

Protezione Ambientale del Veneto

Meteorological operational services for civil protection

in Veneto region (North-Eastern Italy).

Adriano Barbi, Marco Monai, Franco Zardini

ARPAV - DRST - CMT

Regional Agency for Environmental Prevention and Protection - Land Safety Department – Meteorological Center of Teolo, via Marconi 55, Teolo (PD), Italy, abarbi@arpa.veneto.it

Introduction

- ARPAV is the Regional Agency for Environmental Prevention and Protection of Veneto in Northeastern Italy.
- The Meteorological Centre of Teolo (CMT), belonging to ARPAV, is the operational regional meteorological service in Veneto.
- Since April 2009 the Centre is linked, and supplies meteorological monitoring and forecasting, to the recently constituted Functional Centre of the regional civil protection (CFD Veneto), which operates in the framework of National Civil Protection.
- The Veneto region, due to its topographic configuration including Alpine reliefs, plans and a coast exposed to the Adriatic Sea, is conducive to heavy and long-lasting precipitation events. Also, strong thunderstorm activity with high precipitation rates, hail, wind gusts, and even tornadoes have relatively frequent occurrences



Fig. 1: Veneto region in Europe

The Functional Centre of regional civil protection (CFD Veneto)

- CFD-Veneto is a new regional multidisciplinary structure, in the framework of national network of Functional Centers, that supplies the civil protection system with technical-scientific support.
- Main focus of CFD-Veneto is the management of the environmental emergencies through an effective integration between the forecast activities, the real time conditions and the emergency actions.
- CFD-Veneto evaluates with continuity every day the level of alert for hydrogeologic, hydraulic and, during snow season, avalanches risks, through the following steps:
 - weather forecast (rain, snow, wind and the like) into a Meteorological Bulletin;
 - evaluation of expected risks and effects which such phenomena could cause to the integrity of life, assets, settlements and of the environment as a whole;
 - assessment of the level of criticality on the regional territory into a specific Criticality Bulletin (0 absent, 1 ordinary, 2 moderate, 3 elevate criticality).
- CFD-Veneto in case of moderate or elevate criticality, supports the management of the emergencies through a continuous surveillance service (24h) managed by sector experts who interpret the system data and the forecast models.

Meteorological operational services of ARPAV-CMT for civil protection

• ARPAV-CMT provides every day meteorological monitoring and weather forecasts for the

| se arpav | METEO VENETO |
|--|--|
| Dipartimento per la Sicurezza del Territorio | Lunedì 22 Dicembre 2008 - ore 13 Copertura: regionale - Freguenza: giornaliera - Periodicità : annuale |
| | voluzione generale |
| to a Martedi l'anticicione della Azzorre mantern debolirà e da Giovedì si verificherà l'ingresso d ranno condizioni di variabilità, con possibili moc | il tempo stabile ed in prevalenza soleggiato. Mercoledi l'atta pressione fredde correnti da nord-est; da Natale il clima diverrà molto freddo e ste precipitazioni e limite della neve in calo fino a quote basse. |
| Pomeriggio/sera di | unedì 22 Martedi mattina |
| Ilo sereno o poco nuvoloso in pianura e parzialr Ile zone montane clima ventoso per correnti da ehn in alcune valli, mperature generalmente superiori alla norma, cuni fondovalle. | ente nuveloso in montagna. quadranti settentrionali con effetto n modo più sensibile in quota ed in |
| Martedì 23 | |
| ato del cielo co o parzialmente nuvoloso. ecipitazioni | |

REGIONE DEL VENETO) Centro Funzionale Decentrato



1+1-PLINIUS CONFERENCE OF

MEDITERRANEAN STORMS

regional territory, integrating data from global and limited area models, a multi-sensor network including Meteosat-9 satellite data, two meteorological c-band radars, one x-band radar and a high resolution surface network of automatic weather stations.

- In accordance with specific thresholds for some meteorological phenomena, such as heavy rain, thunderstorm, snowfall, when adverse weather phenomena are expected for the successive 24-72 hours, ARPAV-CMT provides the CFD Veneto a specific warning message with accurate and detailed weather forecasts of meteorological hazards.
- Hydrological CFD service, or Avalanches CFD service in case of severe snowfall events in the mountains, defines the related alert level for several homogenous area covering the region, and reports it into a specific Criticality Bulletin.
- The warning and alert messages are disseminated to the regional authorities via sms, fax, e-mail and published on CFD web site.



Fig. 2: ARPAV-CMT weatherFig. 3: Example of Warningforecast bulletin "Meteo Veneto"Message for adversemeteorological conditionsMessage for adverse

Fig. 4: Example of Criticality bulletin; in evidence the alert levels forecast for the several regional areas.

Long lasting precipitation event of 26th-30th April 2009

During 26th-30th April 2009 period a long lasting precipitation event occurred on the region, with strong and persistent precipitations especially on pre-alpine zone between 27th and 28th and scattered thunderstorms on the plan between 29th and 30th April.

The synoptic in this season is typically favorable to strong and persistent precipitations in the pre-alpine area: a cold upper-level low over Western Europe elongates from Great Britain to Spain, producing a southerly to south-westerly jet over the central-western Mediterranean; at low level this situation brings warm and moist air towards the region with strong orographic effects on southern alpine reliefs.



Over the pre-alpine area of the region, were locally measured totals of 200-300 mm in 2 days, 300-400 mm in 4 days, with maximums of 200-240 mm in 24h

In some areas of the region the thresholds of ordinary to moderate criticality for hydraulic risk (floods) have been caught up, while for hydrogeologic risk (landslips) moderate to elevate thresholds have been exceeded.

Fig. 5: 27th and 28th April '09 precipitation [mm] in the alert areas of Veneto region.

The flood hydrometric levels of some important rivers (with catchment basins > 1000 km^2 , such us Fratta-Gorzone, Bacchiglione and Brenta) reached values among the highest in the last fifteen years. Some high-water bed areas were flooded and the transit on some bridges

Strong convective events of 6th June 2009

Between 5th and 6th June 2009 strong convective events interested the region with heavy thunderstorms, hail and severe wind gusts, especially on 6th June with a probable tornado event in a locality of Treviso province (Riese Pio X Municipality).

The synoptic showed the presence of a huge upper through over WEurope with a SFC-low complex over western/central Europe. On 6th June a relative low was present over NW Italy and rapidly moved eastward causing reinforces of southeasterly surface winds (Scirocco) across the high Adriatic See, warm and moist advection and increasing shear conditions over NItaly.

CFD-Veneto issued on 5th of June a meteo warning message, forecasting elevate probability of scattered strong thunderstorms, with hail and heavy wind gusts. For hydro-geological and hydraulic risks, the subsequent criticality warning message issued from CFD pointed out levels of ordinary criticality, associated to possible negative consequences on the smaller hydrographical net and, locally, to flash floods and debris-flow on the mountains.

During the event severe thunderstorms and heavy rain were monitored; precipitation rates of 30-50 mm in 30' and 40-70 mm in 1h were measured, with large hail and 100-120 Km/h wind gusts; a probable tornado presumably with F2-F3 intensity (Fujita Scale) occurred in Riese Pio X Municipality (Treviso Province), causing severe damages in some buildings, transmission line towers, trees and some people wounded.

in the plain (between Vicenza and Padova Provinces) was forbidden.



Fig. 6: Comparison observed/forecast precipitation on 27th April '09 (histogram) and comparison with threshold (point) for hydraulic criticality in several areas of Veneto region. During this event, the first after the starting of CFD-Veneto, the CFD-Veneto alert procedure worked efficiently and usefully. A first meteo warning message was issued on the 24th of April, forecasting the approach of disturbed weather since the 26th afternoon/evening. In the following days - up to the 28th of April- several updated meteo warnings were issued. Related to these messages, several "criticality warnings" were issued, pointing out a hydro-geological and hydraulic alert level between moderate and high.

During the most intense phase of the event a continuous monitoring service was activated, by the meteorological and the hydrologic surveillance personnel, and a specific hydro-meteo nowcasting bulletin was issued every six hours, with updated data and forecast.



Fig. 7: reflectivity of the CMT radar (PPI 1.5°) 14.00 UTC 6th June 2009 and corresponding vertical cross section positioned close to Comune of Riese PioX in Treviso province (Veneto region)



Fig. 8: Some damages produced by severe thunderstorm (probable tornado F2-F3) registered on 6th June in Comune of Riese PioX, in Treviso province (Veneto region)

In this case and in other similar convective strong events, the CFD-Veneto alert procedure, based mainly on precipitation thresholds for hydro-geologic and hydraulic risks, produced a correct but generic warning but wasn't able to provide local authorities with precise time-spatial forecast of the particular phenomena.

Conclusions

- The analysis highlights the difficulty of an efficient weather forecast for civil defence purposes in a complex situation as ours, where many types of different events are possible.
- Especially cases of rapid convective events with their intense and very localized phenomena are a significant challenge. It is well-known that such events can bring remarkable material damages and serious danger for the people.
- An effective warning system which can handle this type of events is needed, and may feature different procedures and warning methods than for long-lasting precipitation events. The latter are generally more predictable by meteorological models, have slow and more continuous time-spatial evolutions with delayed hydrogeologic and hydraulic impacts (landslides, landslips, floods, etc.). This allows more efficient anticipated warnings, also supported, to some extent, by hydrologic modelling.