

MAGIC

2013-05-29

A newsletter for non-scientists (and scientists) interested in MAGIC

The second phase of MAGIC is progressing smoothly and most instruments are up and running again. The *Spirit* arrived in Honolulu last night and will depart tonight, starting Leg11B. Big news: I recently received a photograph from Doris Day autographed to me personally! I like it even better than the one in the 2013-05-02 update (all previous updates can be found at the website below my signature), on which I received several comments (mostly from friends who were plainly jealous—admit it guys!).

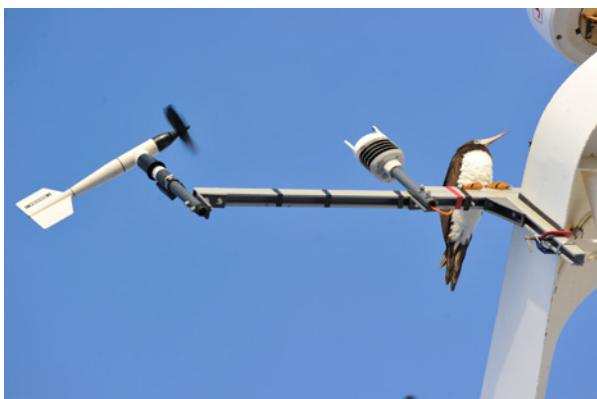


It's springtime here in the northeast, and for me means bird migration. Some birds move north and south in regular seasonal patterns (migration) because of food availability. Those birds that remain all winter often feed on seeds (most of these birds have thick, stubby bills) as opposed to insects, which typically are not available during colder weather. Many of the small, colorful songbirds are now returning from having spent the winter in Central America. Some of these so-called neotropical migrants nest here in the summer (and some continue further north), and at this time of year they are in their best plumage so they can show off and attract mates. The American Redstart, shown below, is one example (I saw several of these last weekend). These guys weight about $\frac{1}{4}$ of an ounce, meaning you could mail four of them across the country for 46¢, yet they fly nonstop more than 500 miles across the Gulf of Mexico during their return in the spring. Pretty amazing, if you ask me.



Male American Redstart (*Setophaga ruticilla*)

Why, you may ask, am I talking about birds? My friends will tell you that I will use any excuse to talk about birds (which is true), but the purpose of this update is really to talk about radars. Recall that a radar acts essentially like a flashlight in that it sends out a beam of light (although the wavelength, or “color,” of the light is not one that human eyes can see), and then detects what is reflected back by various objects. The objects of interest for our MAGIC radars are cloud drops and raindrops, but radar was originally developed in the early 1940s in Britain (and in the US) to detect aircraft, a role it still fulfils. Aircraft are large, shiny objects that are highly reflective to the electromagnetic radiation (a fancy name for light of various wavelengths) emitted by radars, just as metal is shiny and highly reflective to visible light. Other objects, such as raindrops, also reflect radar, just as you can observe raindrops illuminated by car headlights on a dark night, and the early radar operators quickly realized that they could detect weather events with their radars. Additionally, individual birds were first detected with radar from Dover, on the south shore of England (and known for its white cliffs) in 1941, although because radar activity was classified this fact wasn’t published until 1945. The first bird so detected was a Northern Gannet (*Morus bassanus*), which is in the same family as the Brown Booby that hitched a ride on the *Spirit* during Leg03B of MAGIC.



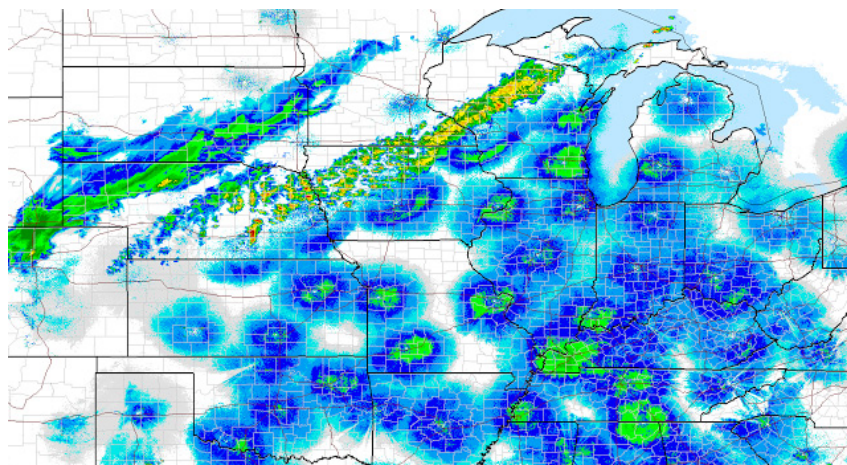
Brown Booby (*Sula leucogaster*) on meteorological mast



Brown Booby in flight

Distinguishing birds from aircraft was originally problematic; a 1945 paper states: “with the introduction of higher powered transmitters late in 1943, bird echoes became such a menace on British coast-watching equipment that we specially trained radar operators to distinguish them from echoes of operational importance” by which they meant aircraft, and at least one false invasion alarm was caused by a bird. Small unexplained blobs of echo of the radar display, later determined to be caused by birds, were originally called “angels”. In some instances, individual wingbeats of birds can be detected.

Birds are not the only flying objects that can be detected by radars. Bats and insects also often occur in sufficient numbers to return appreciable signals, and radar is becoming commonly used to study migrating birds and to estimate the number of bats leaving roosts at night, to name but two examples in the growing field of aeroecology. Differentiating insects from bats from birds can be challenging, but there are certain clues that help. Insects are typically carried with the wind or move at slow speeds, whereas bats and birds fly faster and can move relative to the wind. Bats tend to leave known roost sites soon after dark and fly in a multitude of directions, whereas during migration many species of birds also leave after dark but tend to move north in the spring and south in the fall. Doppler radar can give the relative speeds of the objects being detected (as discussed in the 2012-08-03 update), so if there is high radar reflectivity that starts soon after dark in the spring and shows objects all moving north, then it is safe to assume that this is caused by migrating birds. Birdwatchers make use of this fact to determine when is a good time to look for these migrants by checking radar maps, like the one below from a month ago. The two bands across South Dakota and Iowa/Wisconsin are weather, but the circular blobs (“angels!”) around individual radars are caused by migrating birds. These are often filtered out as unwanted signals for radar maps that are displayed for weather information, but as they say, “One man’s garbage is another man’s treasure,” and for birdwatchers these are indeed treasure.



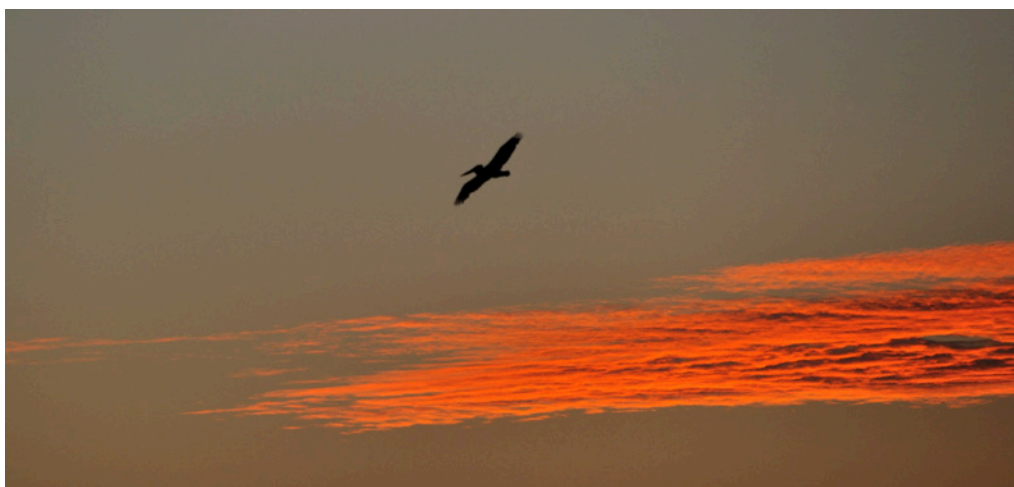
Radar map from April 30, 2013 at 9:45 EST.

One might think that the MAGIC route would be great for seeing birds, but this is not really the case. We do get a few hitch-hikers (as noted above), and Hawaii has some interesting birds (although a lot of them are introduced species, like the Red-crested Cardinal below), but the waters along the way aren't as highly biologically productive as other places are, and low productivity means not much of a food chain. Off the coast of California near Monterey is great for birds, and of course in the waters off both coasts of North America in the Arctic (near Alaska and Greenland) are very productive biologically—think of where the great fisheries are (or were); this is where large flocks of birds occur.



Red-crested Cardinal (*Paroaria coronata*)

Summer students arrive next week, and MAGIC will soon get some new instruments. Stay tuned.



Ernie Lewis
2013-05-29

Please address any questions or comments to elewis@bnl.gov.

All updates and other MAGIC information can be found at <http://www.bnl.gov/envsci/ARM/MAGIC/>.