Recent ET/STC/TT near Iberian Peninsula and Canary Islands

ET, Extratropical Transition
STC, SubTropical Cyclogenesis
TT, Tropical Transition

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• **Why are we here?**

In 2005 and 2006, three tropical cyclones, TC, in origin made landfall in Spanish Atlantic areas.

Two of them suffered a reintensification process during its extratropical transition, ET, generating hazardous weather conditions.

**These are the main reasons!!!**
Summary

• 2005-2006 Atlantic hurricane seasons close to Spain: a short review
• Forecasting problems: lessons learned
• Main actions and activities from INM-AEMet
• Conclusions
Recent ET/STC/TT near Iberian Peninsula and Canary Islands

Close-up view of historical tracks of tropical cyclones: 1851-2007, ... but

- A HISTORICAL ANALOG OF 2005 HURRICANE VINCE

BY J. M. VAQUERO, R. GARCÍA-HERRERA, D. WHEELER, M. CHENOWETH, AND C. J. MOCK
The passage of Hurricane Vince as a tropical depression over Spain and Portugal was once thought to be a unique historical event, but documents show that a rare tropical storm similarly struck southwest Spain in October 1842.

Atlantic hurricane season in 2005

Source, NHC
Recent ET/STC/TT near Iberian Peninsula and Canary Islands

Atlantic hurricane season in 2006

Source, NHC
Recent ET/STC/TT near Iberian Peninsula and Canary Islands: Best-track of hurricane Vince

8-11 Oct. 2005

Cut-off low

Vince
“cold convection area”

Source, NHC
Recent ET/STC/TT near Iberian Peninsula and Canary Islands: 
Best-track of Tropical storm Delta

Source, NHC

22-28 Nov. 2005

ET & reintensification
Recent ET/STC/TT near Iberian Peninsula and Canary Islands: Best-track of hurricane Gordon

10-20 Sept. 2006
Category 3

Source, NHC
Some internal activities related to TC and ET

- Updating of tropical training material and bibliography
- Delta case study: numerical simulations
- Enhancing some research and operational activities related to (sub)tropical meteorology
- Cooperation with NHC
- Participation in some tropical conferences and working groups
- Revising INM/AEMet warning system
Problems to resolve in near real time:

- **Uncertainty**, errors, or deviation of NWP models: probabilistic forecasts
- Where are the **main precipitation region** and the **wind maxima zones?**
- **Local factors**: Orographic interactions and local effects!!
ET properties: COMET modules

Source, COMET
Training material and future actions: diagram phases

Source, Florida State University

http://moe.met.fsu.edu/cyclonephase/
Tropical storm DELTA
A surprising case
22-28 Nov 2005

TT → TC → ET
28-29 Nov 2005
Delta and its Extratropical Transition, ET
Ex Delta and reintensification: a new forecasting challenge
Local and orographic effects
## Wind speeds and maximum gusts in Canary Islands from ex-Delta

### Tropical Cyclones:
- **Tropical depression:** wind speed less than 63 km/h
- **Tropical storm:** 63 - 118 km/h
- **Hurricane:** more than 118 km/h

### Table: Wind speeds and maximum gusts in Canary Islands

<table>
<thead>
<tr>
<th>Location</th>
<th>Wind speed</th>
<th>Time (UTC)</th>
<th>Gust speed</th>
<th>Time (UTC)</th>
</tr>
</thead>
<tbody>
<tr>
<td>La Palma</td>
<td>W 98 km/h</td>
<td>20:00</td>
<td>152 km/h</td>
<td>20:00</td>
</tr>
<tr>
<td>El Hierro</td>
<td>NW 83 km/h</td>
<td>18:00</td>
<td>136 km/h</td>
<td>18:20</td>
</tr>
<tr>
<td>La Gomera</td>
<td>SW 80 km/h</td>
<td>18:30</td>
<td>120 km/h</td>
<td>18:48</td>
</tr>
<tr>
<td>Tenerife Sur</td>
<td>W 87 km/h</td>
<td>21:30</td>
<td>134 km/h</td>
<td>21:38</td>
</tr>
<tr>
<td>Tenerife Norte</td>
<td>NW 116 km/h</td>
<td>21:30</td>
<td>147 km/h</td>
<td>21:30</td>
</tr>
<tr>
<td>Gran Canaria</td>
<td>SW 65 km/h</td>
<td>21:00</td>
<td>102 km/h</td>
<td>21:00</td>
</tr>
<tr>
<td>Fuerteventura</td>
<td>SW 74 km/h</td>
<td>22:30</td>
<td>100 km/h</td>
<td>22:30</td>
</tr>
<tr>
<td>Lanzarote</td>
<td>SW 70 km/h</td>
<td>24:00</td>
<td>91 km/h</td>
<td>24:00</td>
</tr>
</tbody>
</table>

Topographically induced wind effects were very important!!
Set of forecast trajectories of NWP models used at NHC, 25 November 2005 run time. Cyclone positions every six hours

Source, NHC (image courtesy Lixion Avila)
Trajectories and forecasting uncertainty from ECMWF EPS model
Delta case

20051126 0 UTC

Probability that DELTA will pass within 120km radius during the next 120 hours
tracks: black=OPER, green=CTRL, blue=EPS numbers: observed positions at t+.h
• Before 2006, TC and ET were not specifically included in the INM-AEMet warning systems

• Currently, TC and ET are considered in the meteorological warning system as a “special warning event”

• But its associated wind, precipitation and sea waves are considered in the Spanish “Meteoalerta” project
Since 2006 coordination between NHC and INM-AEMet forecasting Service (National Forecasting Center) may be established when a TC is approaching to Spain: special warning messages are issued when a TC is close to Spain (distance < 1000 km)

Winds, precipitation and sea waves associated with TC or ET are considered in the Spanish “Meteoalerta” project: Gordon case example
Probability of tracks of ECMWF models: deterministic and EPS

20060920 0 UTC

Probability that GORDON will pass within 120km radius during the next 120 hours
tracks: black=OPER, green=CTRL, blue=EPS numbers: observed positions at t+..h
“BODY” of the message:

- Meteorological phenomena and associated surface-weather conditions (wind, precipitation, waves,...)
- Affected areas
- Forecast period
- Probability of the events
- Synoptic setting: short description
- Next special warning and issue time

This information is issued by National Forecasting Center to:

- INM/AEMet web page
- Media: TV radio, etc.
- Civil Protection Authorities
Current and future activities

• International Workshop about subtropical cyclones and Extropical Transitions to be held in Madrid (8-9 May 2008)

• Increase the cooperation with NHC: training courses, lectures, ..

• To attend technical conferences of WMO AR IV

• Evaluation campaigns
**Conclusions**

- Three Atlantic tropical cyclones in origin, (Delta-05 and Gordon-06) or a similar to tropical one (Vince-05), have recently affected Spain.

- AEMet has enhanced its internal and external activities related to tropical and subtropical meteorology as well as forecasting tasks: technical coordination with NHC.

- AEMet is increasing the relationship and cooperation with the technical committees of WMO RA (Regional Association) IV.

- AEMet is promoting tropical/subtropical meteorology courses, lectures, workshops, etc.

- TC/ET and Spanish Meteoalerta/warning system: AEMet will issue special warning messages when a TC or an ET is taking place near Spain (distance < 1000 km). Surface weather conditions and forecasts are included in our Meteoalerta system.

**Remarks.** Tropical and subtropical meteorology in Spain is not just only associated with TC and ET: Spain is affected by other types of tropical/subtropical disturbances.
Thanks very much for your attention!!