ASSESSING THE VALUE OF LOCAL HEAT DISCOMFORT FORECASTS IN LOMBARDIA

BY SURVEYING AND MONITORING END USERS

G. P. Minardi, M. Salvati

ARPA Lombardia, Milano, Italy

OVERVIEW

Since the exceptionally hot summer of 2003 there is increased awareness and attention in the health community on the possibilities offered by heatwave and heat discomfort forecasting. At national level, an epidemiological alert system is operational in Italy since 2005, issuing forecasts for the major urban areas. At local level, during summer 2006 the Regional Weather Service (Servizio Meteorologico Regionale-SMR) of Lombardia issued a daily short range forecast of heat discomfort to local health districts.

In this work we present the strategies adopted to assess the value and utility to the health care system of the issued forecasts, and some results obtained so far. A standard statistical analysis has been carried out to quantify forecast quality. However, in order to estimate forecast value it is necessary to include user issues in the analysis. As a first step, a survey on the whole group of users is underway in order to obtain a first, necessarily qualitative, value assessment. A feasibility study will follow to establish a descriptive decision model by further interaction with a subgroup of procedural decision makers.

1 – LOMBARDIA'S HOT AND HUMID SUMMERS ARE INCREASINGLY VIEWED AS A HEALTH HAZARD

Lombardia is delimited to the north by the southern ranges of the Alps and to south by the northernmost Apennines, with the low-lying, densely urbanized Po plain in between. About 9 million people live there.
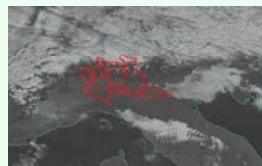
Po valley is characterized by **continental climate, with hot and humid summers and weak winds**. From May to September temperature highs are frequently above 30 °C with relative humidity above 30%.

The national Heat Health Watch Warning System, based on the statistical correlation between specific atmospheric conditions ("heat waves") and the increase of mortality, issues forecast and alerts only for the two main cities of Lombardia, Milano and Brescia.
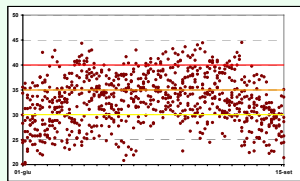
However, atmospheric conditions leading to heat discomfort are widespread and frequent in the area, so **the need for local weather information is felt strongly by the Regional Health Administration,** in order to support health managers in all the provinces not reached by the national alert system.

2 - DURING SUMMER 2006 A DAILY HEAT DISCOMFORT FORECAST WAS ISSUED

A bulletin, called "HUMIDEX" after the index used to evaluate the heat discomfort, was issued daily from June 1st to September 15th 2006.
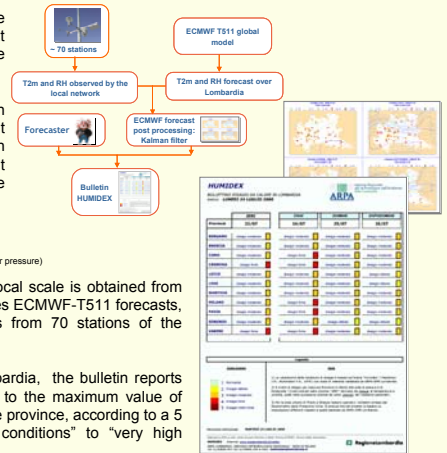
Considered "experimental", the bulletin was not meant for the general public. It was sent to the Local Health Authorities which, in turn, forwarded it to municipalities, hospitals, health care centres, etc.

The humidex index is computed as:

$$H = T + 5/9 \ (e - 10)$$ (where T=temperature, e=vapor pressure)

The prediction of humidex values at local scale is obtained from 2m temperatures and relative humidities ECMWF-T511 forecasts, Kalman-filtered with the observations from 70 stations of the regional network.

For each of the 11 provinces of Lombardia, the bulletin reports the level of discomfort corresponding to the maximum value of humidex measured and forecast on the province, according to a 5 levels scale (ranging from "normal conditions" to "very high discomfort").

3 - THE FORECASTS QUALITY IS MEASURED BY STANDARD VERIFICATION METHODS

Verification was carried out on the forecasts reported on **90 bulletins** (note that the forecasts have not been stratified over provinces, so they are not independent).

The issued forecasts have been verified against the issued analysis, as the aim is to evaluate the information given to users.
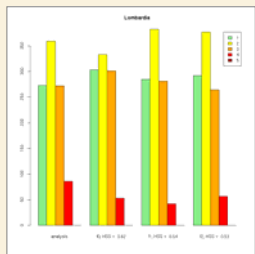
Of the **five discomfort levels**, the highest never occurred nor was forecast. **Level 4 was strongly underforecast**, while the other more numerous levels were slightly overforecast.

Even so, **the forecasting system has good overall scores** (HSS, PSS, ETS).

	Obs 1	Obs 2	Obs 3	Obs 4	Obs 5	Sum fcst
Fcst 1	175	48	1	0	0	224
Fcst 2	31	197	75	2	0	305
Fcst 3	3	48	141	40	0	232
Fcst 4	0	0	13	19	0	42
Fcst 5	0	0	0	0	0	0
Sum obs	209	293	230	71	0	803

PC: 0.67   Hss: 0.54

	1		2		3		4	
B	1.10	B	1.00	B	1.00	B	0.59
POD	0.84	POD	0.67	POD	0.61	POD	0.41
FAR	0.22	FAR	0.35	FAR	0.39	FAR	0.31
F	0.08	F	0.21	F	0.16	F	0.02
ETS	0.58	ETS	0.30	ETS	0.29	ETS	0.31

If **persistence** is used as reference forecast, the forecasting system **does not show marked score improvement**, with skill on ETS mainly below 30%.

Forecasts **gain skill with forecast range** (below 15% for the same day, below 30% for day 1 and 2).

Forecasts have **lower skill on higher levels**, ranging from 15 to 38% on category 1, from 6 to 20% on categories 2 and 3, and none (<5%) on category 4.

Is the forecast information useful at the present level of skill? Does it have any value? Users must be asked!

Data have been analyzed using R, a language and environment for statistical computing and graphics.

4 – AN ONLINE SURVEY HAS BEEN SET UP TO ADDRESS USER ISSUES

About **2000 is the potential survey population** which will be able to answer the online questionnaire.

An **75% (or more!) response rate** is expected, due to the centralized structure of the regional health system and the support of the regional administration.

The survey aims to obtain useful information about:
• **number and main features of the users** of the HUMIDEX bulletins;
• **users view of the service**: delivering time and methods, bulletin layout, etc;
• **how and how often** the users used the bulletin;
• **subjective forecast value**;
• **which users will be available** for future collaboration with SMR for identifying suitable decision models.

Questionnaire structure

Introduction and Respondent info
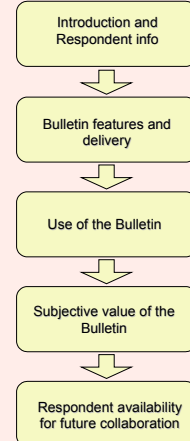
In your Institute, did you use the bulletin HUMIDEX directly (to take decisions or actions) or did you only forward it to others?

Bulletin features and delivery

What is your view of the bulletin HUMIDEX regarding the following features: ease in reading, clearness of content, information completeness?

Use of the Bulletin

Information about heat discomfort given by the bulletin HUMIDEX were used: regularly / occasionally / never

Subjective value of the Bulletin

On a scale from 1 to 5, how do you rate the usefulness of the bulletin HUMIDEX, related to you activity? (1=definitely of no use, 5=very useful)

Respondent availability for future collaboration

Are you available to collaborate with SMR, in the near future, to assess the heat discomfort forecast value for your activity ?

The questionnaire has been designed using **PHPSurveyor,** an open-source web based survey package written in PHP4.
Results from the survey data analysis will be available next spring. Please, look at: www.arpalombardia.it/meteo/humidex

CONCLUSIONS AND FUTURE DEVELOPMENTS

The bulletin "HUMIDEX" was issued during last summer in Lombardia in order to support activities of heat discomfort mitigation. It shows promising characteristics for establishing a good user-oriented verification system: it is "experimental" (that is, it can be easily adjusted), it reports forecasts of a single parameter, it is seasonal, it is directed to a well defined group of users which are both centrally coordinated and likely to possess an implicit or explicit decision model. Results from the quality analysis will hopefully lead to forecast improvement. But results from the online questionnaire survey will allow to assess the present value of the bulletin and to evaluate to what extent quality improvements lead to increased utility.

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- PHPSurveyor, downloadable at http://sourceforge.net/projects/phpsurvey/ , GNU General Public License
- R, downloadable at http://www.r-project.org/ , GNU General Public License

Contacts

Gian Paolo Minardi

ARPA Lombardia – Servisio Meteorologico Regionale

E-mail: g.minardi@arpalombardia.it

Tel: +39 02 69666412

Marta Salvati

ARPA Lombardia – Servizio Meteorologico Regionale

E-mail: m.salvati@arpalombardia.it

Tel: +39 02 69666411