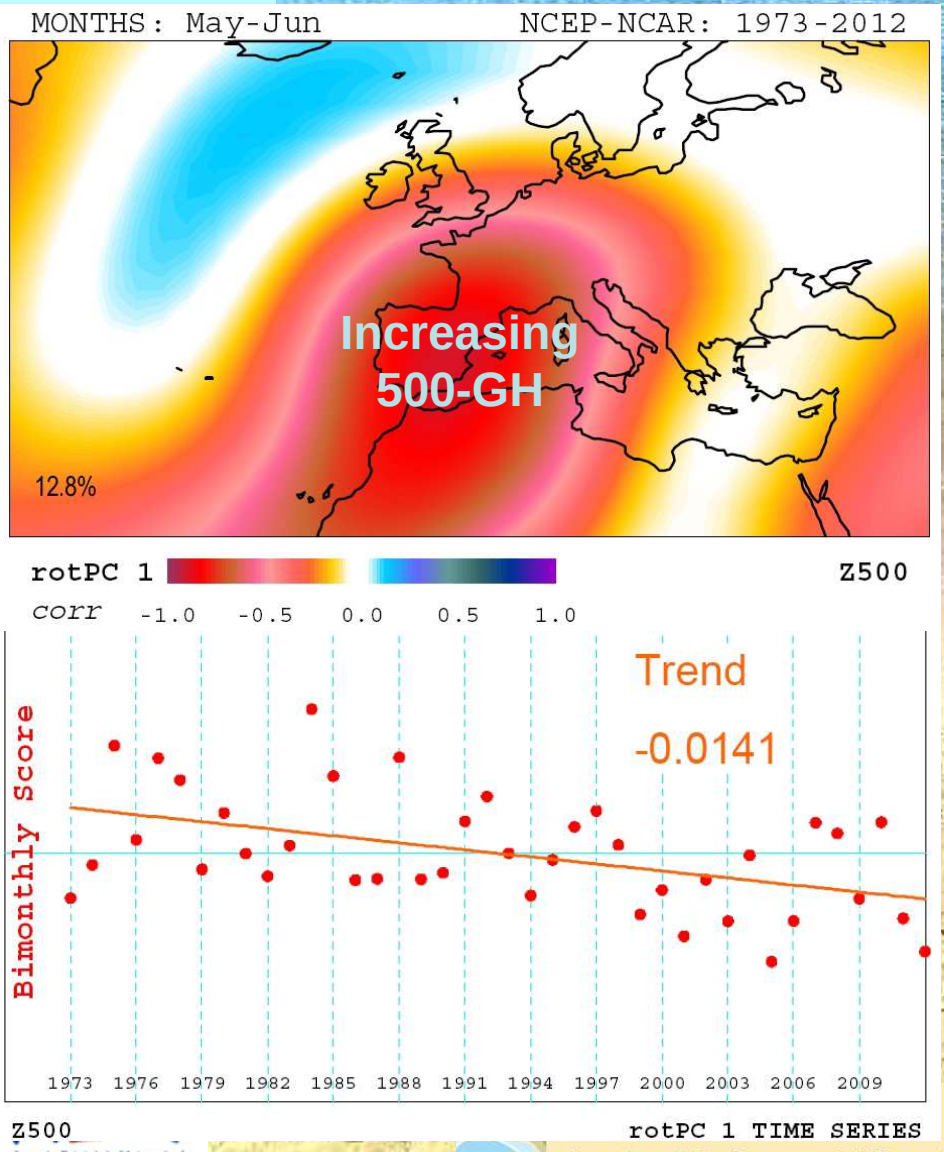


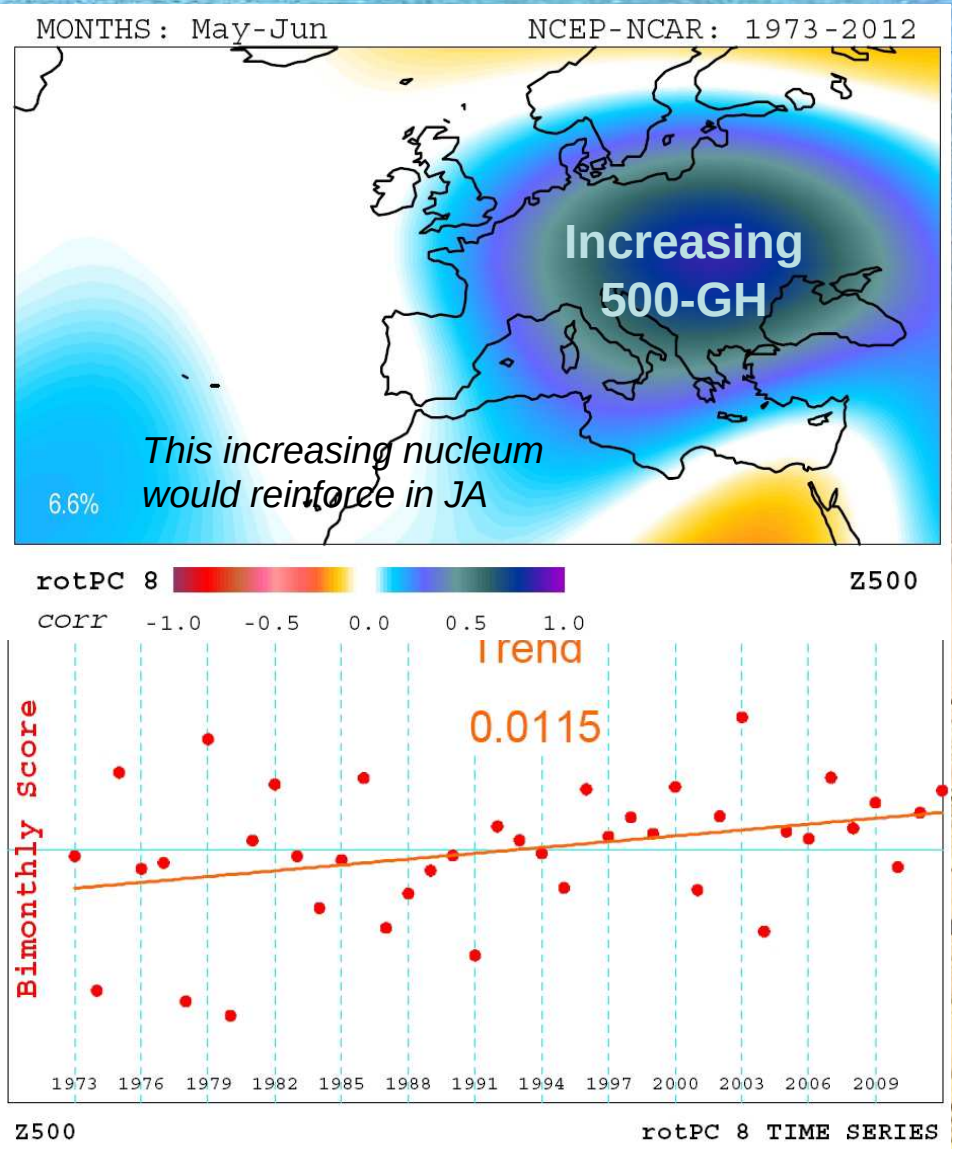
Universitat de les Illes Balears

5th International Conference on Meteorology and Climatology of the Mediterranean
Istanbul (Turkey), 2-4 March 2015

Two PCs present important trends along time in their scores

In other cases the score trends are much weaker





A multi lineal regression model have been obtained to describe the local MJ average temperature at Palma-airport as a function of the scores of the 10 main rotated PCs
Also the contribution to the temperature trend in Palma has been obtained, taking into account the trend of the PCs scores (Note that the 10PCs can explain only part of the total temperature trend, 0,58ºC/decade, instead of observed 0,72ºC/decade)

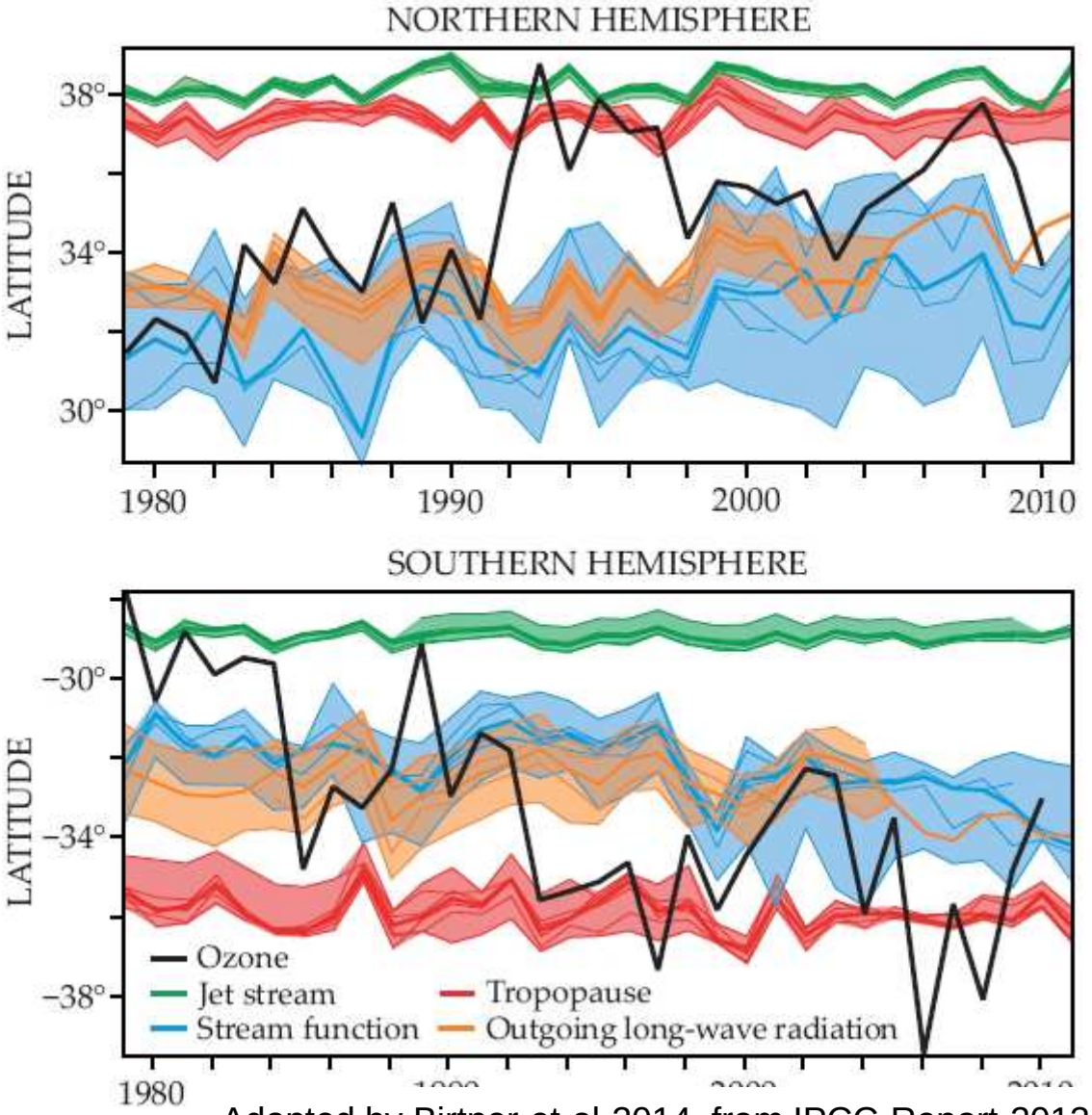
$$TPalm = b0 + b1PC1 + b2PC2 + b3PC3 + b4PC4 + b5PC5 + b6PC6 + b7PC7 + b8PC8 + b9PC9 + b10PC10$$

	bo	b1	b2	b3	b4	b5	b6	b7	b8	b9	b10	
Temp cont.	19,38	-2,54	-1,20	0,70	0,66	-0,16	1,08	0,05	1,38	-0,88	0,39	
PC-trend		-0,14	0,03	0,09	0,05	-0,04	-0,04	0,05	0,12	-0,07	-0,05	
T-trend cont.		0,36	-0,03	0,06	0,03	0,01	-0,05	0,00	0,16	0,06	-0,02	0,58

In the Western Mediterranean and vicinity there is observational evidence of a specially intense warming in the late spring, whith suggests an extension of summer towards spring.

Since the mid-2000's, the idea and some evidences of a supposed expansion of the Hadley Cells or, more in general, of the tropical climatological belt, are gaining ground.

Estimated expansion is 2º lat/decade



Adapted by Birtner-et-al-2014, from IPCC-Report-2013

Although not used in this sense, the 500-GH could provide an alternative or complementary metrics to define the edge of the tropical climatological belt, better than MSLP, for instance, particularly in summer or near summer, when high values of 500-GH are closely associated to warm air, to the tropical warm dome.

The patterns and trends in 500-GH are even better instruments to analyse the expansion of the tropical belt in a limited region and in a limited season.

Our conclusion can be that the intense warming in the Western Mediterranean area and vicinity could be a consequence of a limited expansion of high 500-GH associated to a limited –ridge-shaped- expansion of the tropical climatological area in the zone in MJ.

To the east, at higher latitudes (towards Russia) an analogous phenomenon occurs in JA.


5th International Conference on Meteorology and Climatology of the Mediterranean
Istanbul (Turkey), 2-4 March 2015
MetMed
Thank you for your attention!
AEMet
Agencia Estatal de Meteorología
IMEDEA
Institut Mediterrani d'Estudis Avancats
UIB
Universitat
de les Illes Balears