Report on Short Visit Grant within the framework of the ESF Activity "Mediterranean Climate Variability and Predictability"

Short Visit Data

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ESF Activity Data

Unit: LESC
Activity Title: Mediterranean Climate Variability and Predictability
Activity Acronym: MedCLIVAR

Project

Title: The Role of Ex-hurricanes on extreme precipitation events over the Western Mediterranean
Date of Visit: 5.11-16.11 (12 days)

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Host: Prof. Dr. Giorgio Boni
Host Institute: Centro di Ricerca interuniversitario in Monitoraggio Ambientale (CIMA). Universitá degli Studi di Genova e della Basilicata. Via Cadorna 7, 17100 Savona, Italy

1. Purpose of the visit

The purpose of my visit was the continuation of the scientific collaboration with colleagues from CIMA on the identification large-scale meteorological conditions leading to hydrological extreme events over the Western Mediterranean. In particular, we wanted to discuss the recent results obtained by my student (Sven Ulbrich; he is doing part of his diploma thesis in CIMA from July to December 2007) on the clustering of rainfall annual maxima (RAM) based on the CIMA high resolution rainfall database. Further, we focussed on the diagnostic analysis of the synoptic developments associated with the "types of events" identified by the clustering analysis. Finally, a peer-reviewed paper on the recent results was to be prepared.

2. Description of the work carried out during the visit

The collaboration with the colleagues from CIMA (University of Genova) exists since 2000, and focuses on the analysis of extreme precipitation events over Northwest Italy and its large-scale forcing, particularly those cases associated with North Atlantic tropical storms.

Before my arrival, Sven Ulbrich had updated the CIMA RAM database by including additional stations from Vale D'Aosta. The database includes now extreme precipitation events based information on the hourly rain gauge datasets for the Italian regions of Piemonte, Liguria and Vale D'Aosta, ranked as RAM over 1, 3, 6, 12 and 24 hours time windows. The most extreme events from 1948 until 2006 are identified and classified based on hydrological criteria using an hierarchical cluster analysis considering the Ward's distance amongst the clusters. The main criteria is the total number and percentage of stations recording a rainfall annual maxima (RAM) for a certain time window (e.g. 24 hours) for a single event.

As the number of stations of the dataset varies a lot during the almost 60 years of data, ranging from 30 stations to over 300, we first analysed in our far this fact biased the results. The conclusion is that the detection of an extreme event in fact sensitive to the choice and availability of data: an extreme event is more probable in years when more stations are available (sampling problem). However, the intensity and spatial extension of the events of the events may be sampled to a common basis using area averages. Because of this, we performed the clustering based of three typed of data: the complete time series (as a reference), with a reduced number of stations constant for the whole period, and using area averages to compensate the different number of stations per year. The results explained below are based on this latter variant.

Next, we performed the clustering again in order to obtain a basic set of events and then "condensated" events on consecutive days to a single event, assuming that the precipitation was caused by the same large-scale forcing system (at least for autumn events, e.g. November 4th and 5th, 1994). Going from an initial choice of 5 clusters, the strongest events in the database are attributed to two clusters, with a total of 9 events (from 141). This is robust if the number of clusters is changed, e.g. to 8 or 10. A further cluster (#3 of 5 clusters) is also largely dominated by strong autumn events, but is mixed with a few summer convective events with large intensity. If increasing the number of clusters to 8, this third cluster is separated into two, one of which includes then only further extreme autumn events (minus one exception). Most summer/convective events are in one cluster (#5 of 5), which include also a few (typically minor) autumn events – this is also the most "populated" cluster.

Hence, the results of the clustering correspond to expectations, as they produce synoptically interpretable "groups" or "types" of events. When considering 8 clusters, most of the extraordinary autumn events are associated with only 3 rare clusters, which include only a total of 16 events (from 141 on the list). The synoptic differences between these three clusters were preliminarily analysed with help e.g. of weather charts, trajectory backtracing, cyclone tracks, and a few case studies for each were chosen. This part of the investigation is currently still under way.

The persons involved in the work (other than myself) were: Sven Ulbrich (IGMK), Dr. Antonio Parodi, Dr. Roberto Rudari and Prof. Dr. Giorgio Boni (all CIMA).

3. Description of the main results obtained

The recent results show that there are several (statistical different) types of rainfall extreme events over our study area. The extraordinary rain events over Northwest Italy are characterised by a large area of influence, with a large percentage of stations reporting rain annual maxima values at 24-hour basis, and they occur preferentially in autumn. Further, the

clustering permitted to identify that the extraordinary rainfall events associated with large-scale forcing (in particular those associated with ex-hurricanes) are attributed to two/three rare clusters, clearly separated e.g. from the (much more frequent) convective events that affect smaller areas. In conclusion, the extraordinary rainfall events over Northwest Italy events feature not only different synoptic developments, but also different statistical characteristics than ordinary ones. These new results will be the focus of a publication currently in preparation, to be submitted to Journal of Hydrometeorology (cf. #5)

4. Future collaboration with host institution

First, we are preparing two peer-reviewed papers for submission in 2008. Second, we analysed the possibility of submitting projects together: with this aim, the colleagues from CIMA will be in Cologne next month to prepare a proposal for the new calls of FP7 for the Cooperation Work Programme 2008 on Environment (sub-activity 6.1.3. "Natural Hazards").

5. Projected publications/articles resulting or to result from your grant

During my stay in Savona we started the preparation of a manuscript focussing on the clustering of the rainfall annual maxima data and the analysis of the typical associated large scale developments. The tentative title is "Classification and synoptic characterisation of rainfall annual maxima over Northwest Italy". Our aim is to submit it to Journal of Hydrometeorology in early 2008.
A second publication, focussing on the meteorological aspects and on an extensive analysis of the influence of ex-hurricanes to the events in climatological terms (covering 1948-2006), hence classifying them based on the 3 three basic physical interaction mechanisms proposed in Pinto et al. (2001), is planned for the second half of 2008. The support from ESF/MedCLIVAR will be acknowledged in both publications.

6. Other comments

Explanation for the travel costs:

Due to the high costs associated with booking a flight to Genova in a very short term (2 weeks between ESF notice and departure), I opted to book a night train to travel to Savona (Italy, where CIMA is located) from Bielefeld (Germany, where I live). So the trip to Italy was done on the night from November 5th to November 6th (Monday to Tuesday) and the trip back on the night from November 16th to November 17th (Friday to Saturday). The trip was done via Cologne Central Station and Milano Centrale. Total cost of the train tickets is 251,50€ (see receipt).

Date and Signature:

11.12.2007