

RADAGAST Daily Log

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These brief notes accompany the daily plots of the Radagast data on our website.

Details of the DABEX flights in January and February may be found on the FAAM webpages (<http://www.faam.ac.uk/>).

January 2006

- 1 Clear. Several dust layers.
- 2 Clear. Several dust layers. Some high cloud in the evening.
- 3 Mainly clear, but some high cloud
- 4 Some high cloud.
- 5 Some high cloud.
- 6 Some high cloud. Evidence of multiple aerosol layers again.
- 7 Thicker high cloud around noon, also visible on the GERB 1200 image.
- 8 The impact of the high cloud on the longwave fluxes is very obvious, showing how dry the atmosphere is above the site.
- 9 Thicker aerosol and some medium level cloud forming at the top of the highest layer.
- 10 Large impact of medium level cloud on longwave fluxes around 0400-0600.
- 11 Clearer, but still some thin high level cloud.
- 12 Similar to 11th.
- 13 More high level cloud. Upper aerosol layer quite thick.
First DABEX flight (B156), South to biomass aerosol. Slingo arrives in Niamey.
- 14 Interesting structure in the high cloud.
- 15 Cloud thinning. Looks like a gain change in the MPL data?
- 16 Clear, with aerosol of course.
DABEX Flight B157, South-East towards Ilorin (included Slingo). Many of these flights include overpasses and orbits over the main AMF site and Banizoumbou. As a result, there will be many opportunities for coordinated analysis of the observations.
- 17 Curious very thin mid-level cloud above the highest aerosol layer.
DABEX Flight B158; another biomass flight to the South-East.
- 18 Large temporal changes in the aerosol layers. Note that the aircraft data clearly show that the lowest layer is dust and that the upper layers are biomass aerosol. Variable and quite small amounts of mixing between the two types of aerosol, at least in the vicinity of Niamey at this time.
- 19 Aerosol thicker at lower levels. Intermittent medium level cloud.
DABEX Flight B159. Sampling both dust and biomass aerosol. "Golden day"; flight coincides with overpasses by MODIS, etc. See FAAM website for details.
- 20 Variable aerosol again and small amounts of cloud.
- 21 Similar to 20th.
DABEX Flight B160. First dedicated dust flight to North-East (included Slingo).
- 22 Good aerosol day with minimum cloud.

- 23 As 22nd.
DABEX Flight B161. Very successful dust flight to NE. Heavy dust at low levels.
- 24 Mainly clear with aerosol. Some cloud around midday.
DABEX Flight B162. Biomass flight SE to Ilorin.
- 25 Aerosol thinning. Thicker high cloud in afternoon; big impact on fluxes.
- 26 Multiple aerosol layers and some high cloud.
DABEX Flight B163. Local flights over Niamey, coordinated with the French ULA (microlight), carrying a lidar. The BAe146 underflew the ULA! They also ran their lidar from the surface on the previous two days, next to the AMF. Spectacular detail in the aerosol, including what looked like density currents carrying in dust near midnight.
- 27 High cloud and medium level cloud later in day.
- 28 Medium and lower level cloud. Big impact on fluxes.
DABEX Flight B164. Over airfield.
- 29 Lots of medium level cloud, with impressive impact on MPL and fluxes.
- 30 Cloud thinning. Multiple aerosol layers.
DABEX Flight B165; another flight towards the NE.
- 31 Broken high cloud. Big dust storm well to the N over Algeria and Libya. Some aerosol coming South. Could be a good one to look for the OLR signature in the GERB data, although probably not over Niamey itself.

February 2006

- 1 Good clear day with aerosol.
DABEX Flight B 166. Went SE to biomass. Dust storm has moved East. Backing up on North side of Tibesti. Some dust coming S over Niamey. Check ARM data later.
- 2 Another good clear day with aerosol.
DABEX Flight B 167. Local flight over Niamey.
- 3 Some high cloud in daytime.
End of DABEX; transit to Dakar, Flight B 168. Dust event coming off the Bodele (green blob on GERB/ARCH at 1200).
- 4 Mainly clear, with thinner aerosol.
- 5 Clear, with thin aerosol.
- 6 Another clear day. gain change in MPL.
- 7 Clear; small amount of high cloud later.
- 8 Another aerosol day.
Two dust storms; over Bodele and South edge of Massif de l'Air (this would have been well within aircraft range, but it looks like it is curving away to the N of Niamey).
- 9 High cloud has come in. If anything, less dust. Another Bodele dust storm.
It looks like the MJO is coming through; extensive and organised high cloud.
- 10 Lots of high cloud. Often seems to be at two preferred heights, around 9 and 15km or so. The aerosol appears thinner, or at least fewer layers. Smaller biomass contribution?
- 11 Some high cloud. Aerosol now in two quite separate layers.
- 12 Similar to 11th. GERB has been having some problems switching scan modes.
- 13 Lower aerosol layer (dust?) is thicker.

- 14 Thin high cloud, but mainly clear.
- 15 More dust coming off Bodele. Another case with very thin middle-level cloud (in the early hours), followed by broken high and middle-level cloud. Rather well seen in the dust imagery, which colours these cloud layers differently. Impressive structure in the dust seen by the MPL.
- 16 Strange behaviour in the MPL data just before dawn. Meteosat dust imagery shows a dust outbreak coming down from the North.
- 17 Email from Ben Mohamed reporting that the dust outbreak has reached Ougadougou, where the visibility is down to about 300m. But it appears to have missed Niamey.
- 18 More unusual plots from the MPL and SKYRADS. Lots of cloud signatures, but the background “clear” (or aerosol-laden) longwave fluxes look strange. But the sondes do show that there are changes going on. Need to go back and try to make sense of these few days. The MWR shows that the thin middle level cloud is at the freezing level.
- 19 Back to normal; mainly clear, with aerosol.
- 20 Mainly clear, with aerosol. Some high cloud and thin middle-level cloud later.
- 21 Mainly clear, with aerosol. Some high cloud early on.
- 22 Big dust storms over Algeria and Sudan. Will they make it down to Niamey?
- 23 Despite much anticipation, the bulk of the dust didn’t reach Niamey, although the feature at low levels in the MPL plot after noon coincides with a blob in the Meteosat dust imagery. There has been clear evidence over the past couple of days from several instruments of very dry air coming in from the North (e.g. MWR and sondes).
- 24 Small amounts of cloud
- 25 Clear with some aerosol. Low diffuse flux. Air extremely dry; longwave down is low.
- 26 Mainly clear with some aerosol.
- 27 Mainly clear with some aerosol.
- 28 The month finishes with high cloud and aerosol (not so high by now).

March 2006

- 1 Aerosol and some high cloud. Big dust storm over Sudan, starting near the Red Sea and propagating to the South, but presumably too far away to get to Niamey.
- 2 Some quite thick medium level cloud moving up into the sub-tropical jet (check out the Meteosat images). The Sudan dust storm is impressive; it clearly skirts round to the West of the Ethiopian highlands, moving into the upper basin of the White Nile.
- 3 Mainly clear, with aerosol. Note that some GERB data are missing for a few days.
- 4 Mainly clear, with aerosol, high cloud later in day.
- 5 Similar. A major dust storm is starting over Northern Algeria.
- 6 Similar, but this is the lull before the storm, which is advancing to the south. At this point, it looks no more likely to reach Niamey than earlier dust storms. However;
- 7 The dust storm seems to intensify across the whole of the western Sahara and hits Niamey at around 0900. The MPL data clearly show the dust coming in at low levels around then. Large impact on the fluxes (GERB, too), although we will have to be careful as the Meteosat imagery shows high cloud from about 1600 onwards.
- 8 The dust dominates all the measurements. Note that there is some high cloud in the satellite data, but the MPL signal is attenuated by the aerosol.
- 9 The dust appears to be thinning near the end of the day, but the impact on the data is

- still very impressive.
- 10 Further thinning, but the diffuse solar and downwelling thermal fluxes still show significant signals.
 - 11 Beginning to see high cloud again on all the fluxes as the dust thins further.
 - 12 Things are returning towards the pre-dust episode values, but diffuse solar is still high.
 - 13 Two aerosol layers visible. Some high cloud, also the thin medium level cloud returns.
 - 14 The medium level cloud, although thin, has a big influence on the downwelling thermal early in the day. Atmosphere is still strongly layered and the 05 sonde picks out where the aerosol is trapped below inversions and the location of the cloud at about 530hPa.
 - 15 Multiple aerosol layers and medium level cloud layers.
 - 16 Things settle down a bit. Lots of thin high cloud. Aerosol appears to thicken around 1500 LT.
 - 17 Multiple aerosol layers and thin high cloud.
 - 18 Very thin cloud forming at around 5km. These layers usually show up on the sondes.
 - 19 The thin cloud has a big impact on the downwelling thermal fluxes overnight.
 - 20 More thin cloud layers, this time at different levels, with cirrus above. First day of data from the cloud radar (“WACR”).
 - 21 Similar to yesterday.
 - 22 Medium level cloud has greater vertical extent; perhaps a sign of things to come.
 - 23 Small amounts of high and medium level cloud, plus aerosol.
 - 24 Less cloud, but the aerosol loading must be significant as diffuse flux is not that small.
 - 25 Rather more high cloud than yesterday.
 - 26 Dust product shows quite a lot of dust in the area and this is confirmed by the diffuse flux, which is quite high, despite there being very little cloud.
 - 27 More high cloud.
 - 28 Less high cloud and aerosol loadings still seem to be significant. Dust event coming west from the Bodele, extending in a big arc.
 - 29 The AMF sees the solar eclipse, which is very nearly total at Niamey, but not quite.
 - 30 Another significant dust event seen from the surface, but there is a lot of high cloud, which can be seen on the satellite data and even on the fluxes, but the MPL is saturated by the dust. The sequence of dust images over the past couple of days suggests that this dust may have come from the Bodele, as opposed to from the north, so the NOAA data at the AMF may be interesting to look at.
 - 31 Still lots of aerosol, but also middle and high cloud.

April 2006

- 1 Multiple aerosol and cloud layers.
- 2 Lots of middle level cloud. If anything, the aerosol looks thicker by the end of the day.
- 3 Somewhat less cloud; the system to the north-west is moving away.
- 4 Much clearer, especially to the north of Niamey in the GERB data. Diffuse fluxes at Niamey are high, which suggests that the aerosol loading is still significant.
- 5 High cloud is still being blown off the convection to the SW and advecting over Niamey as it gets entrained into the sub-tropical south-westerly flow at upper levels.
- 6 Direct solar is bigger than total. Why?

7 Aerosol with small amounts of cloud.
8 As yesterday, but the AMF data suggest that the aerosol is much thicker today.
9 Virtually no cloud today, but notice the direct solar fluxes again at the end of the day.
10 Very small amounts of high cloud, which unusually are moving from the north. In fact, the Meteosat data show northerly flow across the whole of West Africa, with the convection retreating to the coast.
11 Very few clouds. Lots of aerosol, as shown by the Meteosat dust product and the AMF data. Dust all over the region and a dust storm coming off the Bodele and, unusually, to the south coming straight over Lake Chad.
12 There are dust events pretty well every day. The air is very dry (e.g. the mwrlos plot for 10 April).
13 Clear again, but dusty.
14 Still clear, but a wide dust front is coming south across the central Sahara.
15 Cloud is building as the dust approaches, with several elegant plumes behind over the Sahara to the north and east.
16 Quite a bit of high cloud, plus various aerosol events.
17 A notable dust event in Niamey is seen by the MPL, but as a result this misses the much larger amounts of high cloud, evident on the satellite and dust product images.
18 Aerosol loadings are still high and it appears to be coming from the east, but some of the high cloud is just visible by the MPL as the dust clears.
19 There is still plenty of aerosol, but cloud continues to build as the MJO comes across from South America and the convection gets going right across West Africa.
20 Extensive convection to the south, but Niamey remains at the interface between aerosol coming from the north and east and cirrus from the south and west.
21 Similar to yesterday, but a little less cloud and aerosol.
22 Scattered cloud and less aerosol. The dust product clearly has difficulty distinguishing dust when the humidity is higher, hence the blue shades to the south, but this has the advantage of illustrating the slow but steady northward progress of the monsoon air.
23 Mainly clear at Niamey until later in the day, but there is lots of middle level cloud feeding up into the trough to the north-west.
24 Middle and high level cloud is encroaching from the upper-level trough that is progressing across the Sahara, linked to the convection over the coast to the south west of Niamey. Some very thin middle-level cloud layers, as earlier in the year.
25 Things are complicated at the moment, with strong convection to the south, which seems to be producing dust storms on its own, and middle and high cloud over Niamey.
26 Complicated middle and high cloud layers oriented SW to NE over West Africa.
27 Cloud layers dissipating as main system moves away over North Africa.
28 Clearer conditions. Strong lidar returns from middle level cloud; big thermal signatures.
29 Relatively clear over Niamey (certainly in comparison with recent meteorology).
30 Some thin and middle level cloud. The last week or so looks like it won't produce well-defined test cases, although this looks like typical meteorology and should be treated seriously. Total column moisture is half what it was a week ago (2cm cf 4cm), but importantly is still much higher than at the height of the dry season; the monsoon is approaching relentlessly.

May 2006

- 1 Complicated high cloud layers over the region.
- 2 Quite clear over Niamey, but big convective system over Nigeria to the south.
- 3 Convection less organised, but plenty of high cloud around Niamey.
- 4 Mainly clear; dust blowing off Bodele and nearby desert.
- 5 Convection to the South throws up bands of high cloud over Niamey as it dissipates.
- 6 Much clearer. Isolated middle level cloud event in early morning.
- 7 Organised convection to the South throws cloud bands over Niamey.
- 8 Still lots of cloud. The MPL plots continue to show tremendous structure.
- 9 Similar.
- 10 Niamey affected by high cloud from huge convective system to the South.
- 11 High cloud bands over Niamey, but the most impressive aspect of the SEVIRI data is the dust storm over central Sahara.
- 12 Mainly clear; definite structure in the aerosol layer around 3km.
- 13 The unusual behaviour in the early hours, seen both by the MPL and the SKYRADs, is also seen very clearly by the radar. It appears to be the first rain of the season (as shown by the precipitation diagnostic in the "nimmet" datastream. Some evidence that the aerosol decreases afterwards.
- 14 More complicated structure and thin cloud layers. Another rain event after sunset.
- 15 Early cloud but then quite clear. Although convection continues to build to the South, it's fairly quiet at the moment. Still lots of aerosol around; it will be interesting to see what happens to the aerosol when substantial amounts of rain occur.
- 16 Scattered high and medium cloud from the convection to the South. Interesting that the longwave effect of the cloud at the surface is still significant, despite much higher water vapour loadings now than at the height of the dry season (3-4cm compared with <1cm).
- 17 I am now using Gary's excellent browse product animations on the Radagast website to look at the evolution of the daily SEVIRI data. For today, these clearly show deep convection close to Niamey, although the MPL shows that the cloud base is still high. No obvious sign of precipitation in the AMF data, however.
- 18 Lots more convective cloud and lower cloud base. No precipitation measured, although the MPL perhaps suggests something just after 0600. The cloud radar ("nimwacr") is starting to show some pretty cloud structure, particularly in the copolarization mode (and definite suggestions of precip, too).
- 19 I have decided to add the copolar radar plots as these give better information on the thicker monsoon clouds now present. The plots are on a second page and line up with the lidar plot on the first page, allowing comparisons. Fall streaks and rain events are now clearly visible. The MPL is rapidly reverting to being a cloud base recorder, which in fairness is the main role described in the ARM documentation, although until now it has been invaluable in showing the aerosol and thin cirrus layers.
- 20 Lots of precipitation on the radar, although the met data only shows that early on.
- 21 Rain event in the early hours. It's also getting darker under these clouds.
- 22 Cloud early and late, but the clear period in the middle of the day to after sunset could provide some useful clear-sky data, and of course the column water vapour is now much larger than a few months ago.
- 23 Thin high cloud throughout the day, from large convective systems to the South.

- 24 Lots of cloud from several systems, clearly seen in Gary's SEVIRI animations (which now allow you to animate all the individual SEVIRI bands, as well as the dust product). Data are missing from the cloud radar.
- 25 Convective systems are throwing up dust storms all over the region as the gust fronts propagate outwards. Two of these collide early in the day to the North of Niamey. The dust is visible in the MPL plot. The effect of the cloud on radiative fluxes is also large.
- 26 Extensive cloud cover dissipates through the day, revealing the dust.
- 27 Middle level cloud is left early on, but then it becomes mainly cloud-free.
- 28 Convection blows up late in the day and there is some precipitation at about 1600 and 2000. This can also be seen on the radar and it produces spikes on the downwelling thermal fluxes.
- 29 Cloud is dissipating but then there is a significant precipitation event at about 1700 from quite a small isolated cloud system.
- 30 Convective systems come over from the East. Quite weak and not large-scale.
- 31 Convection is quite weak in the region again.
- Are we beginning to see a typically continental pattern in the diurnal cycle of convection?

June 2006

- 1 Small convective storm just happens to come right over the site late in the day.
- 2 Convection is getting stronger over West Africa and one cell in a system comes over the site late in the day. Small dust storm to the North, but it looks like it will miss Niamey to the West.
- 3 All the convective action is to the South today. Even the dust storm avoids the site.
- 4 Scattered high cloud throughout the day. Quite a lot of dust throughout the region, although the main plumes are over in Mali at the moment.
- 5 Rain around 0300, but Niamey is on the edge of the main convection, which is kicking up dust from the gust fronts to the North. Significant amounts of dust are also coming South across much of the central Sahara.
- 6 Convection dies down; relatively clear today.
- 7 Niamey catches some rain early and late in the day. The convection is very variable; a seemingly innocuous storm that passed South of Niamey yesterday grew into a huge complex as it tracked West towards the Atlantic.
- 8 Middle level cloud much of the day, then convection blows up in the evening, giving some precipitation.
- 9 Lots of cloud with aerosol mixed in. Complex cloud system comes across before noon. The radar says it rained, but the met doesn't show anything.
- 10 Little cloud, but the dust imagery shows extensive aerosol with a peak around 0600. Looks like the lidar was off before this but it shows it afterwards.
- 11 Strong aerosol signals showing up on the dust imagery and the lidar, before broken middle level cloud comes in. Another complicated day.
- 12 Cloud clearing through the day, revealing a great deal of aerosol in the dust imagery and in the AMF plots.
- 13 Very little cloud but a lot of aerosol. Looks like an excellent candidate for another aerosol study day.
- 14 Deep convective cloud in the region but plenty of clear periods and lots of aerosol.

- 15 Strong convection to South leaves dissipating high and medium cloud throughout day.
- 16 Lots of middle level cloud but the lidar also shows several aerosol events.
- 17 There are aerosol plumes all over the southern Sahara and also over Niamey. A severe storm comes over the site late in the evening, causing significant damage (as documented on the System Event Log). There will inevitably be some data loss.
- 18 The offending storm moves off to the south-west, leaving dust and scattered clouds.
- 19 Mostly clear, with scattered cloud and lots of dust.
- 20 Scattered cloud again at about 5km or so, with aerosol beneath.
- 21 Mid-level cloud gives way to mainly clear skies, with convection blowing up late on.
- 22 Mainly clear in the daytime, again.
- 23 Niamey catches the edge of some convection in the afternoon and evening, which shows up well on both the MPL and radar.
- 24 Dissipating convection and scattered cloud over the region.
- 25 A small storm kicks up some dust which comes through in the morning, leading to a rather complicated looking MPL plot. Rear end of a convective anvil appears late evening.
- 26 That dissipating anvil is clearly visible on the MPL and radar plots in the early hours.
- 27 Mainly clear with only broken cloud most of the day, but convection comes over the site late on, with some precipitation starting at midnight..
- 28 The convection moves away quickly, leaving mainly clear conditions. Another example of a day with convection building late on and dissipating in the early hours of the next morning.
- 29 Mainly clear, but convection blows up close to Niamey late in the day, again. Dust storm careers down towards the south-east, but is well to the north of Niamey.
- 30 Convection over Niamey in the morning, as seen in the dust animation and very obvious on the MPL and fluxes, but curiously absent on the radar co-polar. Strange.

July 2006

A lot of the GERB Niamey plots are missing from here on, but we will resurrect them later.

- 1 Scattered mid and high level cloud. Convective system at very end of day.
- 2 The system comes over Niamey in the early hours and is followed, as before, with partly cloudy skies and the rise of other systems at the end of the day (on this occasion, in the region, but not over Niamey).
- 3 Weaker convection over Niamey today.
- 4 Another relatively clear day, with only scattered clouds over the AMF, but a big system appears at the end of the day.
- 5 Convective system comes right over the site, producing rain just after midnight and a pretty radar picture today. Broken high cloud thereafter. A lot of dust has been blowing up recently in the lea (West) of the Air massif and to the North. Today's dust animation is particularly impressive.
- 6 Lots of broken cloud and another large convective system arrives just before midnight.
- 7 Convective system produces rain after midnight, taking several hours to clear, leaving extensive middle level cloud (which might provide a cloudy case study, as it is rather more homogeneous than on previous occasions).
- 8 A lot less cloud. Seems to be a two-day periodicity at the moment. Interesting.

- 9 Convection comes over in the morning this time. Pretty radar image. Dust fronts kicked off to the North over Mali, heading Northwards.
- 10 Consistent with the apparent two-day periodicity, convection starts up over the area in the late afternoon but then dies out. Must be something dynamical going on.
- 11 Broken cloud during day, with convection and rain in evening.
- 12 Broken cloud at various levels all day.
- 13 Similar to yesterday.
- 14 Convective event around sunrise. Radar seems to have been off.
- 15 Convection to South throws up a cell over Niamey that evolves through the day. Pretty lidar plot and radar, but radar missing before about 1000 unfortunately. Disk problem reported on 17th; perhaps it was happening here as well.
- 16 Fairly clear; only broken cloud. Lidar does a blip around 0600 but nothing on radar.
- 17 Convection comes through early morning but radar data missing (see log and above). Lidar missing after about 1800. BAe146 transits to Niamey for AMMA. We will need to do a cross-check with the AMMA flight logs to see whether any of the aircraft data will help in the analysis.
- 18 Lidar comes back about 0700. Broken cloud today. Fairly clear in afternoon?
- 19 Convection and rain in morning, clearing through rest of day. Lidar and radar drop out later on.
- 20 Pretty messy. Niamey gets the edge of a system later on in day.
- 21 No deep cloud today but plenty of broken middle level cloud (freezing level?).
- 22 Convective system comes right over the site during the day and has an impressive impact on the solar fluxes. Could make an interesting case study for a thick cloud. Lidar disappears after sunset.
- 23 Mainly clear but very curious things going on in day. Looks like very low cloud.
- 24 Fairly suppressed today. Cloud is quite thin.
- 25 Convective events coming over the site today.
- 26 Two coherent convective systems today. Radar plot shows lots of cloud structure.
- 27 More of those curious isolated boundary layer clouds (?). One actually rains, according to the radar.
- 28 Deep convection misses Niamey today. There's a mixture of broken clouds at all levels.
- 29 Fairly broken again. Lidar shows some weak echos up to 17km.
- 30 Again, nothing big, but more very high lidar returns.
- 31 That's more like it; a big system comes through during the day. Another possible case study, although it may be a bit too structured.

August 2006

- 1 Lidar structures in boundary layer suggest dust (Doug Parker did report dust from aircraft flight yesterday. Picture and report on FAAM site). Fluxes look good later on.
- 2 Thin mid-level cloud early on. Not much else. Again, what look like dust layers low down. Dust imagery sort of supports this, although cloud and water vapour make it hard to see.
- 3 More cloud today. Precipitation in afternoon. The SEVIRI satellite animation shows interesting development in the convection, with multiple cells (?).

- 4 Precipitating system goes through in the early hours and there are various cloud layers through the rest of the day in its wake. The system sets off a large arc of dust that becomes very coherent as it propagates well to the North of Niamey into Algeria.
- 5 Fairly clear, although there are a lot more of those low level echoes on the lidar plot.
- 6 Big system comes over in the day and produces some good looking radar and lidar plots, with precipitation. Large impact on radiative fluxes.
- 7 Much less coherent changes today; cloud at various levels but nothing too structured apart from a relatively small cell in the evening.
- 8 Quite a lot of cloud, although the animation shows that this is dissipating. The cloud base drops progressively through the day and one cell clips Niamey around 1600.
- 9 No organised convection over Niamey today, but sporadic low level echoes in the boundary layer are back. Email correspondence with Peter Lamb (who is in Niamey) suggests that they might be due to small amounts of cloud (or possibly aerosol) forming (or trapped) under the weak inversions apparent on some of the sonde ascents.
- 10 Mainly clear, although the leading edge of convection appears late in the evening.
- 11 Big system comes through in the early hours and through the morning. Gary's SEVIRI timeseries plots show that the 10.8 and 12.0 μm BTs get down to 193K at 0400. This corresponds to the tropopause at about 130hPa, or 15km, on the 0531 sonde. The radar shows cloud reaching that height at 0300, but is completely attenuated by rain at 0400.
- 12 Mainly disorganised mid-level convection today, though with big impact on the fluxes.
- 13 Another mainly clear day, with more low-level lidar echoes, which on this occasion are clearly due to scattered low cloud, as shown by the sondes, skyrads and all-sky camera.
- 14 Large convective system comes across in the middle of the day.
- 15 Lidar shows coherent aerosol layers low down. Less cloud in the morning and less organised, but increasing amounts later on.
- 16 Cloud early in the day, but then becoming progressively clearer. An isolated but strong convective system grows over eastern Burkina Faso, to the southwest of Niamey, and in a few hours dominates the satellite images as it tracks towards the west. This illustrates how difficult it must be to forecast in this region.
- 17 Partly cloudy (and mostly harmless).
- 18 Convective system comes through in the daytime, with a big impact on the fluxes in the morning.
- 19 Mainly cloud-free, especially in the morning, which could provide a good clear-sky case study (clear apart from the ubiquitous dust, that is).
- 20 Another pretty clear day, especially before midday, although not as good as yesterday as there are small amounts of low and mid level broken cloud, particularly in the afternoon.
- 21 Quite a lot of high cloud, with a large system arriving at midnight. Isolated low level cloud after midday. The Bae146 transits from Niamey to Dakar today, completing its AMMA work and starting the second DODO detachment.
- 22 Big convective system comes through and there are strong radar echoes throughout the day. The system appears to be part of a much larger organised event, with lines of cloud propagating to the southwest across the whole of West Africa.
- 23 Still quite a lot of cloud over Niamey today. A system to the east of Niamey develops and moves well to the north, which is unusual. Dust kicked up by gust fronts in the northwestern Sahara. Some of the systems propagating off the west coast into the

Atlantic appear to be getting quite organised. The one that left the coast on 20 August has turned into Tropical Storm Debby, west of the Cape Verde islands, and is featured on the EUMETSAT website today.

- 24 It remains quite active over Niamey, with cloud throughout the day at various levels.
- 25 Much less cloud, although the lidar shows isolated low cloud throughout the day.
- 26 Quite clear early and late, with a system moving through during the early afternoon. Part of a loosely organised line that moves NE to SW across the region.
- 27 Only limited cloud cover today, apart from thin cirrus and isolated clouds at lower levels, but as frequently happens a big system comes over around midnight.
- 28 This systems grows substantially right over Niamey in the early morning, leading to a pretty radar sequence. Clears through after sunset.
- 29 Cloud throughout the day, though rather broken and not particularly organised. BAe146 transits back to the UK at the end of DODO2.
- 30 Dissipating system comes through before noon, with clear skies later.
- 31 Lots of cloud in the morning as a system comes through. Radar shows coherent structure in the high cloud before and afterwards. Small-scale dust storm starts up over Mauritania.

September 2006

- 1 Some cloud all day, with isolated layers shown on radar. The dust storm over Mauritania sweeps out into the Atlantic in an impressive sequence on the dust animation. It would be interesting to look at the change in the GERB fluxes as it crosses from land to sea. This would have been an excellent case for DODO2, but of course the aircraft has now returned home.
- 2 Almost completely cloud-free (could provide a good case study).
- 3 Edge of system touches Niamey in the afternoon. The radar looks more coherent than the cloud on the animation.
- 4 Scattered clouds at various levels but nothing very organised.
- 5 Vague line of convection comes through before noon. Mid-level cloud throughout day.
- 6 Cloud in the night then mainly clear for the rest of the day.
- 7 Similar to yesterday.
- 8 Large and organised system develops around Niamey with coherent structure shown by the radar.
- 9 This system takes a long time to depart, with cloud up to 6-7km in first part of day. A lot of this cloud over the whole region.
- 10 Scattered cloud at various levels throughout the day, but the edge of a more organised system comes over in the evening.
- 11 The remains of this system provides clouds in the morning, then clear after noon.
- 12 Scattered mid and high cloud and a deeper, fast-moving system comes over in the afternoon.
- 13 Much less cloud, except at noon.
- 14 Dissipating system over Niamey in the morning, then cloud-free with multiple aerosol layers evident in the lidar plot.
- 15 Large system east of Niamey dissipates as it comes over and then is rejuvenated by the diurnal cycle once it passes by. Broken high cloud later shown by lidar and radar.

- 16 Scattered mid and high level cloud, without any obvious organisation.
- 17 Similar to yesterday, but cloud-free in the afternoon. Convection generally is not very extensive across West Africa at this time.
- 18 Mainly clear, just broken cloud today over Niamey.
- 19 The northern edge of convection centred south of Niamey produces radar echos up to 16km in the early morning, followed by trailing cirrus and mid-level clouds.
- 20 Broken cloud, generally decreasing in height through the day.
- 21 Convection moves across Niamey during the morning and early afternoon.
- 22 Mid-level cloud in the early hours and then mainly clear skies. The radar picks up echos in the lowest couple of km but nothing much on the lidar. Looking back through the recent plots this appears to be common. Seems to start around sunset. Curious.
- 23 Once again, deep convection seems to be avoiding Niamey, where there is mainly broken high and isolated low cloud today. A thin aerosol layer can be seen in lidar from afternoon onwards. Meteosat-8 has gone into safe mode and Meteosat-9 has become the operational satellite for the present time. Unfortunately, this means that we will not have any GERB data. (Note added later: Meteosat-8 returned to service on October 10).
- 24 ... but not today. Convection comes right over Niamey, with deep radar echos until sunset.
- 25 Some high cloud and mid-level cloud in the morning, otherwise clear. Some strange looking solar fluxes.
- 26 Outflow cirrus from convection to the south persists over Niamey until sunset.
- 27 Some mid-level cloud at various times in the day. There is convection to the west, but not over Niamey.
- 28 Broken cloud with convection over Niamey at noon.
- 29 Thin high cloud but clear during the daytime, with high values of direct flux and relatively low diffuse.
- 30 Convection that had been building to the east advects over the site in the middle of the day, preceded by high and middle level cloud.

The latest summary of the 2006 West African monsoon season at Niamey from Prof. Peter Lamb shows that this has been a very bad year for rainfall. To the end of September, this season has been the second driest in the last 20 years.

October 2006

- 1 A lot of broken mid and low level cloud, with signals in the fluxes that are characteristic of 3-D effects. Gust fronts from the system to the north kicked up a lot of dust and the Bodele has started up again. The dry season is returning, although at this point column water vapour is still around 5cm (but see below).
- 2 Lots of broken cloud again, with the fluxes all over the place.
- 3 Less cloud, but it can hardly be called clear. There is evidence of dust coming in from the east in the evening. The column water vapour is now beginning to decrease. It would be worth checking the sequence of radiosonde profiles and the basic met measurements to document this.
- 4 Very little cloud, but the Lidar shows aerosol arriving in waves through the day. Large diffuse solar fluxes.
- 5 Similar to yesterday; cloud-free but lots of aerosol and high diffuse fluxes. There is a

- broad dust front propagating southwards over Algeria, presumably kicked off by something synoptic.
- 6 Much clearer today, with lower diffuse fluxes, but cirrus after dark. The dust from the north plunges southwestwards over northern Mali, producing a pretty sequence in the dust animation.
 - 7 Scattered cloud throughout the day.
 - 8 More scattered cloud, with large excursions in the fluxes (particularly in the thermal, which is probably due to the steadily decreasing column water vapour, so the effect of higher cloud layers can be seen at the surface).
 - 9 Similar to yesterday.
 - 10 Some thin cirrus, but generally clearer. Meteosat-8 has returned to normal service.
 - 11 Very little cloud and high solar direct fluxes. Some cirrus after sunset, blowing up from convection to the south.
 - 12 Broken high cloud again today.
 - 13 Just when you think the convection has moved completely to the south, something comes over in the early hours and there is evidence of precipitation around 0300 on the radar.
 - 14 Lots of cirrus today, with a thicker patch before midnight.
 - 15 Broken high cloud again. Column water vapour continues its decline, now coming down towards 2cm.
 - 16 Scattered high cloud through the day. The sub-tropical jet stream cirrus over North Africa is now well established and sometimes this comes down over Niamey, otherwise the cirrus is from convection to the south.
 - 17 Almost cloud-free, though the dust animation reveals very thin high cloud (it's very sensitive and a good indicator even when the cirrus doesn't show up on the lidar).
 - 18 Clear before noon, but then the convection to the south becomes organised and throws up cloud over Niamey, with evidence of light precipitation in the afternoon.
 - 19 As the system dissipates there is broken mid and high level cloud over Niamey, with pretty fall-streak features in the radar sequence.
 - 20 The edge of dissipating convection comes over in the early hours, then more scattered cloud.
 - 21 Much clearer, but some broken cloud shows up on the lidar and radiometers.
 - 22 Even clearer; very little evidence of any significant amounts of cloud.
 - 23 Clear again, but some scattered high cloud blowing up from the south.
 - 24 Pretty clear again. Weak dust storm over the Bodele region.
 - 25 Isolated mid-level clouds have surprisingly large impact on the solar fluxes.
 - 26 Another mainly clear day with scattered clouds.
 - 27 and another.
 - 28 Very symmetric solar fluxes but diffuse is a bit higher, suggesting some aerosol, although as seems to be the case at the moment there are always signs of very thin cirrus on the dust product animation, so this could be the cause.
 - 29 Similar to yesterday, but cloud is more obvious throughout today.
 - 30 Strange looking solar fluxes in the afternoon, although it could just be very clear.
 - 31 Very clear indeed. Column water vapour almost reaches 1cm before rising again.

November 2006

- 1 A band of thin high cloud persists over Niamey throughout the daylight hours, otherwise clear skies across the region.
- 2 Clear in morning, then another band of cirrus from the south comes over after noon.
- 3 Yet another band of cirrus comes over in the daylight hours.
- 4 A very clear day; diffuse solar below 150 W/m^2 maximum value..
- 5 An even clearer day; diffuse down to 100 W/m^2 maximum.
- 6 The third very clear day in a row; down to 100 W/m^2 again. The dust animation suggests some very thin cirrus at times. Even so, these three days will provide excellent opportunities for testing radiation codes. It will be interesting to see what the aerosol retrievals are, both at Niamey and at Banizoumbou. The optical depths have to be very low indeed.
- 7 Still pretty clear, but some high cloud on the animation. The feature at about 0400 on the MPL plot looks like dust coming in. There is an impression of something on the dust animation, particularly to the north of Niamey.
- 8 Much more high cloud today, but dust at low levels, rising through the day, is now very clear on the MPL plot and with faith it can also be seen in the dust product animation.
- 9 The MPL shows more dust at low levels.
- 10 A band of cirrus from convection to the south over the Gulf of Guinea comes up and stalls over Niamey. Still plenty of aerosol evident on both lidars.
- 11 The same cirrus band affects the site at various times.
- 12 Some lower cloud has a big influence on the thermal fluxes in the early hours.
- 13 Very little cloud and much lower diffuse fluxes and little variability as a result.
- 14 Some broken cloud. The two lidars show aerosol coming in at low levels around noon.
- 15 More broken high cloud today, streaming up from the Guinea coast to the southwest. But generally there is very little convection down there at the moment.
- 16 Aerosol plumes are coming off the Bodele and are presumably supplying background aerosol over Niamey.
- 17 Very obvious aerosol layers in the lidar returns. As seems to happen frequently, the low-level plume comes in at around 0300.
- 18 Once again, very distinct evidence of aerosol below 1-2 km in the lidars.
- 19 and again today, overlaid with thin high cloud blowing up from the south.
- 20 Not wishing to repeat myself, I won't mention the low level aerosol layers that are there again today, although there are some interesting structures with intrusions of clear air between the plumes in the lidar backscatter plots.
- 21 Small amounts of thin, high cloud. Column water vapour is now below 1cm.
- 22 Some high cloud around sunset, otherwise clear again.
- 23 Very clear today, particularly in the daytime (e.g. solar fluxes show classic behaviour).
- 24 Small amounts of high cloud, otherwise clear again. The Banizoumbou optical depth from the Aeronet site is between 0.3 and 0.2 today.
- 25 A very clear day; check out the low diffuse fluxes. The all-sky image at 1100 shows very small aureole and a very blue sky.
- 26 Another extremely clear day, even more so than two days ago. This sequence will provide lots of excellent cases for testing radiation codes in clear conditions, with minimal amounts of aerosol.

- 27 The run of clear days comes to an end as thin cirrus appears over Niamey. This is blowing off convection in the Atlantic off the coast of Guinea and being entrained into the sub-tropical jet over north Africa.
- 28 A similar day, with broken cirrus in the afternoon.
- 29 Much less cloud; a nose of aerosol is evident in the lidar plots, coming in around 0600 and deepening into the afternoon.
- 30 Broken cirrus after noon again. An outbreak of aerosol is coming off the Bodele.

December 2006

- 1 Quite a bit more cirrus today, with significant vertical structure, and aerosol too.
- 2 Less cloud, but lots of aerosol (strong returns and very clear structure shown by the lidars). The dust animation over the last couple of days shows that it is very likely that at least some of this aerosol has come from the Bodele.
- 3 Intermittent high cloud and multiple aerosol layers on the MPL plot. The upper layers could be biomass?
- 4 Another day with a mixture of thin cirrus and aerosol at low levels.
- 5 Thin, wispy cirrus at various times. Dust at low levels. The MPL shows thin layers up to about 6km which might be aerosol, although the Banizoumbou Aeronet retrievals show dust not biomass aerosol, which is what one would have expected this high up.
- 6 Dust is coming off the Bodele a lot at the moment. Very thin, high cloud today, but again there is a distinct aerosol layer in the MPL around 4km and Banizoumbou only shows dust. This layer is just visible in the noise in the ceilometer returns, so perhaps it is dust after all.
- 7 Very similar story to yesterday, although the dust optical thicknesses increase through the day.
- 8 Hardly any cloud and somewhat less aerosol today. The subsidiary site at Banizoumbou has been shut down early because of a deterioration in the security situation along the roads to and from the site. This gives me a chance to recognise once again the sterling work put in by the on-site technician, Mike Alsop.
- 9 No evidence of any cloud today, just low levels of dust aerosols.
- 10 Small amounts of high cloud, more late in the day. A sizeable dust storm comes off the Bodele straight towards Niamey.
- 11 Broken high cloud through the day, which is a pity, as a great wedge of dust comes across the site, producing some very pretty lidar plots. The Aeronet retrievals go sky high at around 1400, but it looks like there is cloud contamination.
- 12 Still a lot of dust at low levels, but much less cloud, although there seem to be continuous streams of very thin cirrus coming up from the south. The dust browser shows these thin layers very well.
- 13 Those cirrus streamers are very obvious today. All very pretty, but they do get in the way. Despite them, the strongest signals in all the instrumental data come from the dust.
- 14 Still a fair amount of high cloud and more dust is streaming off the Bodele.
- 15 High cloud is still there, although it is dissipating gradually over Niamey.
- 16 Much less cloud and much more aerosol.
- 17 Only small amounts of cloud, but lots of dust around.
- 18 Very small amounts of high cloud, but plenty of dust.

- 19 Similar to yesterday, but rather less dust in evidence.
- 20 Mostly cloud-free, but a thin band of high cloud comes over in the evening. Not much aerosol in evidence.
- 21 Some high cloud at various times. Not much aerosol.
- 22 Similar to yesterday, with small amounts of aerosol.
- 23 High cloud comes up from the coast in the afternoon. Not much aerosol again.
- 24 Very little cloud and little aerosol too (Banizoumbou Aeronet optical depth at 0.55 microns is around 0.15 or so).
- 25 Small amounts of cloud after noon, but otherwise clear skies and little aerosol. However, sled tracks are apparent in the desert to the north; looks like there was a forced landing last night. Rudolf must have had a flame-out because of the dust.
- 26 Similar to yesterday, but rather more high cloud in the afternoon.
- 27 Very clear over Niamey, but a big dust storm starts over the Bodele and a wide front of dust is heading this way.
- 28 The leading edge of the dust reaches Niamey at the end of the day, as seen by the lidars.
- 29 The dust produces big signals in all of the instruments (check out the all-sky camera image at 1100, which as usual in such events shows how red the light is), but the signals are also affected by small amounts of high cloud). Banizoumbou optical depth is about 1.2 at 0.55 microns; so far this dust storm is modest but not spectacular.
- 30 A lot more high cloud today. The dust is evident over much of West Africa and more plumes continue to come off the Bodele and other dust sources.
- 31 Dust everywhere. I really wonder sometimes how any desert remains in the face of such relentless erosion. It's quite appropriate that the year should end with a dust storm.

January 2007

- 1 This has turned into a pretty large event after all, as well as being long-lived. The winds are more from the East than in previous events and the Bodele is but one of several sources contributing to dust across the whole of West Africa. To appreciate the extent, go to the Eumetsat website and look at the whole-disk animation.
- 2 High cloud is blowing over Niamey from the south-west and this is confusing the signals from the dust, although there is obviously a great deal of it around.
- 3 Even more high cloud today. The dust is beginning to show signs of clearing.
- 4 It's a pity that there has been a steady stream of high cloud from the south-west, which is very obvious today, as this has made this a less attractive case study from the point of view of being able to analyse the radiation measurements. The cloud begins to clear late in the day.
- 5 Less cloud today and unfortunately less aerosol, although there are still significant amounts and multiple layers up to 4-5km are apparent in the MPL data now that it can penetrate through the low level gunk.
- 6 Almost cloud-free over Niamey. The aerosol loading appears to increase through the day as another low-level intrusion comes in from the east.
- 7 Another cloud-free day with multiple aerosol layers and good radiation data. These two days at least should provide useful data for testing models under some quite high aerosol loadings (Banizoumbou optical depths of 1 or more).
- 8 and that's it; data collection has stopped and the site is being closed down. Next stop; the Black Forest. Thanks once again to everyone in ARM for a tremendous dataset!