A missing flash-flood: a real case which show how the "human side" of the weather forecast process can not be ignored.

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On the 3rd October 2006 a flash flood occurred in the central part of Ticino (Switzerland), on the south slope of the Swiss Alps. The exceptional precipitations developed during the passage of a cold front, linked with the movement of a small low pressure system, which crossed the alpine barrier in the late afternoon. The flash flood caused damages in different valleys, the interruption of communication ways and, unfortunately, the death of a person. The passage of the frontal system was announced since some days by the synoptical analysis and by the numerical weather models as well. Unfortunately no warning was send out by the regional forecaster centre and the civil authorities and the rescue teams were partially taken by surprise.

The post-analysis of the flash flood has given some interesting results about how the decisions were taken in the forecaster's team and about the basis which led to the decision not to send out any warning. It was clearly recognized that in this special case the "human side" of the decision-making process was the critical point. Indeed the forecaster on duty, despite having recognized the dangerous potential of the incoming frontal system, was confronted with clearly opposite model guidance, resulting one from the high-resolution model and the second from the ensemble models. With these contradicting indications, the final decision was strongly influenced by a "short term experience": two weeks before, the same forecaster, was faced with another severe weather situation, and the warning he issued, was a false alarm warning. The result of the analysis of this false alarm warning, applied two weeks later to the new situation, leads direct to the missing warning.

The presentation will focus, after a short description of the weather situation, on the

various phases of the decision-making process in order to show how the "human side" is still an important component in weather forecasting. A component which we should seriously consider, if we want to take full advantage of the technical improvements in the science of meteorology. In the last years a lot of research and development has been done in improving the NWP and in developing new tools for a better and easier visualization of the meteorological data. But in different cases the introduction of these new technological systems in the regular daily forecasting process has been not so easy, because the forecaster were not always enthusiastic to adopt the new tools and models. More, even when the systems were well integrated in the forecaster practice, the improving in the quality of weather forecasting was not always as expected.

We think that a possible explanation can be found in a lack of consideration, during the development and the introduction of the news systems, of what are called by the cognitive sciences "the human factors". A human forecaster, doing any activity in the forecaster's room, interact with the technical systems (software and hardware) and is constantly subjects to external influences (coming from the work environment in a general sense). This interaction is strong influenced by the cognitive processes of the human forecaster that permit to give a sense at the data and lead to the elaboration of a forecast. Despite a lot of research in other fields were people take decisions normally under time pressure or in stress situations (for example fire fighter, police or medical teams, army, ...) it seems that up to now less knowledge has been gained in understanding the cognitive tasks and the nature of expertise in weather forecasting. Questions as: "how do humans use weather information to produce forecasts?" or "what expertise does a forecaster apply to allow him to make the judgment that this would be "a day like no other"? or "how can we avoid that important signals in the model guidance or in the measured data will not be lost by the forecaster among a huge amount of other unimportant details?" are questions which are still waiting for an answer. Giving an answer to these questions is equivalent to try to understand the nature of expertise in assessing weather situations and forecasting their development.

We think that an increasing knowledge of the cognitive processes present in weather forecasting can help to improve the design of new technical tools, to develop more efficient training courses for learning how to use these tools, to reorganize the work of the forecaster's team with the new tools, and - at the end - to improve the quality of the entire weather service.

Despite the development of the last years, numerical models have still some problems in forecasting severe weather events, which usually occur in critical weather situation, not really good described by the conceptual models too. And in an alpine environment, strong influenced by the orography, even high resolution models can propose erroneous forecast. Exactly in these situations we think that an experienced human

forecaster can add an important value to the model guidance. But, as the case study of the 3rd October 2006 demonstrated, the interaction between "human" und "technical" sides of the weather forecast processes need to be better understand.