ANALYSIS OF THE 18 JULY 2005 TORNADIC SUPERCELL OVER THE LAKE GENEVA REGION

Lionel Peyraud[1], Alessandro M. Hering[2], Christophe Salamin[1], Urs Germann[2]

[1]Federal Office of Meteorology and Climatology, MeteoSwiss, Regional Forecast Office, Geneva, Switzerland, lionel.peyraud@meteoswiss.ch
[2]Federal Office of Meteorology and Climatology, MeteoSwiss, Radar and Satellite Research Group (RASA), Locarno-Monti, Switzerland, alessandro.hering@meteoswiss.ch
(Dated : April 27, 2007)

I. INTRODUCTION

While supercell thunderstorms tend to be most prevalent in North America east of the Rockies over predominantly flat terrain, many other countries around the world experience them as well, albeit on a less frequent basis. Switzerland is no exception. Houze et al., 1993 found based on 8 yrs worth of data that Swiss hailstorms were equally divided between right and left moving storms and that this balance was most likely attributable to the orographic nature of the terrain. Schiesser et al., 1995 studied 82 Swiss mesoscale convective systems (MCSs) over a 5 year period and were able to classify them into general categories of organization, similar to Houze et al. 1990 who examined the mesoscale structure of major springtime rainstorms in Oklahoma.

With regards to tornado production, Dotzek, 2003 has recently found that contrary to Alfred Wegener's 1917 estimate of at least 100 tornadoes per year over the European continent, that the number is closer to 170 based on observations and that the true number is most likely closer to 300 due to significant underreporting. Out of 107 significant tornado events over France reported between 1680-1988, Dessens and Snow, 1993 identified several regions where where tornadic thunderstorms tended to cluster, among which a sector along the Swiss-French border in the Jura mountains considered to be a local tornado alley.

These observations and others, suggest that low-level wind flow modified through channelling by the mountains may provide a locally favourable wind shear environment for tornadogenesis, given the appropriate large-scale dynamics are in place and that sufficient thermodymanic support is available.

II. CASE STUDY

On the afternoon of July 18th 2005, a particularly intense supercell thunderstorm struck the Lake Geneva region. The storm initiated just southwest of Lyon, France and tracked over 300 km towards the northeast before losing its supercell characteristics in the central Alpine foothills around the town of Interlaken. During its 3-hour lifespan, the storm's forward translation averaged 60-80 km/h. At the height of its severity, this supercell was responsible for hail the size of golf balls, wind gusts up to 160 km/h and two confirmed tornadoes. Miraculously, nobody was killed nor seriously injured. However, the material losses were considerable including ravaged vineyards, damage to buildings and vehicles and sections of forests completely destroyed.

III. RESULTS AND CONCLUSIONS

It can be seen through careful examination of forecasted model fields up to 48hrs prior to the event and later through meticulous scrutiny of the observations on the morning of this case that the conditions typically associated with organized severe convection were in place or about to materialize. During the event, various observational platforms such as satellite/radar imagery as well as automated surface stations captured several distinctive signatures typically associated with supercell thunderstorms. Features such as the V-notch, Weak Echo Region (WER), thunderstorm longevity, deviant motion, storm splitting and mesocyclone signatures were all decernable. Less evident, was the probability that tornadoes could ensue from the convection given the meteorological information available and the complex topography within which the storm evolved.

Synoptic conditions leading up to the event were nevertheless well anticipated already a few days ahead of time and severe thunderstorm watches and warnings were issued prior to and as the event unfolded. Forecasters were rather well equipped to handle the event but nowcasting visualization techniques within the office at the time did not allow for a sufficiently fine storm scale analysis in real-time. With the arrival of new satellite/radar visualization software/techniques, the NinJo graphical user interface and additional on-the-job training, it is expected and hoped that forecasters will be able to better anticipate the severe phenomena associated with such storms in the future.

IV. AKNOWLEDGMENTS

The primary author would like to thank Alessandro Hering, Urs Germann and fellow colleagues of MeteoSwiss – Locarno for their aid in obtaining critical satellite and radar information. A warm thanks also goes out to Yannick Barton for his tornado photo and the local authorities in general for their help in obtaining pertinent information on this case.

V. REFERENCES

Bosart, L. F., Seimon, A., LaPenta, K.D., Dickinson, M.J., 2006 : Supercell Tornadogenesis over Complex Terrain: The Great Barrington, Massachusetts, Tornado on 29 May 1995. *Wea. Forecasting*, 21, 897-922.

Collier, C.G., Lilley, R.B.E., 1994: Forecasting thunderstorm initiation in north-west Europe using thermodynamic indices, satellite and radar data. *Met. Apps*., 1, 75-84.

Dessens, J., J. T. Snow, 1993: Comparative description of tornadoes in France and the United States. *Geophys. Monogr*. 79, 427-434.

Dotzek, N., 2003: An updated estimate of tornado occurrence in Europe. *Atmos Res.,* 67-68, 153-161.

Hernandez, E., Cana, L., Diaz, J., Garcia, R., Gimeno, L., 1998 : Mesoscale Convective Complexes over the Western Mediterranean area during 1990-1994. *Meteorol. Atmos. Phys*., 68, 1-12.

Hering, A.M., Germann, U., Boscacci, M., Senesi, S., 2006: Operational thunderstorm nowcasting in the Alpine region using 3D-radar severe weather parameters and lightning data. ERAD 2006 proceedings.

Houze Jr., R.A., Smull, B.F., Dodge, P., 1990: Mesoscale Organization of Springtime Rainstorms in Oklahoma. *Mon. Wea. Rev*., 118, 613-654.

Houze Jr., R.A., Schmid W., Fovell R.G., Schiesser H.H., 1993 : Hailstorms in Switzerland : Left movers, right movers and false hooks. *Mon. Wea. Rev*., 121, 3345-3370.

Huntrieser, H., Schiesser, H.H., Schmid, W., Waldvogel, A., 1997: Comparison of traditional and newly developed thunderstorm indices for Switzerland. *Wea. Forecasting*, 12, 108-125.

Johns, R.H., Doswell III, C.A., 1992: Severe Local Storms Forecasting. *Wea. Forecasting*, 7, 588-611.

Moller, A.R., Doswell III, C.A., Foster, M.P., Woodall, G.R., 1994: The Operational Recognition of Supercell Thunderstorm Environments and Storm Structures. *Wea. Forecasting*, 9, 327-347.

Nielsen-Gammon, J.W., 1995: Detection and interpretation of left moving severe thunderstorms using the WSR-88D- A case-study. *Wea. Forecasting,* 10, 127-140.

Robert, C., Calas, C., 2004: Les tornades de saison froide en France. *La Météorologie*, 44, 28-36.

Schiesser, H.H., Houze Jr., R.A., Huntrieser, H., 1995: The mesoscale structure of severe precipitation systems in Switzerland. *Mon. Wea. Rev*., 123, 2070-2097.

Schmid, W., H.-H. Schiesser, B. Bauer-Messmer, 1997: Supercell storms in Switzerland: Case studies and implications for nowcasting severe winds with Doppler radar. *Meteor. Appl*. 4, 49-67.

Tripoli, G.J., Cotton, W.R., 1986: An intense, quasi-steady thunderstorm over mountainous terrain. Part IV: Three-dimensional numerical simulation. *J. Atmos. Sci*., 43, 894-912.

Wegener, A., 1917: Wind- und Wasserhosen in Europa. Friedrich Vieweg & Sohn, Braunschweig, 301 pp.

Weisman, M.L., Klemp, J.B., 1982: The dependence of numerically simulated convective storms on wind shear and buoyancy. *Mon. Wea. Rev*., 110, 504-520.

Weisman, M.L., Klemp, J.B., 1984: The structure and classification of numerically simulated convective storms in directionally varying wind shears. *Mon. Wea. Rev*., 112, 2479-2498.