Spring Colloquium on
‘Regional Weather Predictability and Modeling’
April 11 - 22, 2005

1) Workshop on Design and Use of Regional Weather Prediction Models, April 11 - 19

2) Conference on Current Efforts Toward Advancing the Skill of Regional Weather Prediction. Challenges and Outlook, April 20 - 22

Dynamic tropopause perspective of an Atlantic - Mediterranean Teleconnection Event of November-December 2001

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Conference on Current Efforts Toward Advancing the Skill of Regional Weather Prediction. Challenges and Outlook,
April 20 – 22, Trieste Italy
References


- Considering the time interval
  Nov. 24th at 00z – Dec. 5th 2001

- The period was characterized by
  (a) Intense rainfall in Israel
  (b) Hurricane Olga

- Using the NCEP reanalysis data NNRP
  (Kalnay et al. 1996) and Meteosat-7 images
UNUSUALLY INTENSE RAINS IN ISRAEL
260 mm of rain during about 24 hrs (annual precipitation in the region = ~ 650 mm)

WHY?
Analysis of NNRP data
Precipitable water is the column integrated water vapor

\[ PRWT = \frac{1}{g} \int_{p_1}^{p_2} w \, dp \]
NNRP PRWT

Ave Pr_Water 20E–34E;30N–38N

27.11.01 19.2 cm
01.12.01 17.9 cm
03.12.01 17.4 cm
NNRP
SLP/ WND850 / PRWT
patterns
SLP—wind850—prec water: 12:00 UTC 301101
Conclusion # 1

The PRWT is advected from the region of the Atlantic very far to the north-east. Much further than usual.

Why?
Hurricane Olga

November 24 - Tropical storm;
November 27 – 29 - Hurricane;
November 30 – December 4 – Tropical storm
Hurricane Olga
Circulation in a hurricane
Meteosat – 7
WV imageries
(© Eumetsat 2003)
Intensification of the Iceland Low/Siberian High system
Conclusion #2

Intensification of the Iceland Low/Siberian High system was associated with an inflow of Olga’s wet air masses to the polar region;
Dynamic Tropopause analysis
Ertel:

\[ P = -g(f + \zeta_\theta) \left( \frac{\partial \theta}{\partial p} \right) \approx \frac{(f + \zeta_\theta)}{-(\Delta p / \Delta \theta) / g} \]

*Vorticity times static stability*
Formation and eastward drift of a PV anomaly
Olga’s role in the process
Dynamic Tropopause Maps

The dynamic tropopause is defined as the 1.5 PVU surface

1 PVU = $10^{-6} \text{m}^2\text{s}^{-1}\text{K kg}^{-1}$
Conventional Tropopause maps vs Dynamic Tropopause Maps
Eastward drift of the Olga associated DT disturbance
(b) DT / TT Pressures 00281101
PV Anomaly: Anomalous Winds

Think of each PV anomaly as a cyclonic or anticyclonic vortex.
The PRWT patterns again
(b) DT pressure & precipitable water 00281101
(c) DT pressure & precipitable water 00291101
Summary

The process was triggered by a potent PV anomaly caused by hurricane Olga. Development of a tropopause disturbance took place.

An additional apparently very important process took place over the northern Atlantic where that the low-level environment is warmed, moistened, and destabilized by a persistent southerly flow ahead of the approaching PV anomaly.

Air-mass ascent and a lowering of the DT (also associated with a lowering of the potential temperature) ahead of the PV anomaly contribute to further destabilization.
Summary cont’d

All these effects determined the intensity of the wet and relatively warm Atlantic air-masses into the high-latitudes.

Joint contribution of these two effects lead to intensification of the Iceland Low and Siberian High large scale systems and finally the cyclogenetic process over the eastern Mediterranean region.

Intense weather processes have possibly been observed on the opposite (eastern) side of the Siberian High.
Predictability aspects

Main processes of the event

1) Hurricane Olga;
2) PV anomaly;
3) Coherent dropopause disturbance;
4) Intensification of the Iceland Low/ Siberian High dipole;
5) Mesoscale EM cyclone

Accurate prediction of the item # 2 on November 28 would allow that of the EM torrential rains of December 4.
Predictability aspects

Observations:
Where?
What to measure?
How accurately?

High resolution modeling: Where?
How it should be performed?

Verification: How to verify?