

Notes on SEA Radar Sites

General Overview:

- a. All utilized radar imagery is sent through algorithms to automatically remove the backgrounds and leave only the radar pixels. Additionally, cropping is automatically performed on any images that require it to remove unwanted parts of the image such as the color bar and text. This removal process often leaves outlines of state boundaries in the final image and in some instances not all of the background can be removed. This happens when colors in the background are the same color as a color used to represent a radar echo.
- b. Radar imagery is available online for the following countries: Thailand (17 sites), Malaysia (10 sites composited into location sets), Bangladesh (5 sites), and Vietnam (3 sites).
- c. These sites for the most part only offer a single image (usually at the lowest feasible elevation scan). There is currently no other radar information available such as upper elevation scans or Doppler velocity.
- d. Thailand and Malaysia are processed and used in Google Earth but Bangladesh and Vietnam are not. The reasons for this are discussed below but mostly have to do with issues of projection onto Google Earth and reliability (Bangladesh), and a lack of ground clutter filters (Vietnam). That does not mean however, that images from these sites cannot be archived.
- e. The websites for each of these countries are as follows:
 - a. Thailand: <http://www2.tmd.go.th/radar/>
 - b. Malaysia:
http://www.met.gov.my/index.php?option=com_weathersatellite&Itemid=911&lang=english
 - c. Bangladesh: http://www.bmd.gov.bd/radar_image.php
 - d. Vietnam: <http://www.nchmf.gov.vn/web/en-US/73/Default.aspx>
- f. There is no known radar coverage in Burma, Cambodia, Laos, Nepal, or Indonesia.
- g. The Phillipines look to possibly have radars but radar imagery and/or data is not publically available at this time.
- h. Detailed notes about each country's radars are described on the pages that follow.

1. Thailand Notes:

- a. The Thai radar network consists of many different models of radar from either DongYu Enterprises (<http://www.koreaweather.com/eng>) and/or from Enterprise Electronics Corporation (<http://www.eecradar.com>) :
 - i. DWSR-93C:
 - 1. Chiang Rai
 - ii. DWSR-93S:
 - 1. Hua Hin
 - iii. DWSR-74C:
 - 1. Phitsanulok
 - iv. DWSR-88S:
 - 1. Khon Kaen
 - 2. Don Mueang
 - 3. Surat Thani
 - v. DWSR-88C:
 - 1. Sakon Nakhon
 - 2. Ubon Ratchathani
 - vi. DWSR-8501S:
 - 1. Suvamabhumi
 - vii. DWSR-2501C
 - 1. Phuket
 - 2. Krabi
 - viii. Unknown:
 - 1. Lamphun
 - 2. Phetchabun
 - 3. Surin
 - 4. Chumphon
 - 5. Songkhla
 - 6. Bangkok

- b. Many of these sites have their own color bars and backgrounds, which can make the integration of all the images into a single workable product in Google Earth a little bit difficult...but it is doable.
- c. There are various update intervals for the various sites. Some update on 1 hour intervals, some 30 minute intervals, etc.
- d. Most sites use Reflectivity as the measure of echo intensity but several use rain rate (mm/hr) as the measure of echo intensity.
- e. Images are generally of low quality (approx. 650x550 pixels or less).
- f. There are four other sites (Omkoi, Pimai, Cha-am, and Sattahip) listed on the website as 'RainMaking Radar' but it looks as though these are an older network of radars judging by the model numbers and their updates look to be a bit unreliable so these are not currently being used in Google Earth. Their color bar setup is also much different than the TMD sites.
- g. Several of the sites offer various radar ranges such as 120 Km or 240 Km. In each of these cases, only the images with the longest ranges are used.

h. Thailand Individual Site Notes:

i. Bangkok(BMA):

- 1. Update Interval: 5 Minutes. Google Earth version is about two minutes later than latest availability on internet to account for any late site updates and removal of backgrounds.
- 2. Range : ~60 Km.
- 3. Data Type: PPI Reflectivity (dBZ) from 20-60 dBZ. As a result this site often shows very few echoes.
- 4. Elevation: 3.5 deg.

ii. Chiang Rai:

- 1. Update Interval: Hourly (website updates at approximately HH:35). Google Earth version updates at HH:37 to account for late update times and to remove backgrounds.
- 2. Range: ~240 Km.
- 3. Data Type: PPI Reflectivity (dBZ) from -10.5 to 66.5 dBZ. Google Earth version removes the low end echoes and starts at about 6.5 dBZ.
- 4. Elevation: 0.90 Deg.

iii. Lamphun:

- 1. Update Interval: Hourly (website updates at approximately HH:35). Google Earth version updates at HH:38 to account for late updates and to remove backgrounds.
- 2. Range: ~240 Km.

3. Data Type: PPI Reflectivity (dBZ) from -10.0 to 66.5 dBZ.
4. **Currently Lamphun is not being utilized in the Google Earth viewer due to frequent radar downtimes.**
5. Elevation: 1.49 Deg.

iv. Phitsanulok:

1. Update Interval: Hourly (website updates at approximately HH:35). Google Earth version updates at HH:39 to account for late updates and to remove backgrounds.
2. Range: ~240 Km.
3. Data Type: PPI Reflectivity (dBZ) from -10.5 to 66.5 dBZ.
4. Elevation: 0.65 Deg.

v. Phetchabun:

1. Update Interval: 15 Minutes (website updates at approximately HH:05, HH:20, HH:35, and HH:50). Google Earth version updates at HH:10, HH:25, HH:41, and HH:55 to account for late updates and to remove backgrounds.
2. Range: ~240 Km.
3. Data Type CAPPI Reflectivity (dBZ) from -10.5 to 66.5 dBZ. Google Earth version starts at about 1.5 dBZ to remove clutter from low echoes.
4. Elevation: 4.0 Km.

vi. Khon Kaen:

1. Update Interval: Hourly (website updates at approximately HH:35). Google Earth version updates at HH:42 to account for late site updates and to remove backgrounds.
2. Range: ~240 Km .
3. Data Type PPI Reflectivity (dBZ) from -10.5 to 66.5. Google Earth version starts at about 5 dBZ.
4. Elevation: 1.3 Degrees.

vii. Sakon Nakhon:

1. Update Interval: Hourly (website updates at approximately HH:35). Google Earth version updates at HH:38 to account for late site updates and to remove backgrounds.
2. Range: ~240 Km.
3. Data Type: PPI Reflectivity (dBZ) from -10.5 to 66.5. Google Earth version starts at about 5 dBZ.
4. Elevation: 0.90 Degrees.

viii. Ubon Ratchathani:

1. Update Interval: Hourly (website updates at approximately HH:35). Google Earth version updates at HH:37 to account for late site updates and to remove backgrounds.
2. Range: ~240 Km.
3. Data Type: PPI Reflectivity (dBZ) from -10.5 to 66.5 dBZ. Google Earth version starts at about 5 dBZ.
4. Elevation 0.50 Degrees.

ix. Surin:

1. Update Interval: 15 Minutes (website updates at approximately HH:20, HH:35, HH:50, and HH:05). Google Earth version updates at HH:25, HH:40, HH:55, and HH:10 to account for late site updates and to remove backgrounds.
2. Range: ~240 Km.
3. Data Type PPI Reflectivity (dBZ) from -10.5 to 66.5 dBZ. Google Earth version starts at about 1.5 dBZ.
4. Elevation: 0.5 Degrees.

x. Don Mueang:

1. Update Interval: 30 Minutes (website updates at approximately HH:07, and HH:37). Google Earth version updates at HH:11, and HH:41 to account for late site updates and to remove backgrounds.
2. Range: ~240 Km.
3. Data Type: PPI Reflectivity (dBZ) from -10.5 to 66.5. Google Earth version starts at about 4 dBZ.
4. Elevation: 0.6 Degrees.

xi. Suvamabhum:

1. Update Interval: 15 Minutes (website updates at approximately HH:20, HH:35, HH:50, and HH:05). Google Earth version updates at HH:22, HH:38, HH:52, and HH:07 to account for late site updates and to remove backgrounds.
2. Range: ~240 Km.
3. Data Type PPI Reflectivity from -10.5 to 66.5. Google Earth version starts at about 5 dBZ.
4. Elevation: 0.6 Degrees.

xii. Hua Hin:

1. Update Interval: Hourly (website updates at approximately HH:35). Google Earth version updates at HH:41 to account for late site updates and to remove backgrounds.
2. Range: ~240 Km.
3. Data Type: PPI Reflectivity from -28.0 to 66.5. Google Earth version starts at about 3 dBZ.
4. Elevation: 0.4 Degrees.

xiii. Chumphon:

1. Update Interval: 15 Minutes (website updates at approximately HH:20, HH:35, HH:50, and HH:05). Google Earth version updates at approximately HH:25, HH:40, HH:55, and HH:10 to account for late site updates and to remove backgrounds.
2. Range: ~240 Km.
3. Data Type: PPI Reflectivity (dBZ) from -10 to 66.5 dBZ. Google Earth version starts at about 1.5 dBZ.
4. Elevation: 0.79 Degrees.
5. Often shows irregularities in reflectivity. It could be a side lobe effect, anomalous propagation, ground clutter or combination of these.

xiv. Surat Thani:

1. Update Interval: Hourly (website updates at approximately HH:05). Google Earth version updates at approximately HH:07 to account for late arrivals.
2. Range: ~240 Km
3. Data Type: PPI Reflectivity (dBZ)
4. Elevation: 0.6 Degrees.

xv. Phuket:

1. Update Interval: 20 Minutes (website updates at approximately HH:15, HH:35, HH:55). Google Earth version updates at approximately HH:19, HH:39, and HH:59 to account for late site updates and to remove backgrounds.
2. Range: ~240 Km.
3. Data Type: PPI Reflectivity (dBZ) from -10.5 to 66.5. Google Earth version starts at about 5 dBZ.
4. Elevation: 0.5 Degrees.

xvi. Krabi:

1. Update Interval: Hourly (website updates at approximately HH:05). Google Earth version updates at approximately HH:08 to account for late site updates and to remove backgrounds.
2. Range: ~240 Km.
3. Data Type: PPI Reflectivity (dBZ) from -10.5 to 66.5. Google Earth version starts at about 5 dBZ.
4. Elevation: 0.7 Degrees.

xvii. Songkhla:

1. Update Interval: 30 Minutes (website updates at approximately HH:05 and HH:35). Google Earth version updates at HH:09, and HH:39 to account for late site updates and to remove backgrounds.
2. Range: ~240 Km.
3. Data Type: PPI Reflectivity (dBZ) from -10.5 to 66.5. Google Earth version starts at about 1.5 dBZ.
4. Elevation: 0.5 Degrees.

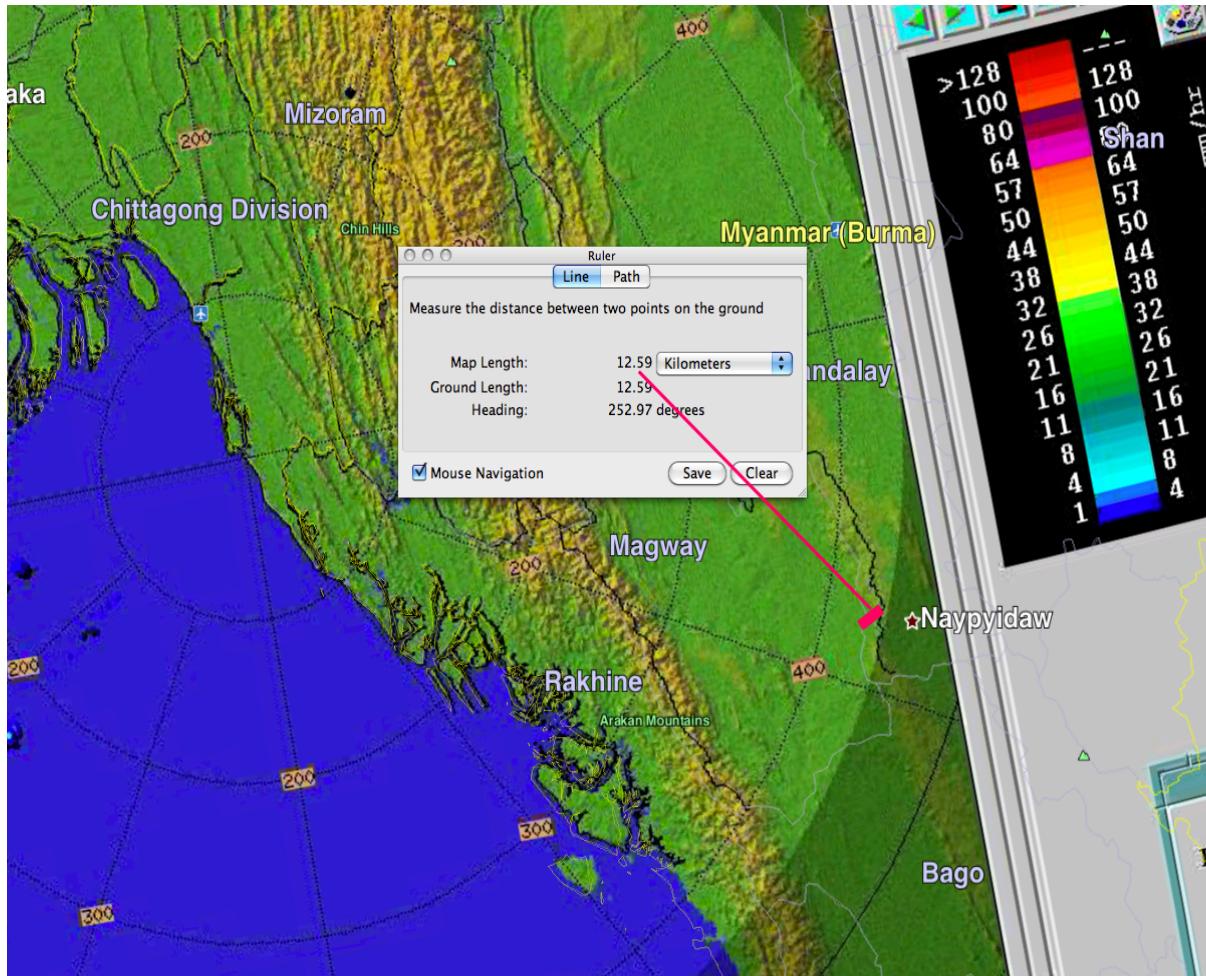
2. Malaysia Radar Notes

- a. Malaysia splits its radar sites (10 in all) into two categories:
 - i. Peninsula- Located south of Thailand
 - ii. Sabah & Sarawak – Northern tier of the Indonesian mainland.
- b. The radar sites (6 Peninsula, 4 Sabah and Sarawak) are lumped so that each region comprises of one image instead of each region having its own image the way Thailand does.
- c. While most of the ranges of the radars in Thailand are 240 Km, the Malaysian radars have a maximum range of 300 Km except for the one near Kuala Lumpur which has a maximum radius of about 340 Km.
- d. Each region's radar images are updated once every 10 minutes. The images are updated 10 minutes after the time stamp on the image in most instances. The Google Earth version updates 1-2 minutes after the site updates so the images can be as old as about 22 minutes before getting a fresh update on Google Earth.
- e. Radar measured intensity is plotted as rainfall rate ranging from 0.05 mm/hr to >800 mm/hr. However to help prevent clutter the Google Earth version starts at about 1 mm/hr which is dark green on the color bar.
- f. Image sizes are a little bit larger than those offered by Thailand but since the image covers multiple radars the quality still isn't the greatest.
- g. Since the intensity is being measured in rain rates, a CAPPI (Constant Altitude Plan Position Indicator) format is used which uses multiple

elevation scans to derive the intensity at a height level (2 Km in this case) instead of a single elevation angle.

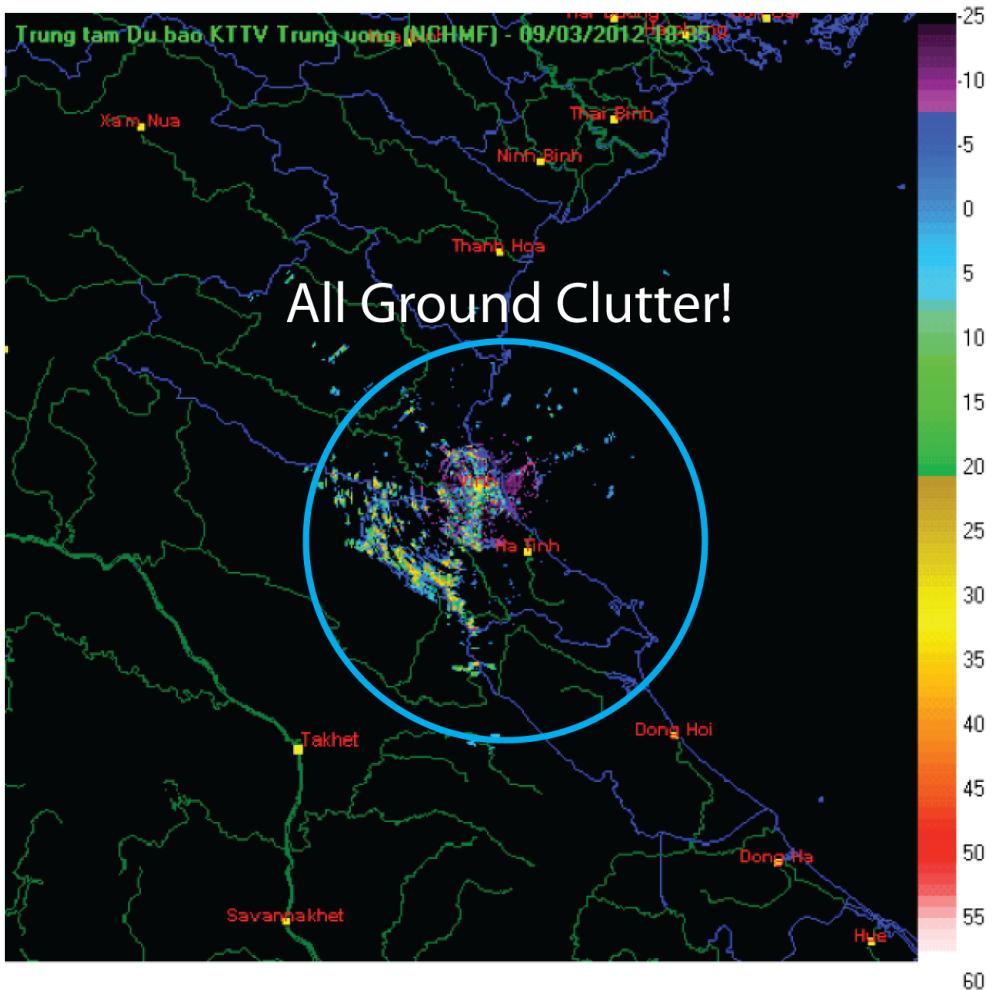
3. Bangladesh

- a. Currently Bangladesh radar imagery **is not being utilized** for Google Earth because the projection of the imagery is different than that of Google Earth, and there seems to be an issue with maintenance as images are often severely outdated. As a result of the difference in projection, trying to overlay imagery will result in discrepancies in radar echo location. See the figure below. As can be seen in the example, the image is offset by as much as 12.5 Km or more in some locations.
- b. The Bangladesh radars all have a 440 Km range and use the CAPPI format with a CAPPI height of 1.0 Km with the exception of Dhaka which according to the imagery is set to 0.0 Km (not sure how this would be possible unless the lowest elevation scan is set at 0.0 degrees which should really never be done because of ground clutter issues).
- c. Radar intensity is measured as rain rate in mm/hr. Intensity scale ranges from 1 to > 128 mm/hr.
- d. There are five sites:
 - i. Dhaka
 - ii. Cox's Bazer
 - iii. Khepupara
 - iv. Rangpur
 - v. Molvibazar
- e. Overall there looks to be issues with consistent updates with most of these sites. At the time of this writing several of the 'current' images were more than 3 days old.
- f. The update frequency looks to be 15 minutes for each site (though this is inconclusive since at the time of this writing none of the radar sites were up to date).



4. Vietnam

- a. Vietnam has three radar sites:
 - i. Vinh
 - ii. Viet Tri
 - iii. Phu Lien
- b. Each site has a 5 minute update frequency.
- c. Intensity is given as PPI Reflectivity (dBZ) with a range of -25 to 60 dBZ.
- d. The Vietnam radars are currently **not being utilized** in Google Earth because there is no ground clutter removal what so ever. As a result, there are significant false targets as far out as nearly 100 Km from the radar site (see figure below).
- e. The maximum range of each of the radars is 256 Km.
- f. It is not known what elevation scan is being used but it is most likely the lowest available scan (0.4 to 0.6 degrees) given the significant ground clutter.



5. India

- a. India has a publically available radar network (<http://www.imd.gov.in/section/dwr/dynamic/dwr.htm>) but most of the imagery is of no use since it mostly covers mainland India. There is some coverage just off of the mainland into the Bay of Bengal and into Nepal, but not very much. The projections are also not the same as Google Earth. There were also a few sites that did not have imagery available at the time of this writing. See the figure below:

