

Rural Training Center – Thailand (RTC-TH)



**Community-based Environmental Education
for the Self-sufficiency and Sustainability of
Small Rural Family Farms**

Advanced MEWS

Weather bserving Lesson A6: Weather Forecasting



MEWS Lesson A6



A Mobile Emergency Weather Station (MEWS) Training Series presentation



Rural Training Center-Thailand
Emergency Communications Program

Ready to serve and sustain our community

For other lessons in the series e-mail hs0zhm@gmail.com
www.neighborhoodlink.com/RTC-TH_Tech/pages

A part of the RTC-TH EmComm Program

The Rural Training Center-
Thailand Emergency
Communications program
is a volunteer effort to
provide emergency

amateur radio communications for
local community self-sufficiency and
sustainability in times of need.



The Rural Training Center-Thailand (RTC-TH)



is an all volunteer
organization providing
community-based
environmental education
for self-sufficiency and
sustainability of small
rural family farms

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MEWS adapts weather lessons from two existing RTC-TH programs



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The Rural Training Center-Thailand was created to honor the life and memory of Mr. Tang Suttisan, a father, farmer and former custodian of Ban Na Fa Elementary School who appreciated and valued education.



CAUTION!

Weather forecasting by the methods in this lesson is very rough. MEWS is not a substitute for official government weather forecasts.

MEWS weather forecasting is made to give possible weather warning for survivors and on-site emergency relief leaders. ***If you are not comfortable making a forecast, DON'T.*** It is better to leave the forecasting to professionals rather than to mislead on-site emergency leaders and survivors.

Although this is an “Advanced” MEWS lesson, the forecasting methods are simplistic in contrast to professional forecasts from government agencies.

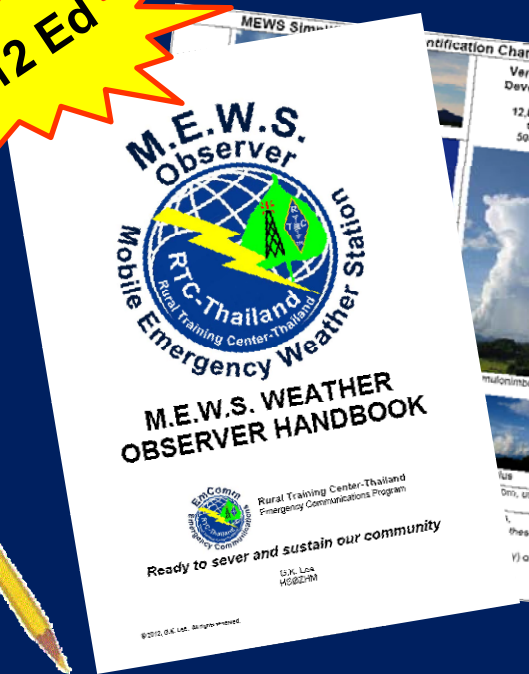


What you need to have to prepare a local weather forecast

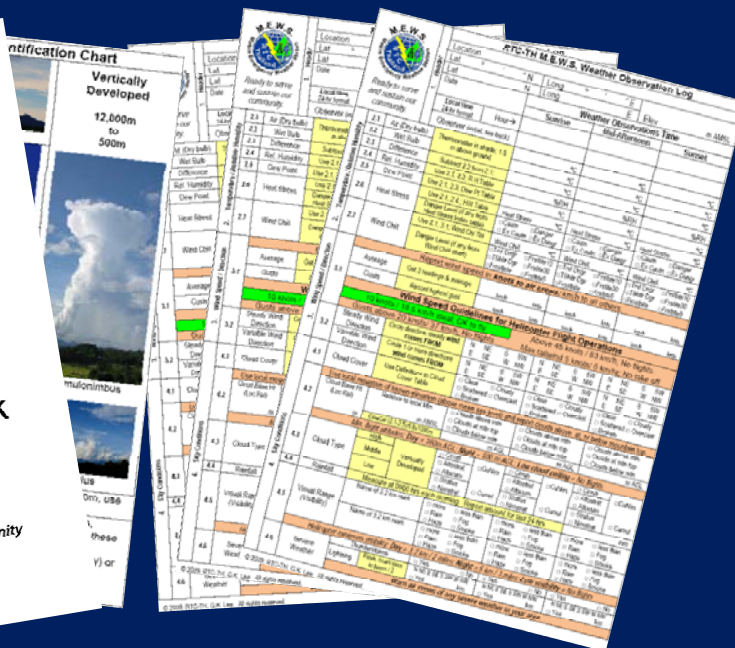
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Pencil



MEWS Handbook and Cloud Chart



Completed Log s from 2-3 days

Optional



Digital weather station or barometer / altimeter

Weather forecasting is NOT a standard MEWS activity so there is not space on the Log Form for it.



Key local forecast variables

Variable	Data Source	Note
Cloud changes	Previous 3 days MEWS Logs	Keep all logs
Pressure changes	Analog barometer, Altimeter, or digital weather station*	Optional equipment
Changes in wind direction	Previous 3 days MEWS Logs	Keep all logs

* Generally analog barometers are less expensive than digital weather stations.



Analog barometers



Barometric altimeter



Digital weather station



Start with completed log forms

The key data are:

- Cloud cover (4.1)
- Cloud Base Height (4.2)
- Cloud type (4.3)

It may be useful to get completed logs from the previous 24-48 hours if they are available.

















RTC-TH M.E.W.S. Weather Observation Log									
Location									
Lat ° ' " N		Long ° ' " E		Lat ° ' " N		Long ° ' " E		Elev m AMSL	
Date		Weather Observations Time							
Local time 24-hr format		Hour →		Sunrise		Mid-Afternoon		Sunset	
Observer (initial; see back)									
1. Temperature / Relative Humidity	2.1	Air (Dry bulb)	Thermometer in shade; 1.5 m above ground	°C	°C	°C	°C	°C	°C
	2.2	Wet Bulb		°C	°C	°C	°C	°C	°C
	2.3	Difference	Subtract 2.2 from 2.1;	°C	°C	°C	°C	°C	°C
	2.4	Rel. Humidity	Use 2.1, 2.3; R H Table	%RH	%RH	%RH	%RH	%RH	%RH
	2.5	Dew Point	Use 2.1, 2.3; Dew Pt Table	°C	°C	°C	°C	°C	°C
2. Temperature / Relative Humidity	2.6	Heat Stress	Use 2.1, 2.4; HSI Table	Heat Stress °C	Heat Stress °C	Heat Stress °C	Heat Stress °C	Heat Stress °C	Heat Stress °C
	2.7	Wind Chill	Use 2.1, 3.1; Wind Chl Tbl	Wind Chill °C	Wind Chill °C	Wind Chill °C	Wind Chill °C	Wind Chill °C	Wind Chill °C
3. Wind Speed / Direction	Report wind speed in knots to air crews ; km/h to all others.								
	Average	Get 3 readings & average	km/h	knts	km/h	knts	km/h	knts	km/h
	Gusts	Record highest gust	km/h	knts	km/h	knts	km/h	knts	km/h
	Wind Speed Guidelines for Helicopter Flight Operations								
	10 knots / 18.5 km/h ideal, OK to fly Above 45 knots / 83 km/h; No flights. Gusts above 20 knots/ 37 km/h; No flights Max tailwind 5 knots/ 6 km/hr; No take off								
3. Wind Speed / Direction	3.1	Steady Wind Direction	Circle direction steady wind comes FROM	N NE S SW E SE W NW	N NE S SW E SE W NW	N NE S SW E SE W NW	N NE S SW E SE W NW	N NE S SW E SE W NW	
	3.2	Variable Wind Direction	Circle 1 or more directions wind comes FROM	N NE S SW E SE W NW	N NE S SW E SE W NW	N NE S SW E SE W NW	N NE S SW E SE W NW	N NE S SW E SE W NW	
4. Sky Conditions	4.1	Cloud Cover	Use Definitions in Cloud Cover Table	<input type="checkbox"/> Clear <input type="checkbox"/> Cloudy <input type="checkbox"/> Scattered <input type="checkbox"/> Overcast <input type="checkbox"/> Broken	<input type="checkbox"/> Clear <input type="checkbox"/> Cloudy <input type="checkbox"/> Scattered <input type="checkbox"/> Overcast <input type="checkbox"/> Broken	<input type="checkbox"/> Clear <input type="checkbox"/> Cloudy <input type="checkbox"/> Scattered <input type="checkbox"/> Overcast <input type="checkbox"/> Broken	<input type="checkbox"/> Clear <input type="checkbox"/> Cloudy <input type="checkbox"/> Scattered <input type="checkbox"/> Overcast <input type="checkbox"/> Broken	<input type="checkbox"/> Clear <input type="checkbox"/> Cloudy <input type="checkbox"/> Scattered <input type="checkbox"/> Overcast <input type="checkbox"/> Broken	
	4.2	Cloud Base Height (Loc Rel)	Use local mountain of known elevation (above mean sea level) and report clouds above, at, or below mountain top.	Clouds above mtn	Clouds above mtn	Clouds above mtn	Clouds above mtn	Clouds above mtn	
		Relative to local Mtn	Clouds at mtn top	Clouds at mtn top	Clouds at mtn top	Clouds at mtn top	Clouds at mtn top		
		m AMSL	Clouds below mtn	Clouds below mtn	Clouds below mtn	Clouds below mtn	Clouds below mtn		
		DewCal (2.1-2.5)/9.8x1000m	m AGL	m AGL	m AGL	m AGL	m AGL		
4.3	Cloud Type	High Middle Low	Vertically Developed	<input type="checkbox"/> Cirrus <input type="checkbox"/> Altostrat <input type="checkbox"/> Altocum <input type="checkbox"/> Stratus <input type="checkbox"/> Nimstrat	<input type="checkbox"/> CuNim <input type="checkbox"/> Cumul	<input type="checkbox"/> Cirrus <input type="checkbox"/> Altostrat <input type="checkbox"/> Altocum <input type="checkbox"/> Stratus <input type="checkbox"/> Nimstrat	<input type="checkbox"/> CuNim <input type="checkbox"/> Cumul	<input type="checkbox"/> Cirrus <input type="checkbox"/> Altostrat <input type="checkbox"/> Altocum <input type="checkbox"/> Stratus <input type="checkbox"/> Nimstrat	
4.4	Rainfall	Measure at 0900 hrs each morning. Report amount for last 24 hrs.	mm	mm	mm	mm	mm		
4.5	Visual Range (Visibility)	Name of 3.2 km mark	<input type="checkbox"/> more <input type="checkbox"/> less than	<input type="checkbox"/> more <input type="checkbox"/> less than	<input type="checkbox"/> more <input type="checkbox"/> less than	<input type="checkbox"/> more <input type="checkbox"/> less than	<input type="checkbox"/> more <input type="checkbox"/> less than		
		Name of 3.2 km mark	<input type="checkbox"/> Rain <input type="checkbox"/> Fog <input type="checkbox"/> Haze <input type="checkbox"/> Smoke	<input type="checkbox"/> Rain <input type="checkbox"/> Fog <input type="checkbox"/> Haze <input type="checkbox"/> Smoke	<input type="checkbox"/> Rain <input type="checkbox"/> Fog <input type="checkbox"/> Haze <input type="checkbox"/> Smoke	<input type="checkbox"/> Rain <input type="checkbox"/> Fog <input type="checkbox"/> Haze <input type="checkbox"/> Smoke	<input type="checkbox"/> Rain <input type="checkbox"/> Fog <input type="checkbox"/> Haze <input type="checkbox"/> Smoke		
4.6	Severe Weather	Thunderstorms	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No	<input type="checkbox"/> Yes <input type="checkbox"/> No		
	Lightning	Flash, count secs to boom / 3	N NE E SE S SW W NW	N NE E SE S SW W NW	N NE E SE S SW W NW	N NE E SE S SW W NW	N NE E SE S SW W NW		
			km	km	km	km	km		
Warn air crews of any severe weather in your area.									

Keep the Cloud Chart handy

Get familiar with the Cloud Chart so you can readily recognize the different types of clouds.

Don't worry about memorizing the chart. Repeated use and familiarity will enable you to learn these quickly.

MEWS Simplified Cloud Identification Chart				
High 12,000m to 6,000m			Vertically Developed 12,000m to 500m	
	Cirrus	Cirrostratus		
				
	Cirrocumulus	Contrails		
Middle 6,000m to 2,000 m				
	Altostratus	Altostratus		
Low 2,000m to Surface				
		Stratus		
				
		Nimbostratus		
Estimating Cloud Base Height: Identify cloud type; report Low clouds as 2000m, use lower limit for other cloud types.				
Flight Advisories: Report flight advisory to air crews for the following conditions. Low Clouds near or at 160m AGL (day); 500m AGL (Night). No flights if below these minimum limits. Reduced Visibility: Smoke, dust, haze, fog reducing visual range to 3.2 km (Day) or 5 km (Night); No flights if below these minimum limits. Severe Weather: Thunderstorms, lightning, heavy rain, excessive winds, or other weather extremes.				



Weather Forecasting Methods in this Lesson

- Forecasting by cloud changes:
Detailed review
- Forecasting by Barometric
Pressure Change
- Forecasting by Changes in
Barometric Pressure and Wind
Direction



You may want to review the addendum to MEWS Lesson B6 about forecasting weather by cloud changes.

Weather Forecasting by Cloud Changes

Watching the changes in clouds is fundamental to weather forecasting

Cloud Feature	Clear / Fair Weather	Changing Weather	Stormy / Rainy Weather
Cloud Type	Cumulus	Cirrus Cirrostratus Cirrocumulus	Alto cumulus Altostratus Cumulonimbus Nimbostratus
Cloud (sky) cover	Decreasing cloudiness		Increasing cloudiness
Cloud Base Height	Increasing height		Decreasing height

Get the Cloud Type data from log form Section 4.3



Clouds Foretelling Weather Change



Cirrus clouds



Altostratus clouds



Stratus Clouds

Cloud Type	Changing Weather
Cirrus	Storm clouds coming in 24-48 hours
Altostratus	Changing weather is approaching
Stratus	Bad weather is approaching



Weather Forecasting by Cloud Observation

If the change is from Cumulus to Cirrus type clouds, there may be a change in 24-48 hours to possible stormy or rainy weather.



Cumulus



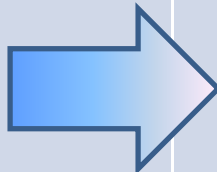
Cirrus clouds



Cirrostratus



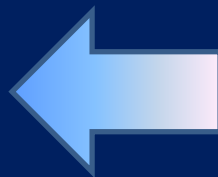
Cirrocumulus

Cloud Feature	Clear / Fair Weather	Changing Weather
4.1 Cloud cover	Decreasing cloudiness	Increasing cloudiness
4.2 Cloud Base Ht	Increasing height	Decreasing height
4.3 Cloud Type	Cumulus 	Cirrus Cirrostratus Cirrocumulus

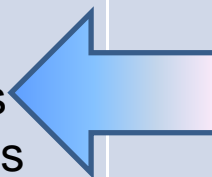


Weather Forecasting by Cloud Changes

If rain clouds are followed by Cirrus type clouds, fair / clear weather is 24-48 hours away.



Cloud Feature	Changing Weather	Stormy / Rainy Weather
4.1 Cloud cover	Decreasing cloudiness	Increasing cloudiness
4.2 Cloud Base Ht	Increasing height	Decreasing height
4.3 Cloud Type	Cirrus Cirrostratus Cirrocumulus	Altocumulus Altostratus Cumulonimbus Nimbostratus



Clouds of Fair Weather



Cumulus clouds



Altostratus clouds

Cloud Type	Fair Weather
Cumulus	When small and widely scattered
Altostratus	Settled weather conditions



Rainy Weather Clouds



Cumulonimbus

Cumulus

Nimbostratus

Stratocumulus

Stratus

Some images from
the internet:
educational fair use
clause

Cloud Type	Rainy Weather
Cumulonimbus	Rain, lightning, thunder, heavy rain, hail possible.
Cumulus	Rain possible especially on hot summer days and when clouds get thick and dark
Nimbostratus	Rainstorm likely when dark gray clouds are low and widely cover the sky; drizzly rain.
Stratocumulus	When wide spread possible drizzly rain.
Stratus	Drizzly rain when clouds stretched out widely in calm flat layers.

Darker clouds are thicker and block more sunlight. Thicker clouds mean more vertical development which could mean more turbulence, rain, lightning, thunder.



Weather Forecasting by Barometric Pressure Change

Generally, low pressures = foul weather



Generally, high pressures = fair weather

Pressure Trend	Clear / Fair Weather	Changing Weather	Stormy / Rainy Weather
Rising	Fair weather ahead		
Steady		No change from present weather	
Falling			Cloudy/rainy weather ahead

Rate of Barometric Pressure Change

The following terms are used to describe the pressure trend. For example, if the barometric pressure is “rising”, the rate of rising is described by adding the proper adjective: Fast, Moderately, Slowly.

Pressure Change	Descriptive Details
Fast	More than 6 mb change in 3 hours
Moderately	3-6 mb change in 3 hours
Slowly	Less than 3 mb change in 3 hours
Steady	Little or no change



Optional Equipment: A Barometer

Barometers come in two basic types:
Analog or Digital



Cost and convenience drives the decision for most people.

Analog Barometers

The RTC-TH EmComm practice is to use the reference needle to monitor relative pressure changes without keeping written records.



At the start of the day, set the Index needle (yellow arrow) to match the barometer needle (red arrow).



Later, look at the barometer and notice the change relative to the Index needle. In this case, the pressure went up.

Digital Weather Station



Digital weather stations come in a wide array of choices as to what measurements they make. Most will have temperature, pressure, date, time, and a graphic icons for forecasts.

Many digital systems need about 24 hours to stabilize if the unit is moved 45 km or so from one location to another. Be sure you have spare batteries.



Digital Weather Station

This digital unit uses an arrow to indicate the pressure change trend.

A graphic icon shows the weather forecast. In this case, “sunny”.



Digital Weather station

This digital barometer tracks the measured pressure changes 0, 1, 3, 6, 12, 24 hours ago. The graphic display lets you describe the rate of pressure change.

Actual current pressure units is displayed



Weather forecast icon is showing “partly sunny”



Forecasting by Pressure / Wind Changes

This forecasting method requires you to have past wind direction data (Section 3.2 from the MEWS log form) and a barometer or barometric altimeter.

You also need to be able to know the pressure trend and the rate of pressure change.

Use the following tables to make your forecast.



M.E.W.S. Mobile Emergency Weather Station									
RTC-TH M.E.W.S. Weather Observation Log									
1. Header		Location							
Lat		°		° N		Long		° ° E	
Lat		N		Long		E		Elev m AMSL	
Date		Weather Observations Time							
Local time 24-hr format		Hour		Sunrise		Mid-Afternoon		Sunset	
Observer (initial; see back)									
2.1	Air (Dry bulb)	Thermometer in shade; 1.5 m above ground		°C		°C		°C	
	Wet Bulb			°C		°C		°C	
	Difference	Subtract 2.2 from 2.1;		°C		°C		°C	
	Rel. Humidity	Use 2.1, 2.3, R H Table		%RH		%RH		%RH	
	Dew Point	Use 2.1, 2.3, Dew Pt Table		°C		°C		°C	
2.6	Heat Stress	Use 2.1, 2.4; HSI Table		Heat Stress °C		Heat Stress °C		Heat Stress °C	
		Danger Level (if any from Heat Stress Index table)		°C		°C		°C	
2.7	Wind Chill	Use 2.1, 3.1; Wind Chl Tbl		Wind Chill °C		Wind Chill °C		Wind Chill °C	
		Danger Level (if any from Wind Chill chart)		°C		°C		°C	
3.1	Report wind speed in knots to air crews; km/h to all others.								
	Average	Get 3 readings & average		km/h		knts		knts	
3.2	Gusts	Record highest gust		km/h		knts		knts	
				km/h		knts		knts	
3.3	Wind Speed / Direction	Wind Speed Guidelines for Helicopter Flight Operations							
		10 knots / 18.5 km/h ideal. OK to fly. Above 45 knots / 83 km/h: No flights.							
3.4	Steady Wind Direction	Circle direction steady wind comes FROM		N NE S SW		N NE S SW		N NE S SW	
	Variable Wind Direction	Circle 1 or more directions wind comes FROM		E SE W NW		E SE W NW		E SE W NW	
4.1	Cloud Cover	Use Definitions in Cloud Cover Table		Clear ☐ Cloudy ☐ Scattered ☐ Overcast ☐ Broken		Clear ☐ Cloudy ☐ Scattered ☐ Overcast ☐ Broken		Clear ☐ Cloudy ☐ Scattered ☐ Overcast ☐ Broken	
4.2	Cloud Base Ht (Loc Rel)	Relative to local Min		Clouds above min		Clouds above min		Clouds above min	
		m AMSL		Clouds at min top		Clouds at min top		Clouds at min top	
4.3	Cloud Type	Middle Vertically Developed		Cirrus ☐ Altostrat ☐ Altostrat ☐ Cumul ☐ Cumul ☐ Nimstrat		Cirrus ☐ Altostrat ☐ Altostrat ☐ Cumul ☐ Cumul ☐ Nimstrat		Cirrus ☐ Altostrat ☐ Altostrat ☐ Cumul ☐ Cumul ☐ Nimstrat	
4.4	Rainfall	Measure at 0900 hrs each morning. Report amount for last 24 hrs.		more ☐ less than ☐		more ☐ less than ☐		more ☐ less than ☐	
4.5	Visual Range (Visibility)	Name of 3.2 km mark		more ☐ less than ☐		more ☐ less than ☐		more ☐ less than ☐	
4.6	Severe Weather	Thunderstorms ☐ Yes ☐ No		N NE E SE S SW W NW		N NE E SE S SW W NW		N NE E SE S SW W NW	
		Flash, count secs to boom / 3		km		km		km	
Helicopter minimum visibility: Day = 3.2 km / 2 miles; Night = 5 km / 3 miles; Low visibility = No flights.									
Warn air crews of any severe weather in your area.									

Forecasting by Pressure / Wind Changes

Psu (mb)	Psu Trend	Wind Change	Forecast
1020-1024	Steady	SW to NW	Fair for 1-2 days
	Rising Fast		Fair; warmer temps and rain in 2 days
	Falling Slowly		Warmer with rain 24-36 hrs
	Falling Fast		Warmer with rain 18-24 hrs
1024+	Steady		Continued fair
1024+	Falling Slowly		Slow temp increase; fair for 2 days

Forecasting by Pressure / Wind Changes

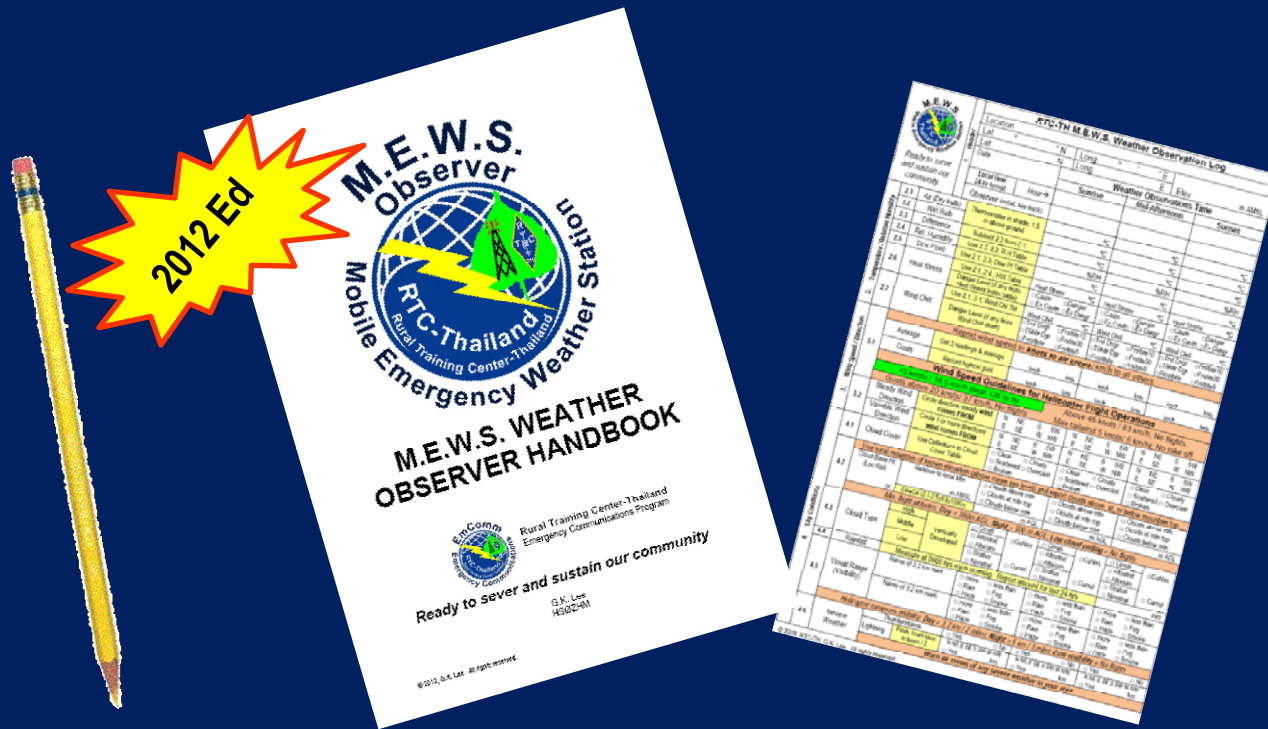
Psu (mb)	Psu Trend	Wind Change	Forecast
1020-1024	Falling Slowly	S to SE	Rain in 24 hrs
	Falling Fast		Increasing winds; rain in 12-24 hrs.
	Falling Slowly	SE to NE	Rain in 18-24 hrs.
	Falling Fast		Increasing winds; rain in 12 hrs
1020 +	Falling Slowly	E to NE	Summer: light wind, no rain for several days. Winter: rain in 24 hrs
	Falling Fast		Summer: rain in 12-24 hrs. Winter: rain; increasing winds from NE

Forecasting by Pressure / Wind Changes

Psu (mb)	Psu Trend	Wind Change	Forecast
1019 or less	Falling Slowly	SE to NE	Rain continues 1-2 days
	Falling Fast		Rain, high winds; clearing in 24 hrs
	Rising Slowly	S to SW	Clearing in a few hrs; continues several days
1009 or less	Falling Fast	S to E	Severe storm; clearing in 24 hrs
	Falling Fast	E to N	Severe storm; cooler temperatures follow
	Rising Fast	Going to W	Clearing; colder temperatures



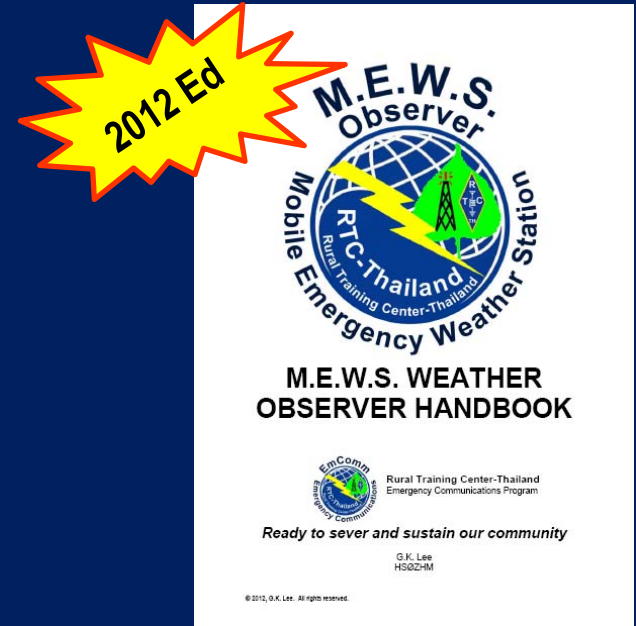
Now you know how to try to forecast the weather



You have completed the Advanced MEWS Lessons. If you want to learn more about Emergency Preparedness, consider getting those lessons. See details later in this lesson.

Questions or Comments

Refer to the MEWS
Weather Observer
Handbook for more
details on any of the
procedures in this lesson.



You may also contact us by e-mail:
hs0zhm@gmail.com
We are always trying to improve our
lessons. Your comments and
suggestions are welcomed.

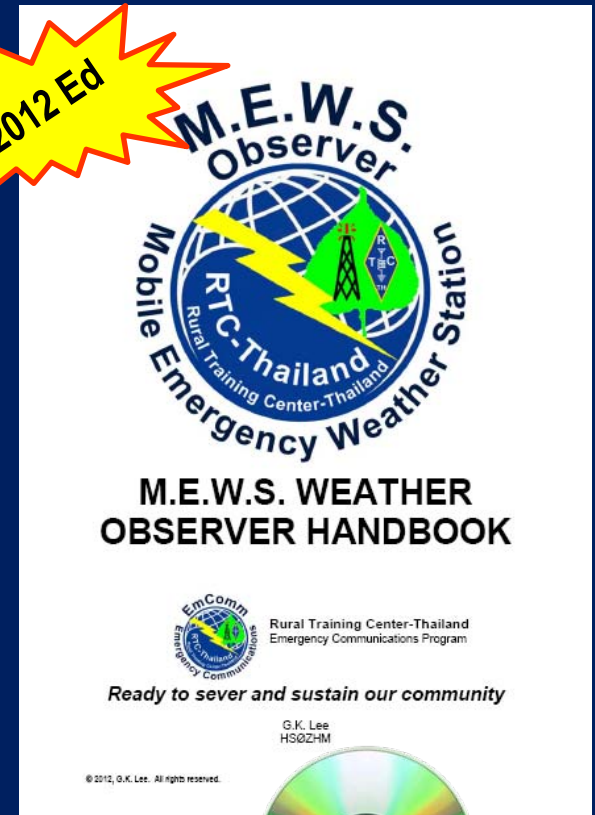
Free Self-Study Materials by Internet

- RTC-TH Weather Observer manual
- Illustrated PDF topical lessons



All of the lessons have been classroom and field proven.

Send e-mail to
hs0zhm@gmail.com to request
free training materials for non-
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These materials are in English. Volunteer assistance for Thai translation to is welcome and will be acknowledged and cited.

Advanced MEWS PDF Lessons

A 1: Measuring Relative Humidity and Heat Stress

A 2: Measuring Wind Speed and Wind Chill

A 3: Using Dew Point Temperature to Calculate Cloud Base Height

A 4: Measuring Rainfall

A 5: Reporting Severe Weather

A 6: Weather Forecasting

Be sure to check www.neighborhoodlink.com/RTC-TH_Tech/pages for the latest updated editions of MEWS lessons



Advanced MEWS PDF Lessons

2012 Ed

Advanced MEWS Weather Observing Lesson A1: Measuring Relative Humidity and Heat Stress



Advanced MEWS Weather Observing Lesson A2: Measuring Wind Speed and Wind Chill



Advanced MEWS Weather Observing Lesson A3: Using Dew Point Temperature to Calculate Cloud Base Height



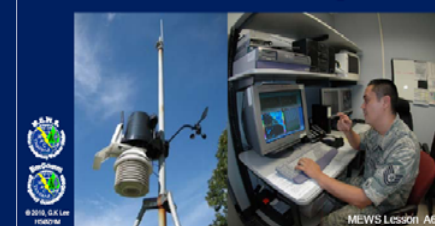
Advanced MEWS Weather Observing Lesson A4: Measuring Rainfall



Advanced MEWS Weather Observing Lesson A5: Reporting Severe Weather



Advanced MEWS Weather Observing Lesson A6: Weather Forecasting



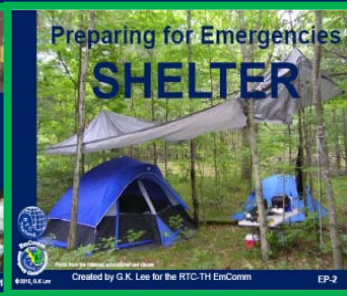
Six slide show lessons;
Some show how to build your own weather
equipment



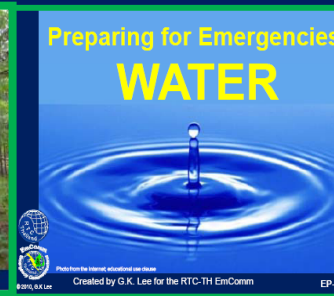
The EP Lesson Series



EP-1



EP-2



EP-3



EP-4



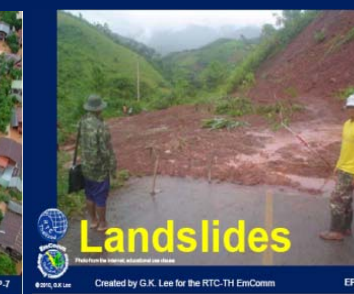
EP-5



EP-6



EP-7



EP-8



EP-9



EP-10



EP-11



EP-12



www.neighborhoodlink.com/RTC-TH_Tech/pages

For More Information about M.E.W.S.



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MEWS Creator / Mentor



Via E-mail
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Via Skype video
conference call: [rtc_th](https://rtc_th.skype.com)

Community-based Environmental Education for



The End

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