Answer to Anonymous Referee #1

Inter-annual variations of snow days over Switzerland from 2000-2010 derived from MODIS satellite data

N. Foppa[1] **and G. Seiz**[1]

[1]{Swiss GCOS Office, Federal Office of Meteorology and Climatology MeteoSwiss, Switzerland}

Address: Kraehbuehlstrasse 58, P.O. Box 514, CH-8044 Zurich, Switzerland

Correspondence to: N. Foppa (Nando.Foppa@meteoswiss.ch; Tel. +41 44 256 93 10)

General comment to Anonymous Referees

We are grateful to both of the reviewers who have taken the time to read and assess our manuscript. The constructive suggestions will certainly improve the manuscript.

Answer to Anonymous Referee #1

1. Results. Table 2. By this table the results for the Samedan station look worse than the low land stations. On the contrary the relative errors for Samedan are lower than Basel and Lugano. We suggest a more complete table containing the relative errors.
   Yes, the relative error gives an additional information to the absolute deviation. We updated Table 2 with the relative errors and modified the text accordingly. However, it should be stated, that the relative errors are high for certain years when only very few snow days occur (discussed in Section 4.1).

2. Results. Analysis of monthly SCD. In table 3 the are some months when monitoring is more difficult than other ones: for instance in Samedan in autumn and spring, in Lugano and Basel in autumn, winter and spring for climatologic reasons. On the contrary the summer months in all three stations and the winter months in Samedan present lower errors. In order to take in account for this climatic difference it should be interesting evaluate the Skill Score respect to the “climatological value”: SSclim=1 Sat_error/Climate_error, here Climate_error is the error obtained using the climatological value for each station and each month. Of course this Skill Score can be evaluate for the whole year. We suggest to include this Skill Score in Table 3.

This is an interesting suggestion. We calculated the Climatological Skill Score (SS_{Clim}) following Wilks (2006, p. 280 ff.) for each month and each station based on the Mean Squared Error (MSE). The values are now included in Table 3, discussed in the text and presented here in a condensed form. SSclim is positive when SCD_{MODIS} is better than the climatological estimation based on in situ observations of the snow cover. It is not possible to define this Skill Score SS_{Clim} when the Mean Squared Error MSE is zero (no snow days observed over the 10 years and the climatological value is zero).

a) Basel

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
SS_{clim}	**0.16**	**0.26**	**0.31**	**0.74**	**0.83**	**0.30**	**-0.01**	**0**	**-**	**0**	**-**	**0**

b) Samedan

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
SS_{clim}	**0.20**	**0.70**	**-0.17**	**-5.50**	**0.73**	**0.36**	**0.45**	**-1.45**	**-3.60**	**-5.70**	**-**	**-2.17**

c) Lugano

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
SS_{clim}	**-**	**0.10**	**0.41**	**-0.63**	**0.67**	**0.33**	**-**	**-**	**-**	**-**	**-**	**-**

3. Results. Analysis of daily SCD. Table 4 presents three confusion matrix. The only percentage of correct (Hit Rate: 88.4% for Basel, 88.7% for Samedan and 93.7% for Lugan) could be misleading, and induce the opinion that the performances in the three stations are very similar. The high HR for Lugano and Basel are due to the high cases of snow_free(insitu)/snow_free(satellite). A complete analysis by calculating the Probability of Detection (POD), the False Alarm Rate (FAR) and the Threat Score (TS) shows that POD and TS for Samedan is much higher than Lugano and Basel, while FAR for Samedan is much lower than the other two stations. We suggest a new table showing Hit Rate, FAR, POD and TS for the three stations.

We calculated the proposed skill scores following the definition in Boi (2009) and Zappa (2008) for each site separately over the entire period on a daily basis.

Results are summarized in the following table, which will be included in the revised version of the manuscript (attached here below).

	POD	FAR	HIT	FS
Basel	**0.36**	**0.30**	**0.88**	**0.53**
Samedan	**0.90**	**0.04**	**0.89**	**0.88**
Lugano	**0.54**	**0.16**	**0.94**	**0.49**

However, we prefer to include this table as Table 5 in addition to Table 4. Table 4 presents the number of pixels which show an inconsistency in the gap-filling results (e.g. SCD_{F_snow} and $SCD_{B\_snowfree}$) and is therefore of relevance for the discussion of the gap-filling methodology and helps to better understand the performance of our approach.