Development of Upperair Thailand Cumulus Model (TCM)

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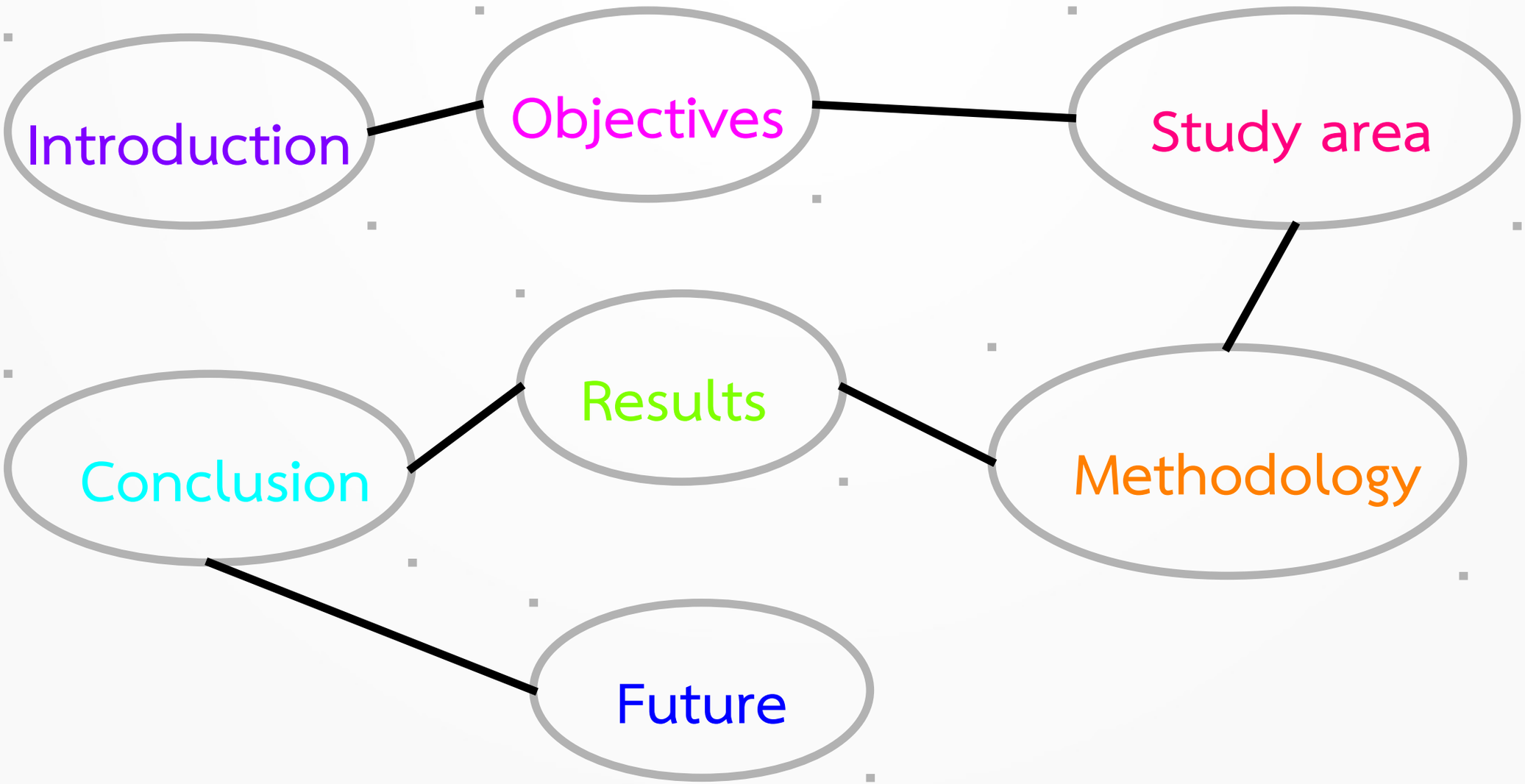
Outline


Introduction
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Introduction

- Royal Rainmaking Operations require reliable warm cloud seeding potential model prediction as daily basis
- Previous model(GPCM or Sonde2) does not match with Thailand topography, land use and atmospheric scale
- Each region of Thailand has different aspects which results in different warm cloud behaviors

Objectives

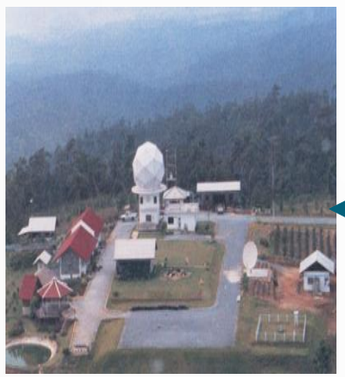
To build reliable warm cloud cumulus model of Thailand for Royal Rainmaking Daily Operations

- To find regional upperair indices which effect to warm cloud seeding potential (WCSP)

- To establish Thailand Cumulus Model (TCM) as reliable daily operation decision making system by regions

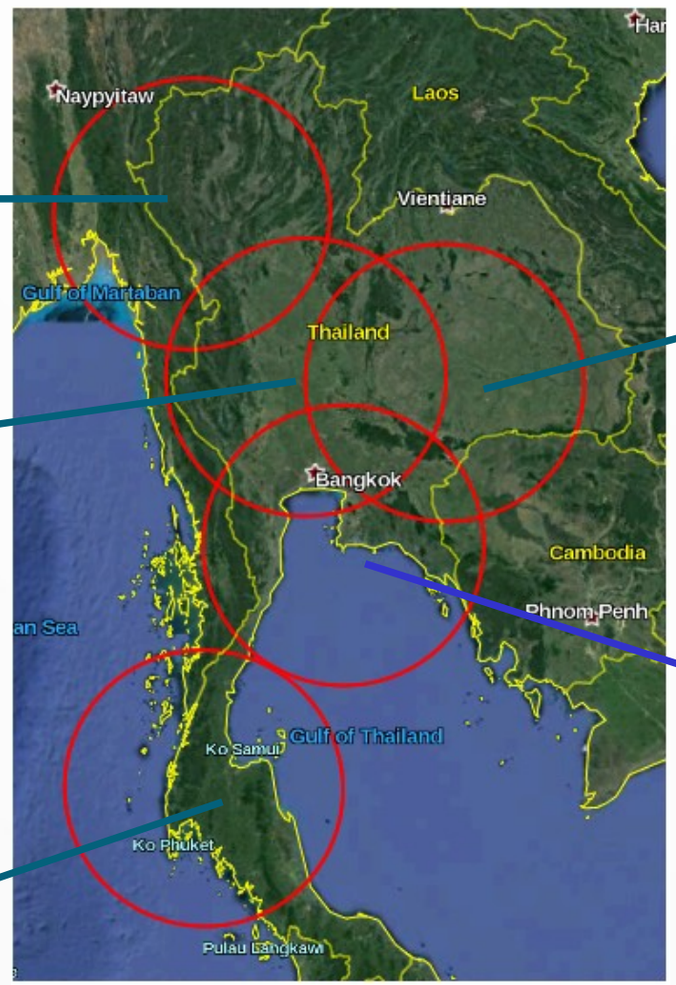
Study Area

Omkoi,
Chiangmai
Alt=1,140 m.



Takli,
Nakornsawan
Alt=235 m.

Panom,
Surathani
Alt=45 m.

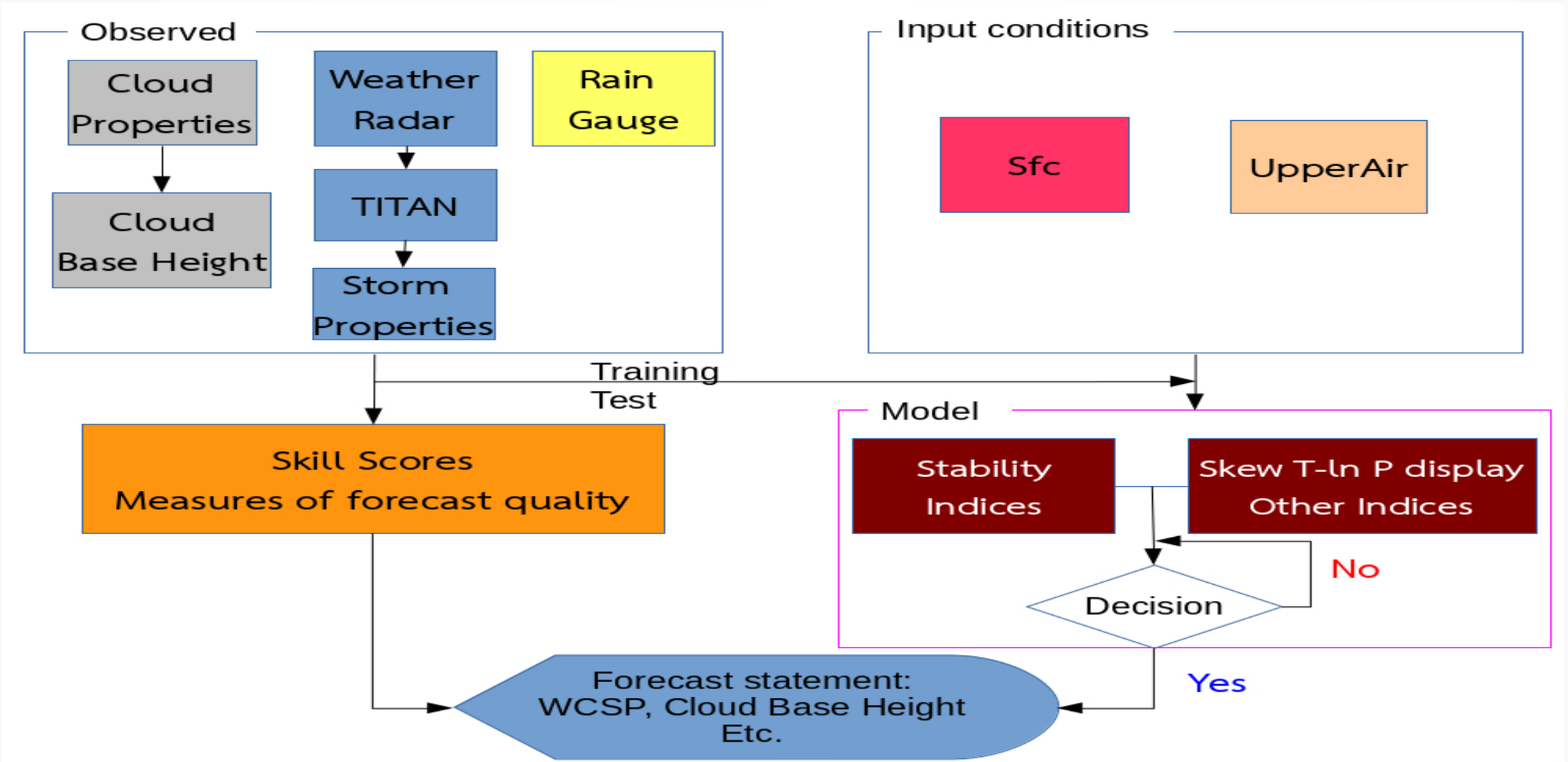


DRRAA Radar(S-band)
and Upperair Station

Pimai
Nakornratchasima
Alt=210 m.

Sattahip
Chonburi
Alt=130 m.

Methodology

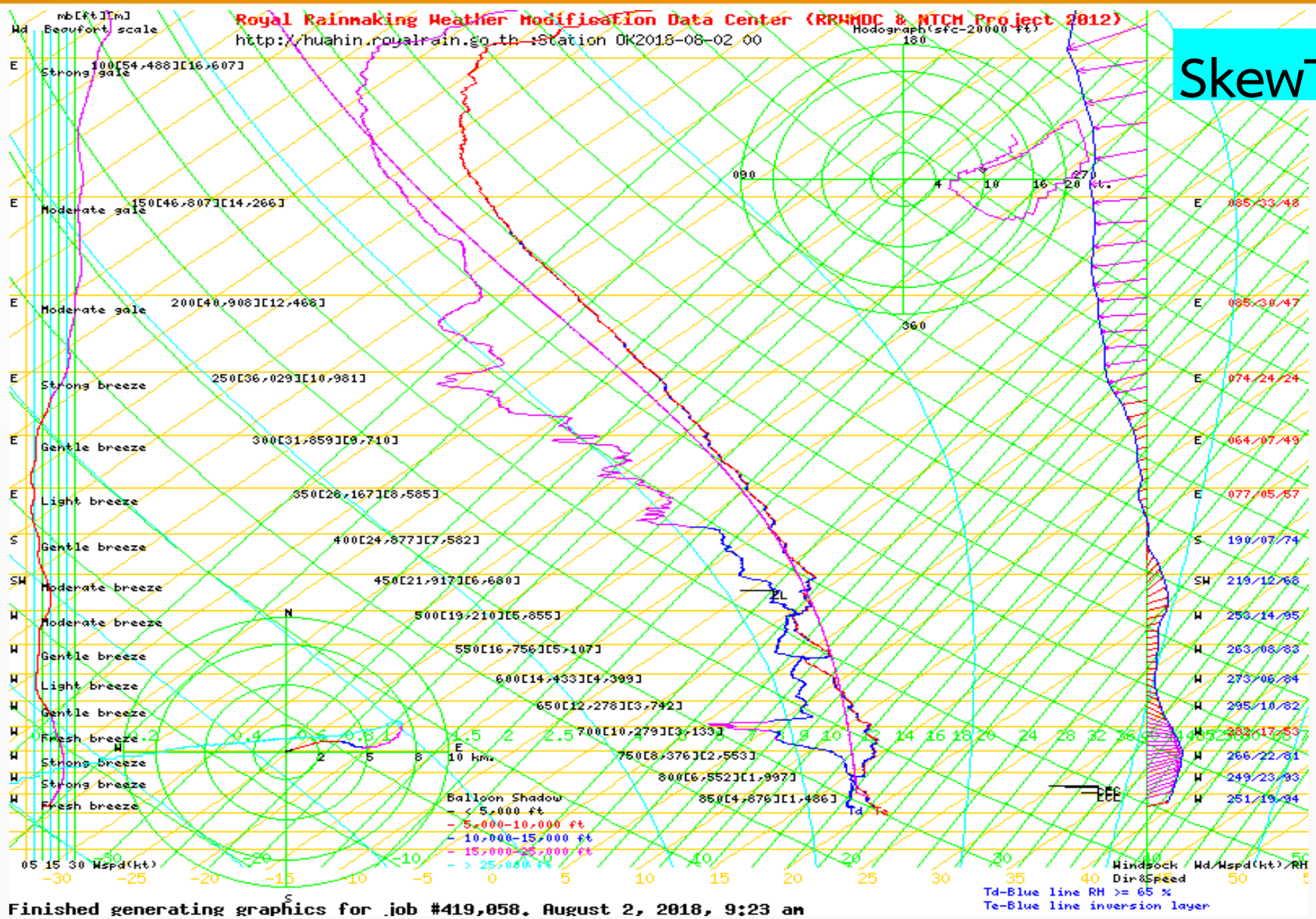


Conceptual Framework

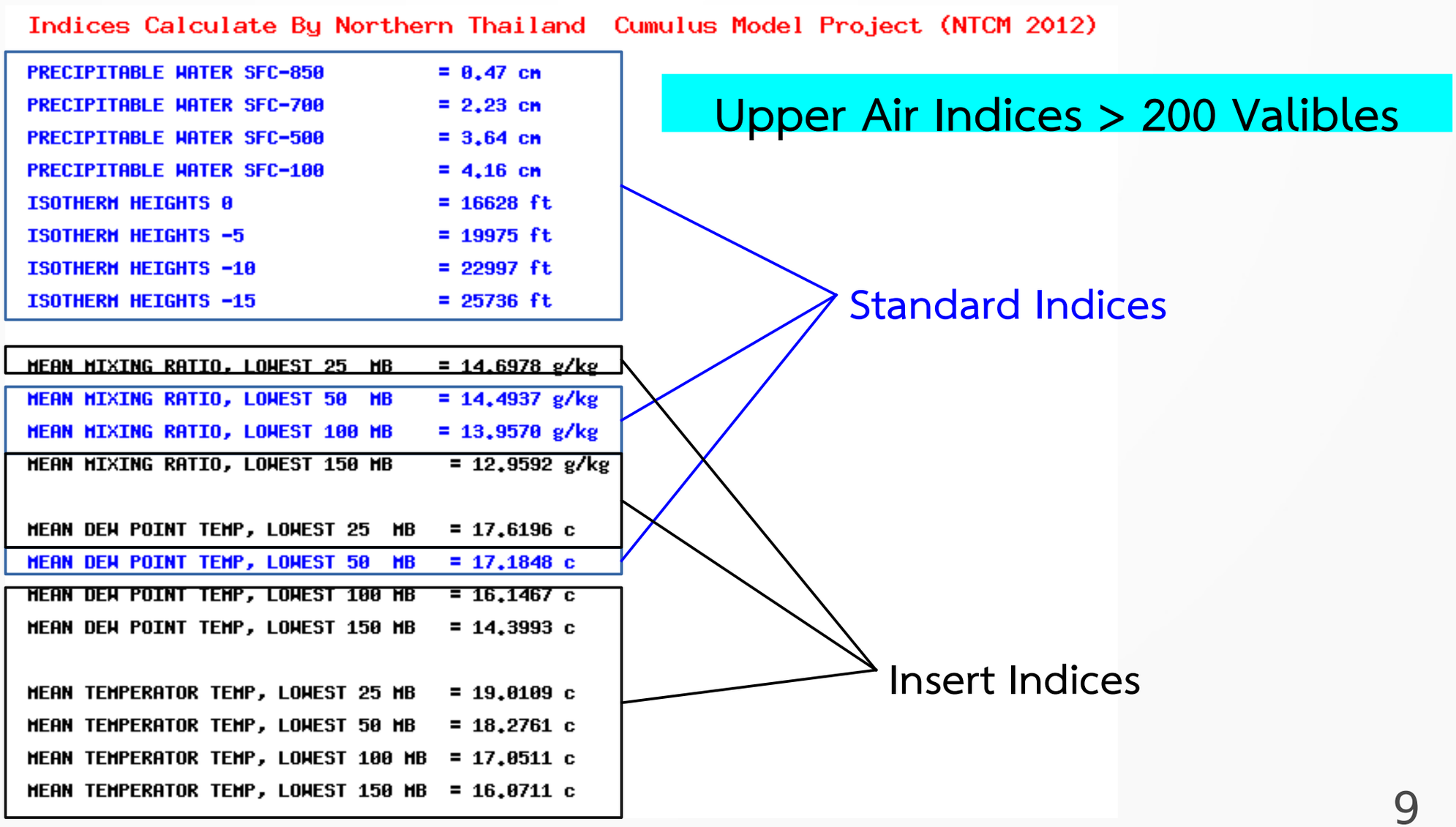
Results

- WCSP forecast vary base on regional characteristics.
- TCM model can be used to help in daily weather modification planning.
- Thailand Cumulus Model (TCM) has 3 sections
  - Skew T ln P
  - Upperair Indices
  - Warm Cloud Seeding Potential (WCSP)

Results(1)


Royal Rainmaking Weather Modification Data Center (RRWMDC & NTCM Project 2012)
http://huahin.royalrain.go.th :Station OK2018-08-02 00
SkewT-lnP
Hodograph(sfc-20000 ft)
Balloon Shadow
Windsock Wd/Wspd(kt)/RH
Dir&Speed
Td-Blue line RH >= 65 %
Te-Blue line inversion layer
Finished generating graphics for job #419,058. August 2, 2018, 9:23 am

Results(2)


Indices Calculate By Northern Thailand Cumulus Model Project (NTCM 2012)
PRECIPITABLE WATER SFC-850 = 0.47 cm
PRECIPITABLE WATER SFC-700 = 2.23 cm
PRECIPITABLE WATER SFC-500 = 3.64 cm
PRECIPITABLE WATER SFC-100 = 4.16 cm
ISOTHERM HEIGHTS 0 = 16628 ft
ISOTHERM HEIGHTS -5 = 19975 ft
ISOTHERM HEIGHTS -10 = 22997 ft
ISOTHERM HEIGHTS -15 = 25736 ft
MEAN MIXING RATIO, LOWEST 25 MB = 14.6978 g/kg
MEAN MIXING RATIO, LOWEST 50 MB = 14.4937 g/kg
MEAN MIXING RATIO, LOWEST 100 MB = 13.9570 g/kg
MEAN MIXING RATIO, LOWEST 150 MB = 12.9592 g/kg
MEAN DEW POINT TEMP, LOWEST 25 MB = 17.6196 c
MEAN DEW POINT TEMP, LOWEST 50 MB = 17.1848 c
MEAN DEW POINT TEMP, LOWEST 100 MB = 16.1467 c
MEAN DEW POINT TEMP, LOWEST 150 MB = 14.3993 c
MEAN TEMPERATOR TEMP, LOWEST 25 MB = 19.0109 c
MEAN TEMPERATOR TEMP, LOWEST 50 MB = 18.2761 c
MEAN TEMPERATOR TEMP, LOWEST 100 MB = 17.0511 c
MEAN TEMPERATOR TEMP, LOWEST 150 MB = 16.0711 c
Upper Air Indices > 200 Valibles
Standard Indices
Insert Indices

Results(3)

Northern Thailand s upperair forcast by NTCM(Omkoi Station)

Warm Cloud Seeding Experimental Day Declaration Criteria

Wet season jd=214 gd=2018-08-02

Max ,Min Criteria = 9,-45

WCSC alt_ftCCLpMean150=9492/-5

WCSC RHCCLMean50=98/1

WCSC AVGRH0_10KFT=84.6591/0

WCSC AVGRH10_18KFT=84.5703/1

WCSC LI50mbLayer500=-0.70/0

WCSC SI850_800mbLayerDifT500mb=-0.58/1

WCSC CAPE850_800=70/-5

WCSC TTI=43.3/0

WCSC CTMean25 TmaxPD=,20.17/-5

Warm Cloud Seeding Potential= Good/-12/61%/1

Warm Cloud Seeding Potential

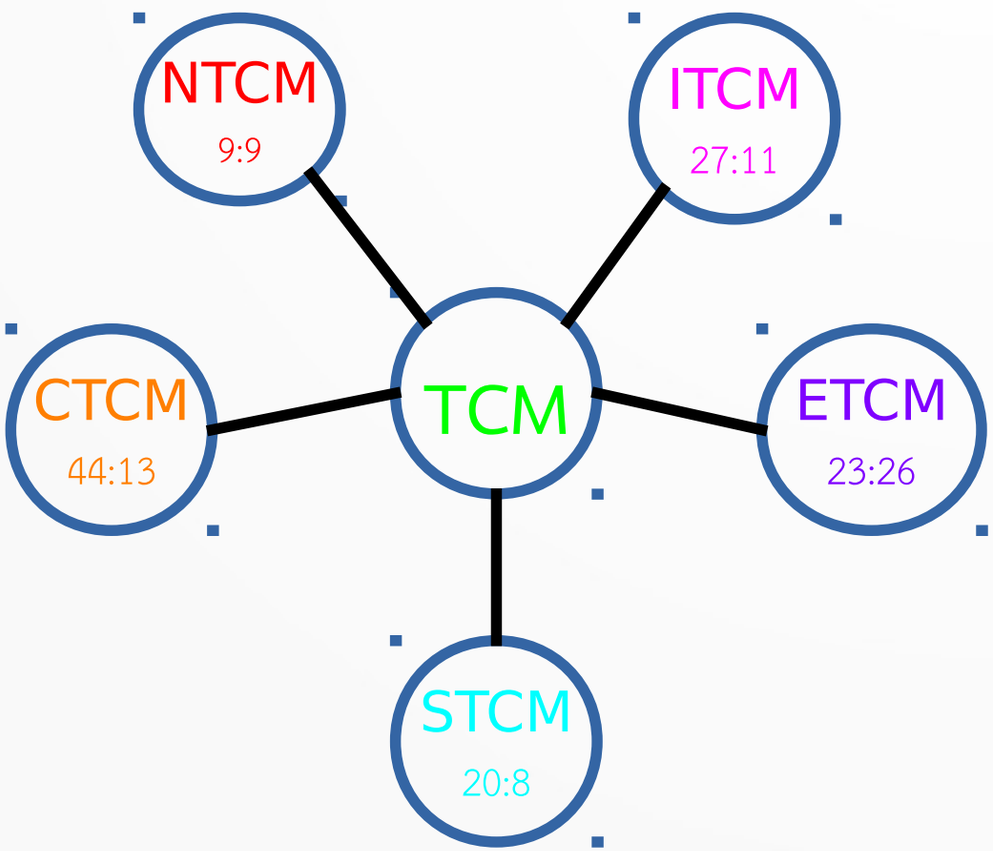
Discussion

The input atmospheric variables can be varied based on

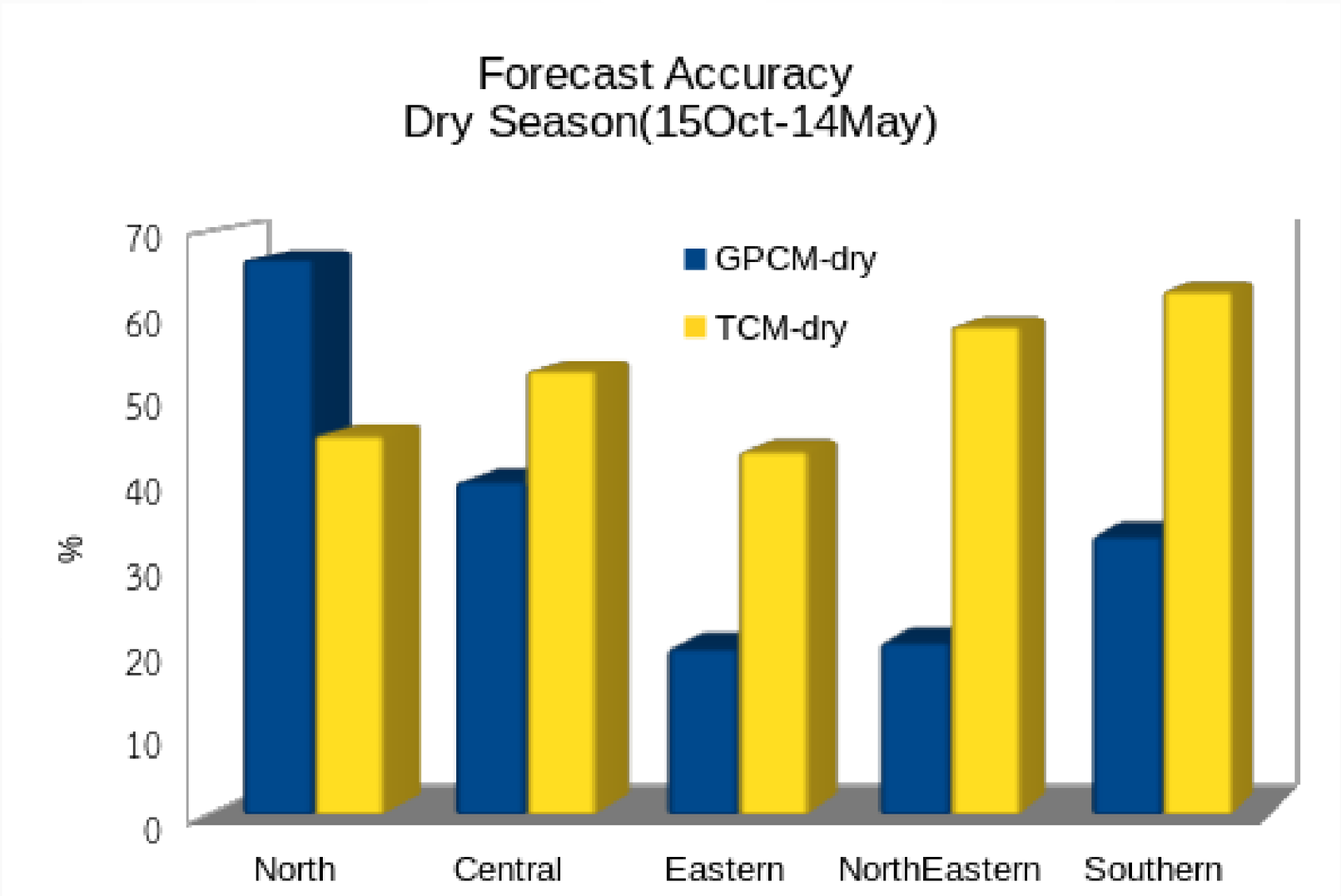
- Season
- Regions
- Topography

Conclusion(1)

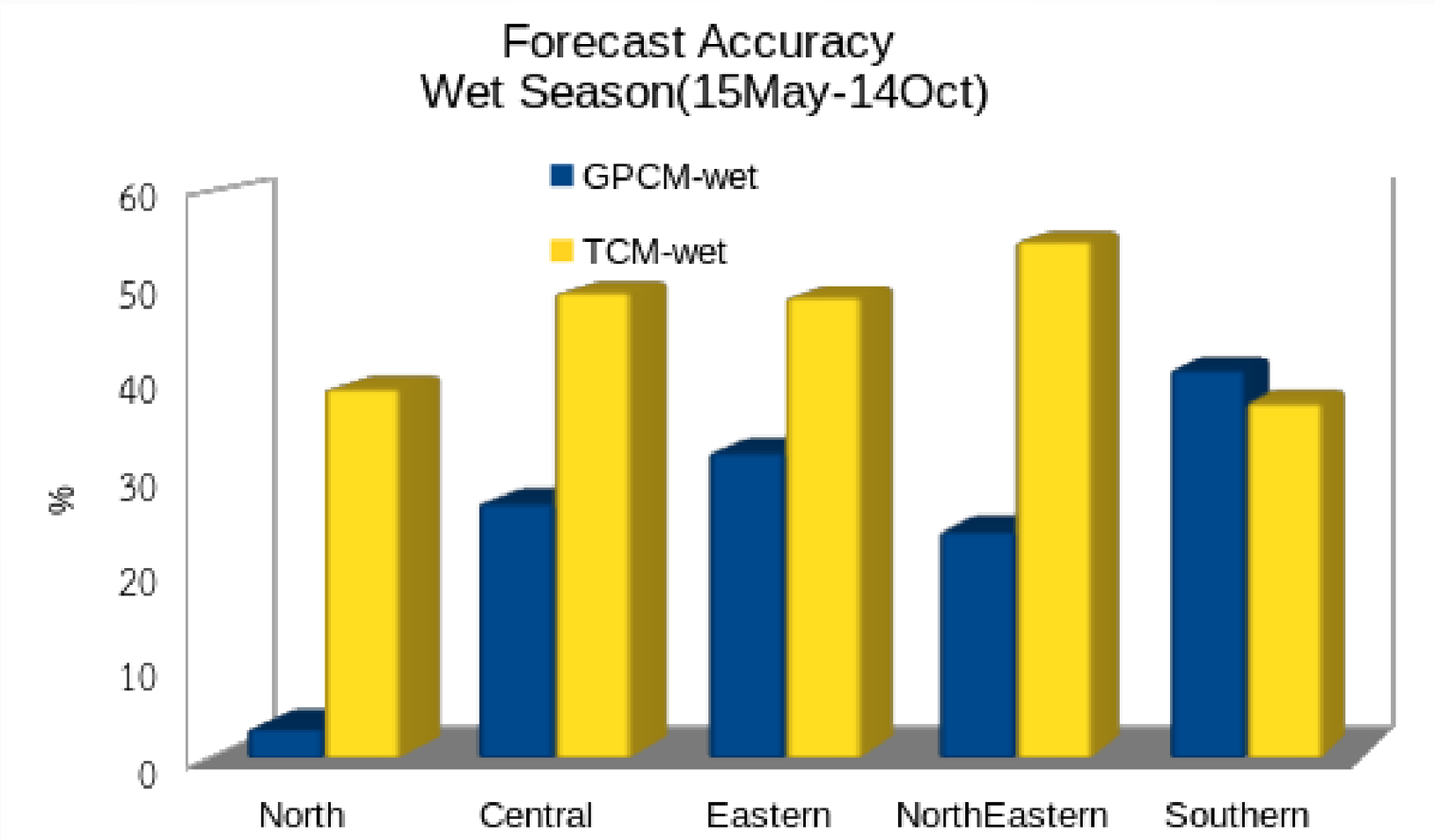
Input significant varibles(#, Dry:Wet)



Conclusion(2)



Conclusion(3)



Recommendations/Future

- TCM can adopt Artificial Intelligent scheme such as Artificial Neutron Network (ANN) for better computation and prediction skill.
- The Thailand Cumulus Model (TCM) can be trained using daily observed variables as input for more precisely Warm Cloud Seeding Model (WCSP) indices forecast.

THANK YOU

http://huahin.royalrain.go.th/

Or

http://122.154.75.4/BRRAAintranet/datacenter/upperairApp/UpperAirMainPub.php