Atmos. Meas. Tech. Discuss., 6, C1936–C1940, 2013
www.atmos-meas-tech-discuss.net/6/C1936/2013/

Atmospheric Measurement Techniques Discussions

Interactive comment on "The identification and tracking of volcanic ash using the Meteosat Second Generation (MSG) Spinning Enhanced Visible and Infra-Red Imager (SEVIRI)" *by* A. R. Naeger and S. A. Christopher

Anonymous Referee #1

Received and published: 7 August 2013

General comments

I think the basic ideas presented in this paper are interesting and merit some form of publication. However, I find the claims made are not at all demonstrated by the data presented. The examples appear to be handpicked and there is no discussion of the sensitivity to thresholds, an error analysis, or of "false" detection rates. It is notoriously difficult to objectively analyse features in multi-spectral, multi-temporal satellite data and there has been a long history (∼30 years) of methods developed for cloud

classification and identification. So it is not surprising that this is a difficult task.

In general I like the paper and support many of the ideas presented, but I find the authors claims to be exaggerated and there is a need to be much more objective and careful in analysing these specific cases. Making general claims from one isolated example is not good practice.

Detailed comments

Pg. 5578 Line 7: Re-write as 14 April to 17(?) May, 2010 Line 15: "even at these high latitudes" At this point in the paper it is not clear why "high latitudes" should present a problem? Perhaps, re-write to say even when solar elevation angles are low. Line 25: A better reference needed. These papers pre-date the eruption. How about Gudmundsson et al. (2013), which describes the eruption and ash generation in detail?

Pg. 5579 Line 1/3: I would remove "dense" as this is a qualitative term and could be misunderstood to mean high concentrations. Line 7: The word "deadly" is a bit dramatic for a scientific paper, and also a judgment. The sentence does not convey the correct impression of the hazard. Ash melts in the hot parts of engines causing them to stall. It is also not really clear whether the sharp-edges matter – if the stuff melts (or more accurately the glassy material undergoes a phase transition) then why should shape matter? Line 26: I think it is often correct that ash cannot be detected below clouds but this does depend on the opacity of the overlying cloud. A safer (less contestable) way to state this is to add the word "thick" between "below" and "clouds".

Pg.5580 Line 3: "examine". Line 15: Include the reference to Prata and Prata (2012) who explicitly use aircraft data to compare with SEVIRI retrievals. Line 24: Yes, and also due to changes in satellite and viewing conditions as well as instrumental effects (gain changes, noise increases etc.)

Pg. 5586 Line 3-5: Presumably when a volcanic cloud is developing there may be quite large temporal variations from pixel-to-pixel because of cloud development, reflectance

and temperature changes. If this is discussed later, ignore this comment here. Line 7: I suppose a land/sea mask is used but it is not stated here. (I see it is stated later). Line 24: Actually every 5 mins over Europe. Line 10 onwards: This is an interesting approach. I would think that the minimum 0.6 μm reflectance is quite a well-behaved parameter and could even be modeled quite well.

Pg.5588 Line 21 onwards: It is not always the case that ash appears less bright than meteorological cloud. Also, "mixing" within the large SEVIRI field of view will, in general produce a continuous distribution of reflectances. Line 13: Surely the correct reference here is Prata (1989) who showed the effect theoretically and called it "reverse" absorption. Line 17: Shouldn't this test be applied in a time-dependent manner? Actually, it hasn't (yet) been stated what the time validity of this approach is. For example, north of 67 degrees N from September to March there is no daylight and so maybe no "daytime". Line 23: I realize that it can be quite difficult to be quantitative concerning ash amounts, but for readers with little experience of this, the terms "thin", "moderate" and "thick" are not very helpful. Perhaps, the authors can decide themselves what they mean by these terms? For example, they could just say they refer to "thin" ash as ash with an AOD<0.1 (or whatever) and thick ash as AOD>1.0 (or whatever). It is accepted that mass loadings below 0.2 g m-2 are generally undetectable by the IR technique and are also below the safe limit for aviation, so this could be labeled as "thin" ash.

Pg. 5590 Line 1-2: Be careful not to rely on just one example. There are many ash clouds that appear as bright or brighter than meteorological clouds. Line 7: This test must certainly be incorrect in some circumstances. When a volcanic eruption column is developing, the cloud top temperature is quite closely related to its height. In fact considerable undercooling is often observed for vigorous eruptions. So temperatures less than 240 K may still represent very opaque ash clouds. Line 18 onwards: SO2 absorbs at 8.7 μm and so does ash. How do these effects influence this test?

Section 3.5 I am a little surprised that there is not some discussion of time of day. All of the tests that rely on temporal information also involve a change in solar conditions.

Near the terminator this should be especially serious. I think some kind of statement here about the time validity of the scheme should be stated. It also seems clear that the tests could easily have a pixel dependent behaviour – since from a geostationary platform every pixel is fixed.

Pg. 5595 Line 19: This sentence is unnecessary, as desert dust is not being discussed. In the interests of "keeping it brief" I suggest remove this. Line 23: Again I think the Gudmundsson et al. (2013) is a better reference here.

Pg. 5596 Line 15 onwards: The discussion here concerning ash identification over Germany using SEVIRI on 19 April is very unconvincing. By this time most of the ash had already been transported south of Germany and any ash now over Europe was of very low concentration and was most likely recirculated and not "fresh ash" from the volcano. There is no evidence in satellite data or from modeling runs that fresh ash was arriving over Germany on 19 April. Fig. 4c, which I assume the authors are referring to, shows orange colours in many places over Europe including large parts of Germany, all along the south coast of Norway, along the southern coast of France and in the Channel, Bay of Biscay and further westwards. It is not sensible to pick out a coincidence of ash identification with an aircraft measurement without also understanding what all the other identifications are. Are these real? It needs also to be made clear what the authors mean by "moderate" ash. My view is that this ash was very low concentration (less than 0.2 g m-2) and posed no threat to aviation at all. No only was it not detected by the conventional scheme but it was recirculated ash at low altitudes (likely) and had been airborne since initial emission 3-4 days before. The Caliop data curtain is also unconvincing. The aerosol subtype (not shown in the paper but available on-line) is classed as "not applicable" or as "smoke" just below 44 °N, but south of 44 °N there is also aerosol identified between 19–24 °N (over the desert), the aerosol subtype is classed as dust. Thus it could equally be hypothesized that the aerosol detection is for dust, smoke or more generally haze. This is a very important aspect because if this new algorithm is accurate, then it identifies more ash

than conventional algorithms and has significant repercussions for aviation warnings.

Pg. 5598 Section 4.2 The discussion of the results shown in Figure 5 is rather unclear. The large orange areas identified by the temporal aspect of the algorithm are unverified but the authors claim these to be ash. The papers by Francis et al. (2012) and Prata and Prata (2012) analysed this event and used FAAM data. They show that there was little or no ash where the authors claim their algorithm detects ash. The aircraft transects through this ash cloud show a definite gradient across the main cloud (identified in Fig. 5 with a different colour – actually Fig. 5d matches other findings better). Also, by animating sequences of SEVIRI ash retrievals it is possible to see the origin and movement of the cloud, making this broader feature less likely to be real. One possibility is that by using the temporal aspect of the data there will inevitably be some smoothing which will tend to make the detected areas look larger than they really are. The Figures should really be labeled as a time period rather than an instant in time.

Extra references

Francis, P. N., Michael C. Cooke,1 and Roger W. Saunders, JOURNAL OF GEOPHYSICAL RESEARCH, VOL. 117, D00U09, doi:10.1029/2011JD016788, 2012.

Gudmundsson, M. T., et al., SCIENTIFIC REPORTS, 2 : 572, DOI: 10.1038/srep00572 1, 2013. (www.nature.com/scientificreports).

Prata, A. J. and A. T. Prata, JOURNAL OF GEOPHYSICAL RESEARCH, VOL. 117, D00U23, doi:10.1029/2011JD016800, 2012.

Interactive comment on Atmos. Meas. Tech. Discuss., 6, 5577, 2013.