COST 733 - WG4:

Applications of weather type classifications

Demuzere, M. (WG4 vice-chair), Ustrnul, Z. (chair of WG4), Bardossy, A., Bertalanic, R., Bogucka, M., Cahynova, M., Caian, M. , Casado, M.J. , Fleig, A., Frei, C., Georgescu, F., Godlowska, J., Kassomenos, P., Latinov, L., Pastor, M.A., Pianko-Kluczynska, K., Pongracz, R., Prudhomme, C., Schiemann, R., Sepp, M., Stefan, S., Tallaksen, L., Tomaszewska, A.M.

Introduction

The main objective of the COST Action 733 is to achieve a general numerical method for assessing, comparing and classifying typical weather situations in the European regions. To accomplish this goal, different workgroups are established, each with their specific aims: ***WG1**: Existing methods and applications (finished); **WG2**: Implementation and development of weather types classification methods; **WG3**: Comparison of selected weather types classifications; **WG4**: Testing methods for various applications.*

The main task of Workgroup 4 (WG4) in COST 733 implies the testing of the selected weather type methods for various classifications. In more detail, WG4 focuses on the following topics:• Selection of dedicated applications (using results from WG1),

- Performance of the selected applications using available weather types provided by WG2,
- Intercomparison of the application results as a results of different methods
- Final assessment of the results and uncertainties,
- Presentation and release of results to the other WGs and external interested
- Recommend specifications for a new (common) method WG2

In order to address these specific aims, various applications are selected and WG4 is divided in subgroups accordingly:

1.Air quality
2. Hydrology (& Climatological mapping)
3. Forest fires
4. Climate change and variability
5. Risks and hazards

Simultaneously, the special attention is paid to the several wide topics concerning some other COST Actions such as: phenology (COST725), biometeorology (COST730), agriculture (COST 734) and mesoscale modelling and air pollution (COST728).

Sub-groups are established to find advantages and disadvantages of different classification methods for different applications. Focus is given to data requirements, spatial and temporal scale, domain area, specific methodology etc. This will end up in requirements for a general classification method.

1. Air quality

- All weather type catalogues are used to reconstruct observed time series of O_3 and PM_{10}. The correlation between the observed and reconstructed time series on a daily basis are used as a 'skill'-index for all weather type methods.
- All weather type catalogues are tested in terms of their explained variance in O_3 (JJA) and PM_{10}, SO_2, NO_2 and CO (NDJF) at various urban, suburban and rural cities in Europe.
- The analysis of long-range transport and local pollution of Total Suspended Particles (TSP) in connection with air circulation over central and eastern part of Europe.

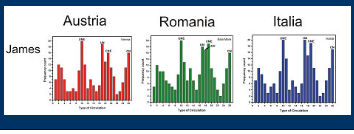

Figure 1: Example of James LWT patterns contributing to local pollution for a measurement sites in Austria, Romania and Italie. Courtesy of S. Stefan.

2. Hydrology

1. **Flood occurrence**
   Data from over 400 European rivers are used to define floods in terms of the peak-over-threshold method. Thereby, links between the derived flood indices and weather types occurrences during and prior (persistence) to the event are investigated.
2. **Hydrological drought**
   Stream flow deficits are used to define time series of hydrological drought in Great Britain and Denmark. Groups of weather types which support drought development are identified and correlations between the occurrence frequencies of these groups and both daily and seasonal drought series are computed
3. **Precipitation mapping**
   Reduced-space optimal interpolation (RSOI) is used for quasi real-time precipitation mapping over Switzerland. The evaluation of maps obtained by (i) RSOI stratified with respect to weather types and (ii) unstratified RSOI shows that the added value due to weather-type information depends strongly on the weather type.

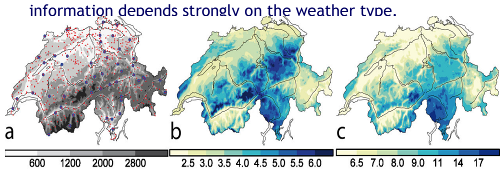

Figure 2: Overview of the study area. Gauges of the sparse network (51 stations; blue circles), the dense network (549 stations; red dots) and height of topography (in m; shading). Long-term mean and standard deviation of daily precipitation (mm per day). Courtesy of R. Schiemann.

3. Forest fires

Applying some of the selected COST weather types catalogues on forest fire event shows that even if we use the short 3-days sequences of the weather types the number of weather types that are associated with wild fires is reduced significantly. From the chosen catalogues SANDRA and PCAXTR it was found that 2 categories, out of 8, account for almost 80-90% of the total wild fires events in Greece. On the other hand the Kirchhofer catalogue is not very successful since wild fire events are almost evenly dispersed among the categories.

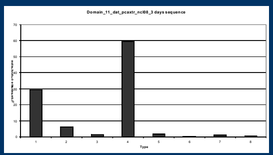

Figure 3: Example of PCAXTR types explaining % of occurence of forest fires over domain 11 (including Greece). Courtesy of P. Kassomenos.

The work proved that the hypothesis of using synoptic classifications to study and possibly predict wild fires events, in a way similar to air pollution episodes and mortality levels, is justifiable, but a lot of work must be done to make it more easily applicable by the authorities in order to protect people and their belongings.

4. Climate change and variability

The main objectives of this subgroup include:

1. Persistence (lifetime) of circulation types over Europe and four specific European domains in 1957–2002.
2. Links between atmospheric circulation classifications and climatic variability and trends in the Czech Republic in 1961–1998, including:
   - ranking of circulation classifications according to their ability to stratify eleven climatic elements into CTs.
   - influence of changes in CTs frequencies on seasonal climatic trends.
3. Relationship between Circulation Types frequencies and teleconnection indices (modes of variability),including the ranking of classifications performing best for discriminating between NAO phases, EA, SCAN and EA/WR.
4. Influence of Circulation Types on precipitation over Spain.

Figure 4: Sensitivity of the standard deviation of precipitation % in domain D09, using PETISCO 9, 18, 27 classes. Courtesy of M.J. Casado & M.A. Pastor.

5. Risks & hazards

1. Atmospheric circulation types favorable for different hazards, especially snow storms and black icing in Bulgaria, are detected and a comparison is done with pure statistical classifications for Domains 00 and 10 obtained by different authors and used in COST-733. The objective is to assess the advantages and disadvantages of the different approaches and to use it in the operational forecasting of these weather hazards.

2. All weather types classifications from the catalogue v1.2 were used with Discriminant Analysis to test the agreement between weather types and measured wind speeds. Accuracy of classification was used as a measure for this agreement. A test was made with daily wind speeds on 14 stations in Slovenia in the period from 1997 to 2001. 58 weather type classifications were tested, all over domains D00, D06, D07 and D10 which cover Slovenia (Figure 5).

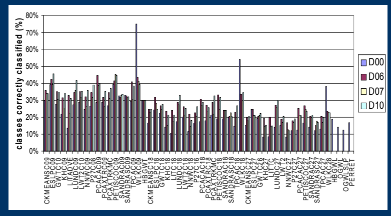

Figure 5: Relation between all COST-733 classification catalogues and wind speeds in Slovenia expressed as the % correctly classified over the Domains 00, 06, 07, 10.

Courtesy of R. Bertalanic.

The best results (around 40 % of data were correctly classified) were achieved by the classifications ESLPC09, PCACA09, PETISCOC09, WLKC09 and WLKC18. Very good classifications with larger number of classes (around 27) were LUNDC27, PETISCOC27 and WLKC28.

More information? Contact:

WG4 – Chair: Zbigniew Ustrnul (*Zbigniew.Ustrnul@imgw.pl*)
WG4 – Vice chair: Matthias Demuzere (*Matthias.demuzere@ees.kuleuven.be*)
Cost 733 Official web page: *http://www.cost733.org*
Cost 733 Chair: Ole Einar Tveito (*ole.einar.tveito@met.no*)
Cost 733 Vice chair: Radan Huth (*huth@ufa.cas.cz*)