

## **Extreme Heat Project - North American Monsoon**

I must admit to being extremely excited at the prospect of this next adventure. A first for Arizona, and I had heard the monsoon season brings in spectacular events for the camera all set in a stunning landscape. Could it get any better for an elemental photographer? The unique and massive movement of moisture flowing into the desert landscape, the monsoons, resulting in intense flash flooding, huge electrical thunderstorms, incredible haboobs (fast moving dust storms) combined with extreme temperatures. With the Grand Canyon and Death Valley a stone's throw distance away I will be within one of the hottest spots on earth. I'm told it gets so hot you can make instant sun tea and hot water comes out of both taps! Let the adventure begin.



### **Technical - What is a Monsoon?**

The word monsoon is derived from the Arabic word mausim, which means season. Dry winds in the winter suddenly do an about turn during the summer, and bring torrential rains to monsoon prone areas. These large scale wind shifts, from dry desert areas to moist tropical areas, occur in many parts of the Earth, including the Oceanic subcontinent, Southeast Asia, Australia, North America, Africa and South America.

These wind shifts, and the dramatic change in weather they bring, are all more or less driven by a similar mechanism. For much of the year, low level winds in dry subtropical regions tend to blow from the land toward the sea. However by late spring, strong solar heating causes temperatures to soar over these land areas. The intense heat causes surface air pressure to fall, forming an area of low pressure known as a thermal low. Adjacent large bodies of water are also warmed, but not as quickly. Thus air pressures remain high relative to the land. Eventually, the pressure difference increases to the point that the cooler and much more humid air over the ocean is drawn toward the hot, dry air over land.

This moist air moving onto the hot land eventually becomes unstable and develops into thunderstorms. Once this occurs and rain begins to fall, humidity levels increase over land, which only triggers more thunderstorms. This cycle will continue until land areas begin to cool in the early fall and water temperatures reach their peak in early fall. This reduces the pressure difference, which in turn causes the moist onshore flow to diminish, and the monsoon gradually ends.

Monsoons typically occur in areas with a large, elevated landmass which further enhances temperature and pressure contrasts between land and ocean, enhances moisture transport, and supports stronger subtropical highs. All of these, in turn, enhance rainfall in monsoon regions. This explains why the Indian Monsoon is the strongest and largest. The presence of the Tibetan Plateau, which resides to the north of the Indian subcontinent, is the largest and highest elevated landmass on Earth.

The North American Monsoon is not as strong or persistent as its Indian counterpart, mainly because the Mexican Plateau is not as high or as large as the Tibetan Plateau in Asia. However, the North American Monsoon shares most of the basic characteristics of its Indian counterpart. There is a shift in wind patterns in summer which occurs as Mexico and the southwest U.S. warm under intense solar heating. As this happens, the flow reverses from dry land areas to moist ocean areas. In the North American Monsoon, the low level moisture is transported primarily from the Gulf of California and eastern Pacific. The Gulf of California, a narrow body of water surrounded by mountains, is particularly important for low-level moisture transport into Arizona and Sonora. Upper level moisture is also transported into the region, mainly from the Gulf of Mexico by easterly winds aloft. Once the forests of the Sierra Madre Occidental green up from the initial monsoon rains, evaporation and plant transpiration can add additional moisture to the atmosphere which will then flow into Arizona. Finally, if the southern Plains of the U.S. are unusually wet and green during the early summer months, that area can also serve as a moisture source. This combination causes a distinct rainy season over large portions of western North America, which develops rather quickly and sometimes dramatically.

Rainfall during the monsoon is not continuous. It varies considerably, depending on a variety of factors. There are usually distinct “burst” periods of heavy rain during the monsoon, and “break” periods with little or no rain. Monsoon precipitation, however, accounts for a substantial portion of annual precipitation in northwest Mexico and the Southwest U.S. Most of these areas receive over half their annual precipitation from the monsoon.

The North American Monsoon circulation pattern typically develops in late May or early June over southwest Mexico. By mid to late summer, thunderstorms increase over the “core” region of the southwest U.S. and northwest Mexico, including the U.S. and Mexican states of Arizona, New Mexico, Sonora, Chihuahua, Sinaloa and Durango. The monsoon typically arrives in mid to late June over northwest Mexico, and early July over the southwest U.S.

It is important to note that the monsoon is not an individual thunderstorm. While the word “monsoon” accurately conjures up images of torrential rains and flooding, calling a single thunderstorm a “monsoon” is incorrect. A monsoon is a large scale weather pattern which causes summer thunderstorms.



Camera equipment - Olympus E3 (x 2) and lenses, 12-60mm SWD, 50-200mm SWD, 90-250mm, 7-14mm, 8mm fisheye.

Other specialist equipment - PClx time lapse controller, lightning trigger.



Prior to departure Al and I were keeping a close eye on weather forecast developments for Arizona. Cyclical moisture movement was well under way but there was also an anomaly in the mix. The week prior to departure Hurricane Dolly developed in the Gulf of Mexico, a Category 2 storm, and which was due to make landfall on the north Mexico coastline, continuing (as a Tropical Storm) due west through northern Mexico and flirt with the US/Arizona. So what were our thoughts as to the effect of Dolly on the monsoon? Well as it stood Dolly would drag copious amounts of moisture from the Gulf of Mexico and which will channel, via the

Sierra Madre Mountains, into Arizona. Dew points were already rising fast and the NWS area forecast discussions for Arizona were very concerned about enhanced risks for flooding and strong thunderstorms. Consequently, before departure we were expecting lots of exciting thunderstorms, dust storms and spectacular lightning upon our arrival. We could not have written the script!

## Day 1

After a gruelling 2 flights, 2 time zone changes and almost 24 hrs of travel we arrived at Tucson, Arizona. It was hot, very hot (96 F) and unexpectedly humid too! It felt tropical. That was down to Dolly pooling in all the moisture. As I walked out of the concrete concourse into the Arizona heat the skies were filled with instability. Storms were all around us as we drove from the airport. Lightning filled the spectacular mountain laden horizon. Wow, what a start to the trip I thought, eager to get stuck into the lightning with my camera. Interestingly there appeared to be very little thunder associated with the seamless cloud to ground spectacular lightning.

As we drove around Arizona's second largest city in search of our base hotel we tuned into the local radio. Flash flood warnings constantly filled the airwaves. It looked like being an active evening!

Three quarters of an hour later we arrived at the foot of the Catalina Hills at our base hotel. It was indeed very nice and much more luxurious than the usual run of the mill American motel I normally frequent. The Holiday Inn Suites at Oro Valley became our home for a week, or so we thought. Al and I dropped our entire luggage real quick, grabbed the camera gear and headed off to the hills in the west of town hoping to get look down on the lightning display. We were both totally exhausted through the constant travelling but could not let the opportunity of good footage slip. We headed west towards the Wasson Peak Mountains just the other side of I10 in order to get some elevation. The first thing we noticed as we drove in search of vantage points was the lack of them! Whilst the terrain away from the ranges was pretty flat it was littered with desert bush, which made photogenic positioning difficult.



We finally drove up to the nearest hill via the wandering road which cut through the rugged terrain and pulled over. It was a good vantage point overlooking some urban landscape albeit not brilliant. We were exhausted, and took it. We stayed about an hour or so until the lightning activity diminished. I remember very little about that shoot except knowing there was a couple of good cloud to ground bolts. Tiredness was killing me and affecting my photography mindset. With this we drove back to the hotel for some rest. Boy that bed was heaven on the first night.

## Day 2

Refreshed, Al and I headed south of Tucson towards the Mexican border, about an hours drive. It was the first real opportunity to take in the desert scenery. Urban Tucson was a flat, stretched out city surrounded by mountains and beautiful National Parks. It was these natural features which help fuel the cyclic monsoon storms. It also looked like a photographers dream location. We pulled off



Interstate 19 at Arivaca amidst the peaks which stretched far into Mexico. Right on the Arivaca junction we came across the most unusual looking bar & grill, The Longhorn. A cave like structure fronted with two huge bull horns, which were visible for miles. We just had to stop there. A few outside photos, which looked pretty cool, set amongst the hills and monsoon storm clouds, and then we enjoyed a great steak grill. I could get used to this monsoon chasing!

Ten minutes further driving has us perched on the crest of a hill with a total 360 degree field of view. Here we experienced our first real monsoon storms. We sat watched and captured storms unleashing vast amounts of precipitation. The storms were hardly moving and the precip core was so sharply defined. Beautiful. These were flood events in the making. They also made for great photos. I had both Olympus E3 cameras on a tripod. One shooting close up on the precip core with a 50-200mm SWD and the other catching the wide angle view with the 7-14mm. It was mighty impressive to watch as the surrounding scenery was spectacular. With the luxury of so much watching time I put every lens to good use. It was also a great location to capture some time lapse. I set the time lapse controller (PClix)

on the E3 with the wide angle lens, set it to capture every few seconds and just left it rolling. It really is that easy. I was hoping to catch the movement and action of the monsoon precip over the mountains as it approached us. Boy did I get some great footage, which compliments the stills perfectly.



Most of the roads in these areas carry signs informing drivers not to pass when flooded. The mostly dry river beds or overflow channels become raging torrents when such monsoon storms arrive. The storm we witnessed was dropping an amazing 1" of rain every 15 mins. If you get caught on such roads in between flooding points then you become trapped. All you can do is sit it out and wait till floods recede. Quite scary and we had to drive and choose our routes carefully that day in order to stay safe.

We picked off many such storms throughout the day stopping for the odd photo shoot and generally heading back towards the Tucson area. We also drove through the beautiful Saguaro National Park which is littered with giant cacti and is so photogenic, especially with storms kicking off in the background. We spent a while here battling with cameras and 100F temps.



As we drove from the Park back through the range towards Tucson city we came across a popular local landmark which was also a mountain. It was simply called the 'A' mountain accessible by a single road which twisted all the way to its summit. The view from here was simply spectacular, the entire Tucson metro area and valley in one shot. We stopped here till sun went down capturing plenty, including again some time lapse work. We even saw a small haboob or dust storm, at the end of the day, created by the downburst of precip from a

small storm over the city.

### Day 3

Not a good day. The remains of Hurricane Dolly have affected weather patterns across the USA. The original westerly track (across Mexico) has shifted big time with Dolly moving north east through Texas. This has crashed all the moisture in Arizona leaving the predicted stormy monsoon week in tatters. High temps, low dew points, lots of dry air and no storms. Yuk.

After a lazy breakfast and feeling quite down about the rest of the week Al and I hooked up with the Silver Lining Tour (SLT) group, who were also staying at our hotel. It was now a case of maximising and riding our luck. The plan today was to head south and east of the city into the Sierra Vista hills around Tombstone and hope for some local storms to produce.

After an easterly drive along I10 we dropped south into the hills, driving through the historical town 'too tough to die'. I was half expecting Wyatt Earp to walk out from the OK corral; at least it would have excited the day up a tad! We hastily drove through the tacky Tombstone. Unfortunately that's as good as it got. We cherry picked a few small storms, but nothing special and nothing very electrical.

After much discussion we planned ahead for tomorrow and aimed to experience real extreme heat by heading north into Phoenix (and beyond) where heat warnings were forecast. There are some spectacular national parks in this vicinity and it would give us an excellent opportunity to put the cameras through some heat tests. Fried eggs and a road spring to mind.

## Day 4



Well today was pretty amazing and a total upturn in luck. We had treated it as a storm down day and headed off early north through Phoenix and onto Flagstaff with a view to capturing some extreme heat and the natural stunning scenery. Phew it was real hot too. Just south of Flagstaff at a rest area I recorded a temp of 110F (44C) with my hand held Kestrel. The nearby sign was warning of poisonous snakes and insects (scorpions). For the first time I was watching my feet when I walked! A British film crew and presenter Gethan Jones also turned up, filming for a future production. I pointed them in the direction of the sign and we made a sharp exit.

We headed towards the only clouds (on the horizon) in an otherwise total blue sky, in hope more than expectation. However, as we drew closer, to our surprise and delight, storms started to build and before long were discharging lightning. We set off in pursuit and were treated to an unexpected monsoon storm with lots of cloud to ground lightning. The precipitation core was spectacular. Al and I captured it all on time lapse. The daytime lightning was stunning to see. Alas my lightning trigger had not yet turned up so my attempts to capture the daytime show were in vain after riding on the luck factor. It was a bit of a circus as we stayed, watched and captured these storms along with the SLT group and the film crew which had managed to tag along. We were witnessing the only storms in Arizona and happy in this respect as the storm gods were squeezing the last of the juice from the air, at least for a few days.



That was it for the day and after a brief lunch we headed to Sedona National Park to see the spectacular Red Rock Canyon. A few touristy type photos (how I hate these) and then Al and I drew breath as we pondered over some pretty difficult decisions. This is where the adventure took another twist. The Arizona monsoon had effectively shut down for

the rest of the week. We discussed our options. At worst we stay in Arizona for 3 days of nothing but heat, at best we look elsewhere across the USA for 'other' events. After considering California forest fires, Volcanoes in Hawaii we became aware of a potential waterspout forecast in Florida. Al and I looked at each other. Our common spirit of adventure did not take long for a decision. We booked ourselves flights to Tampa straight away via the web. We leave early tomorrow. The forecast for the next three days in Florida was good. Electrical storms which could produce waterspouts. Al and I are on our way to the sunshine State.

## Day 5

After a very early start and two flights we arrived in Tampa, Florida. Back through two more time zones it was afternoon. Adventure yes, but hell on the body. We picked up yet another hire car and felt our way around the area. Scattered thunderstorms were already breaking out across the west coast. We headed south and based at Sarasota for the night. We found a motel, dropped bags and carried out a recce. We checked out the local coastline for spout watching vantage points, beaches, roads and retired for the evening pretty early. Waterspouts are generally morning creatures, forming in the water/land heat boundaries. We wanted to be primed and ready at sunrise. The air was full of juice. It felt tropical; a combination of heat and moisture became the sweaty 'swimming pool' environment for working over the next few days. It was not pleasant and also tough on the camera equipment, once again pushing the limits of extreme working.



## Day 6

After a very early sunrise start Al and I left Sarasota and headed north a short distance towards Tampa Bay area. Early morning isolated storms were already forming out to sea and making their way on land. We just needed to pick out a good

viewing point, sit and wait. How that became a challenge! What an awful place for chasing. Way too much traffic, horizon visibility was destroyed by urban landscape and very few places to actually pull over and see anything. Eventually we settled for a spot on the road that runs over Tampa Bay, Gandy Blvd or the I92. We pulled into a car park which gave us access to the water's edge allowing us a good composition. We stayed here a good few hours and got some really good footage of severe storms building, maturing and some great lightning. It was another good opportunity to run through the entire lens stock shooting close with the 50-200mm swd and wide with the 7-14mm and 8mm. We sat through lots of precip too as the storms rolled over us, allowing some good wet working with the gear. No



waterspouts.

In the afternoon we changed scenery and headed right onto the east coastline via St Petersburg basing around the Clearwater area. By now the storms had lost their isolation and became more persistent, ironically more monsoon-ish. There was still plenty of thunder/electrical activity in the air and not wishing to lose out on the opportunity we put our adventurous brains into gear and headed off to a local supermarket. 15 minutes later we were both sitting on the beach underneath umbrellas. We must have been crazy, but anything to get that ultimate daytime beach lightning shot. Please don't try this at home kids! We sat there whilst the rain lashed down, thunder echoing all around and as the beach slowly emptied with punters. A group playing volleyball nearby, having surrendered to the weather glanced over at us. Their stares said it all. They must have thought we had escaped from the local asylum.



We decided to stay overnight in this locality and found a very reasonable hotel at Indiana Rocks overlooking the beach. It was an unexpected nice luxury. Never has a fresh fish dinner and a few beers been more welcome.

## Day 7

There is nothing more pleasing than waking up to the sound of waves crashing down onto a beach or sunrise filling a room with scarlet tones. Places like this don't need windows or curtains. It really is heaven. That is until you walk outside. It is like living and breathing in a sauna, amazingly hot and humid. Suddenly the windows and curtains become *objets du désir*.

Another early start had us screaming back down south towards Sarasota, following some interesting radar signatures. An hour later with skies still clear we got screwed by down radar station. It was not the best start we had hoped for. A reverse turn back to Tampa and sure enough we got our storms. This time we camped out on the causeway along Howard Franklin Bridge on I275. Patience was our virtue as we time lapsed some great convective storms as they approached and rolled over. We experienced a complete whiteout as one storm battered us with hurricane like winds and rain. Great fun.



By now our hopes of Florida waterspouts had gone. This was our last day in Florida with flights back to Arizona beckoning. However we repeated our beach umbrella madness sitting on the sand at Indiana Rocks, a sort of finale mission and one well accomplished.

As we sat in our hotel packing bags once again it was with great relief to see the forecasts for Tucson, Arizona. Moisture had returned along with extreme heat warnings and temps of 120F. If only we could finish off the trip with some great monsoon lightning blazing over downtown Tucson.

### Day 8

Our wish was granted. After arriving back in Tucson we hurried back to the hotel and quickly headed off in search of our final monsoon storms. Whilst away in Florida my lightning trigger had finally arrived. Hurrah, but would I have an opportunity to use it? We found and pursued many storms on this the last day. Lightning was intense. We pursued one such storm south of the city and I was in position, camera on tripod with the trigger primed. The first bolt crashed down just ahead of us and shortly after an almighty bang thundered out as the next pierced the horizon. Click went the camera. I was so impressed. It actually works! The first time I have ever captured quality cloud to ground lightning bolts in the daytime. Lady luck normally plays a big hand without any technical assistance. The trigger is now my best friend. I captured some great lightning bolts and I was very pleased.



As day turned to darkness storms were firing all over Tucson. Now was the time for the ultimate lightning shot. Before I came on this trip I had envisaged my dream lightning shot. A cloud to ground strike over a desert city skyscape. We hurried to our favourite little spot, 'A' mountain. The mountain gets closed off with a barrier, I assume for safety reasons, after 8pm but there were still a few good elevated spots to stand overlooking the city. We pulled over and hastily fixed camera gear to tripods. Lightning strikes all over the place and crashing down on

the city skyscrapers. Al and I screamed with delight as we finally had lenses clicking and video rolling. I was running with both E3's on two tripods. One had the 50-200mm swd homed in on the tall scrapers. I wanted a frame filled capture close up! This was controlled manually through exposures ranging 10-15s. The other camera was equipped with the 12-60mm swd and the trigger. This I could leave on its own. However I kept running between the two cameras checking on the captured images. I screamed 'Wow' and 'Oh my goodness' so many times it almost became tiresome. Al was also on the same planet. We were both in our own, yet the same, wonderful wonderful world. It was hard to contain the satisfaction, achievement and emotional pleasure. Oh what a joy, Oh what a privilege. It seemed to go on all night, but eventually it calmed down, as we did.

Back at the hotel I could hardly stay awake but had to download and fully backup before we left for home the following morning.

The flights back home were easy. It was a seamless sleep trip. My body (and camera system) has been to hell and back this last week, overcoming 8 flights, 8 time zone changes and long days. This trip has been a true definition of adventure.

Mark Humpage  
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Monsoon storm near Arivaca, Tucson – Olympus E3, 12-60mm SWD



Cacti at Saguaro National Park, Tucson – Olympus E3, 8mm fisheye



Daytime lightning, Tucson, Arizona  
Olympus E3, 12-60mm SWD and lightning trigger.



Lightning storm over Tucson, Arizona – Olympus E3, 12-60mm SWD