

Country Presentation

SASCOF 9

27-29 September 2016

Myanmar

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Outline of Presentation

- Country Introduction
- Winter monsoon for Bhutan
- Climatology of winter season (Oct'15 to Feb'16)
- Current Prediction System/Verification
- Prediction for 2016-17 winter season
- Conclusion

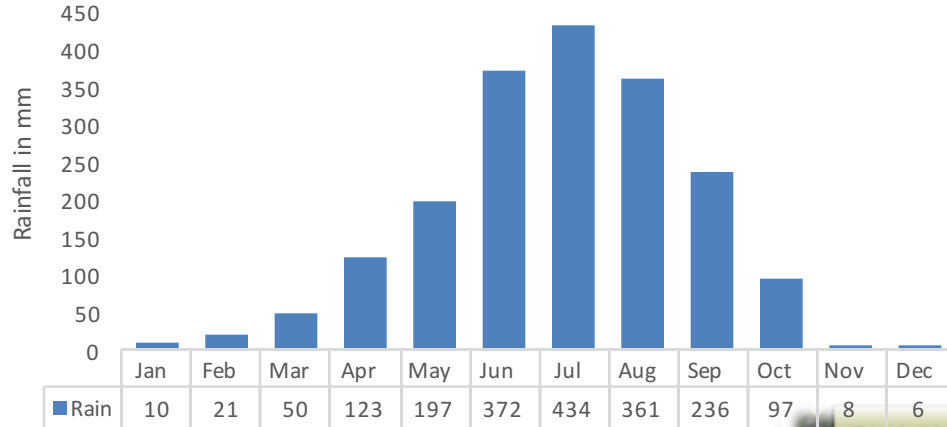
Country Introduction

- Total area: 38,394 Sq. Km
- Population : 750,000
- 79 % of population is farmer
- Location: Southern Asia, between China & India
- Altitude : 100 m in the south to 7500 m to the North above msl
- Forest Coverage: 72.5% - Policy is to ensure at least 60% for all time
- Topography : 95% Mountain terrain



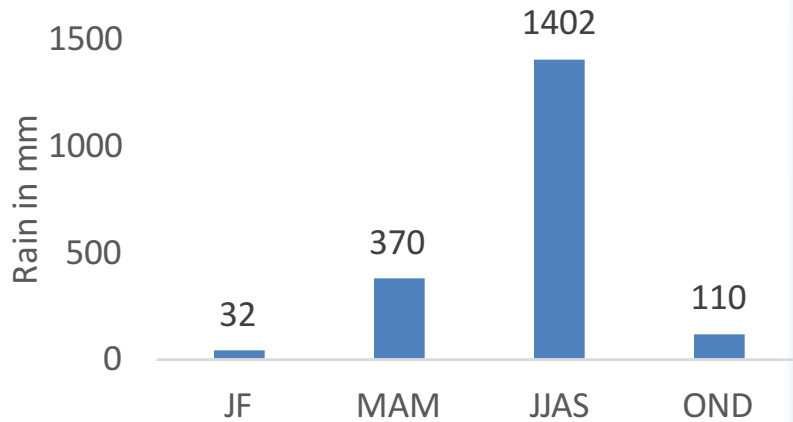
Monsoon in Bhutan

Mean Monthly Rainfall over Bhutan (1996-2015)



Bhutan Climatic is generally dominated by monsoon winds *with dry winter and wet summer monsoon*

Bhutan Seasonal Rain Distribution



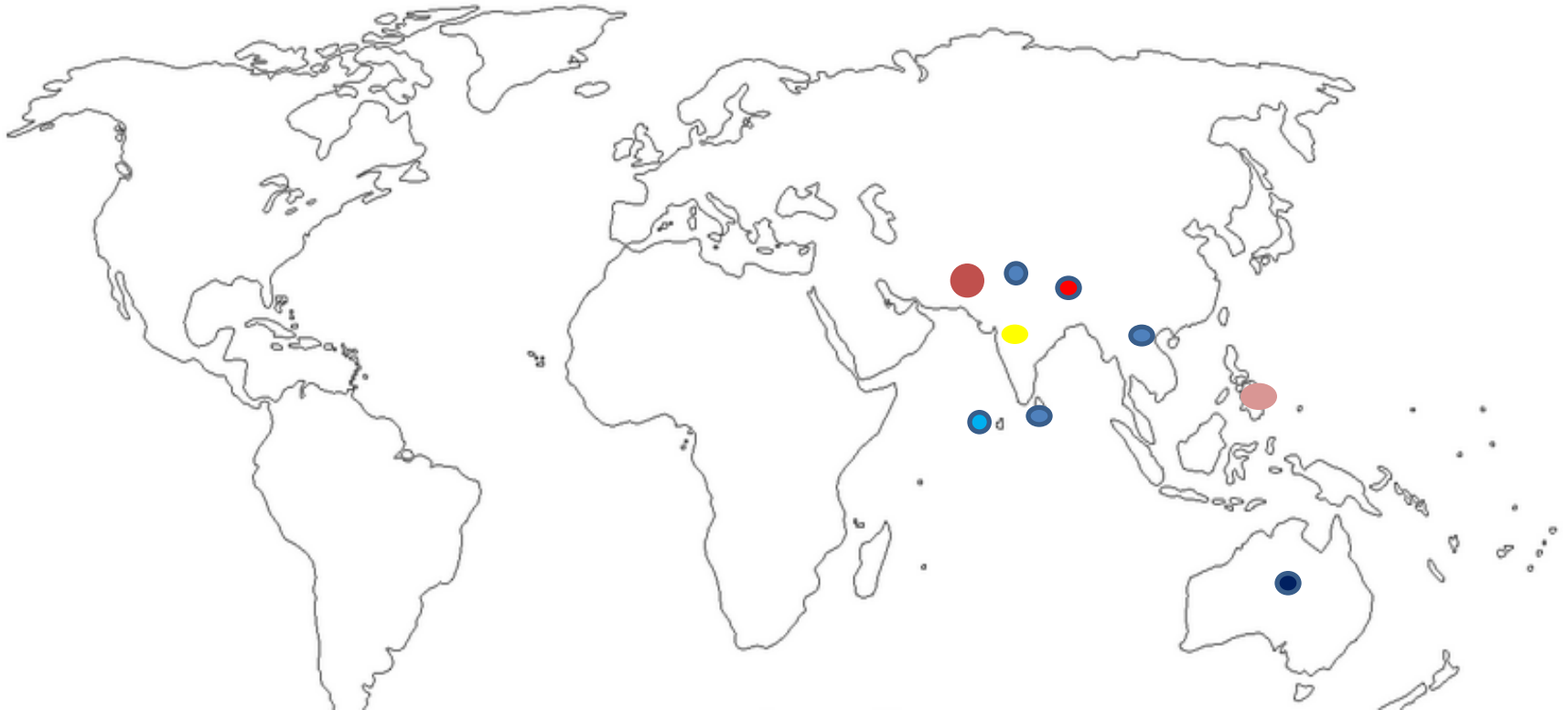
DJF	MAM	JJAS	ON
2%	19%	73%	6%



Forecast and observation for winter monsoon
October 2015-February 2016 (ONDJF)

Concensus from Winter South Asian Seasonal Climate Outlook Forum (Win SASCOF-1) OND

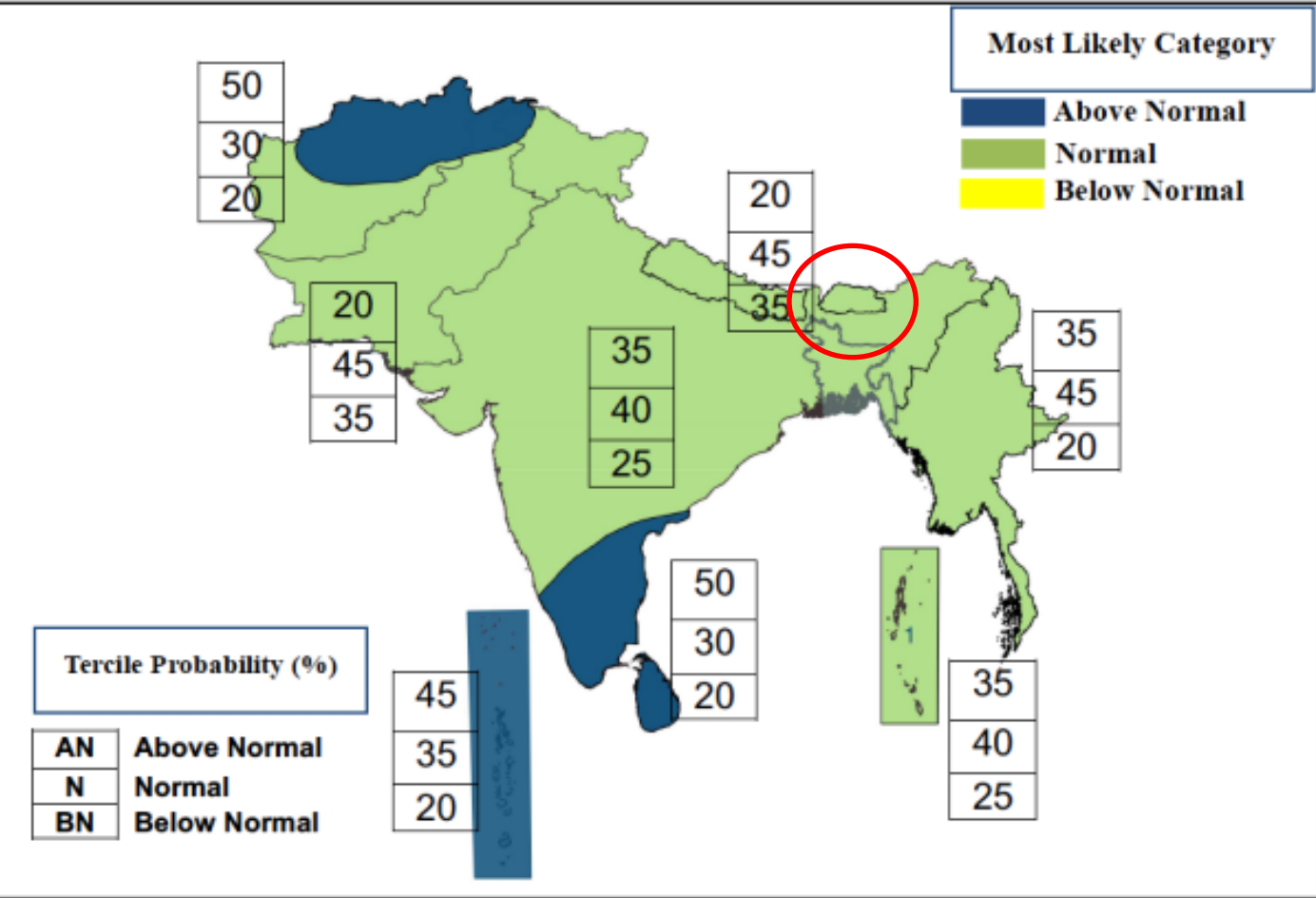
- First Winter SASCOF was conducted from 14-16th October at Chennai, Tamil Nadu, India



Concensus from WinSASCOF

- Normal to above normal is likely during the North East Monsoon (Oct-December) in southern parts of South Asia (Peninsular India, Sri Lanka and Maldives)
- Above Normal is likely over the northern parts of the region
- Others areas that receive very little rainfall (Including Bhutan) during the season are likely to receive **normal rainfall**
- **Above normal** temperature is predicted over most parts of the region in Bhutan
- Prevailing strong El Nino condition in the equatorial pacific is near certain to continue in the season

Concensus from Winter SASCOF- OND

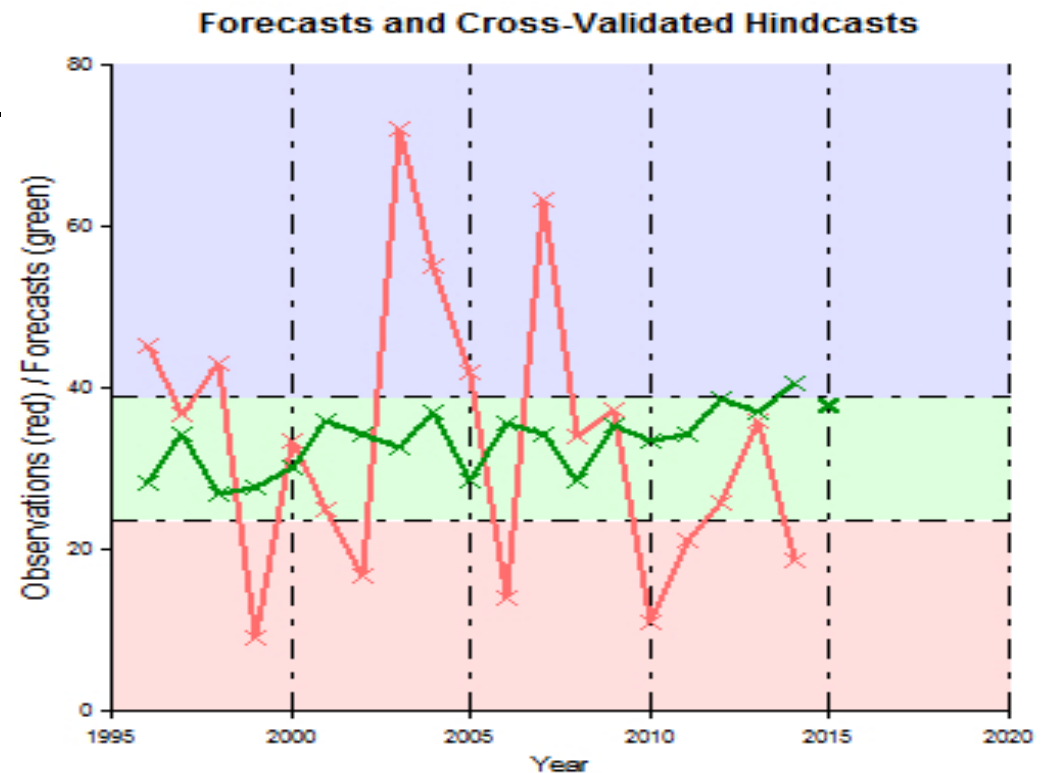


Winter (OND) Rainfall Predicted to be **normal** for Bhutan

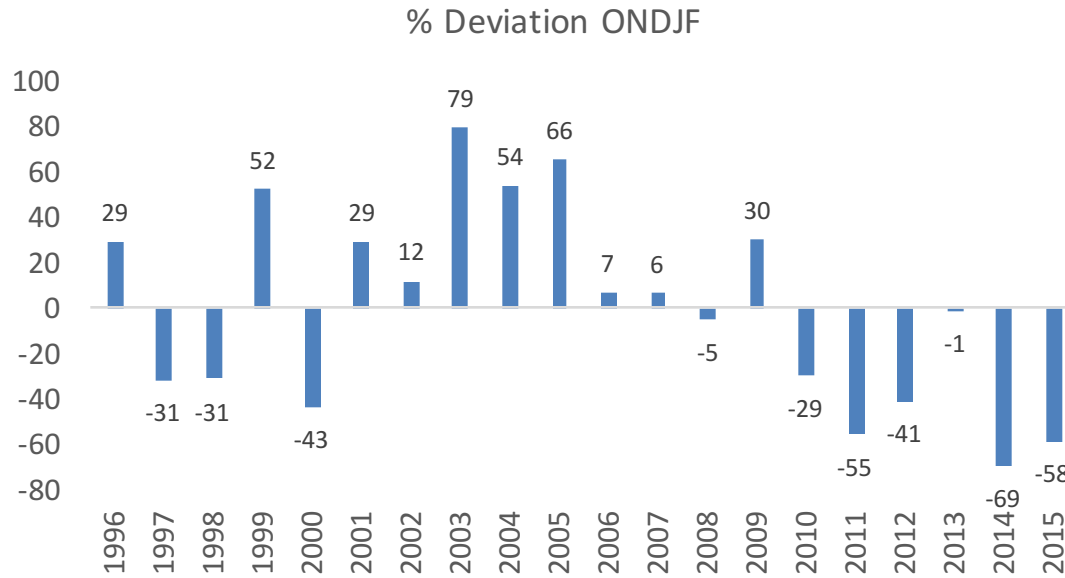
Winter (OND) temperature Predicted to be above normal with El Nino predicted to persist

Prediction for 2015-16 winter

- CPT forecast using SST for JAS to predict ONDJF
- Goodness index = 0.47
- Predicted **normal** for 2015-16 Winter for Bhutan



Winter Rain

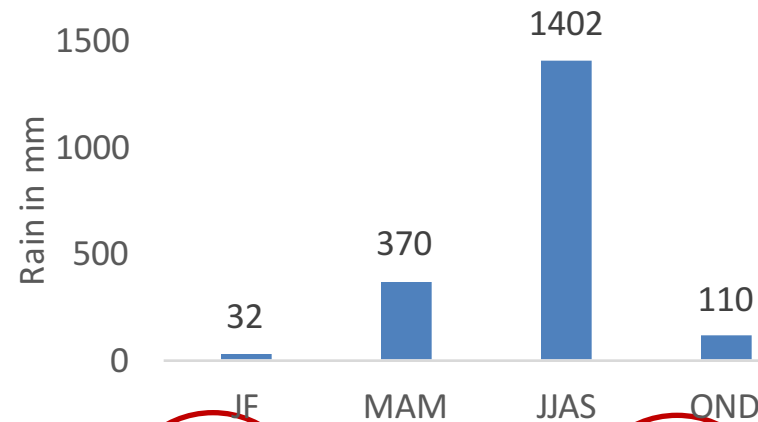


- Normal rain ONDJF = 142 mm
 - JJAS (~ 1400mm)
- OND rain was below normal
- Overall last winter monsoon was below normal

Findings

- 2015-16 Winter ONDJF rainfall forecast not accurate
- Possible reason: Rainfall contribution is very minimal compared to annual. Small amount, large variation.

Bhutan Seasonal Rain Distribution



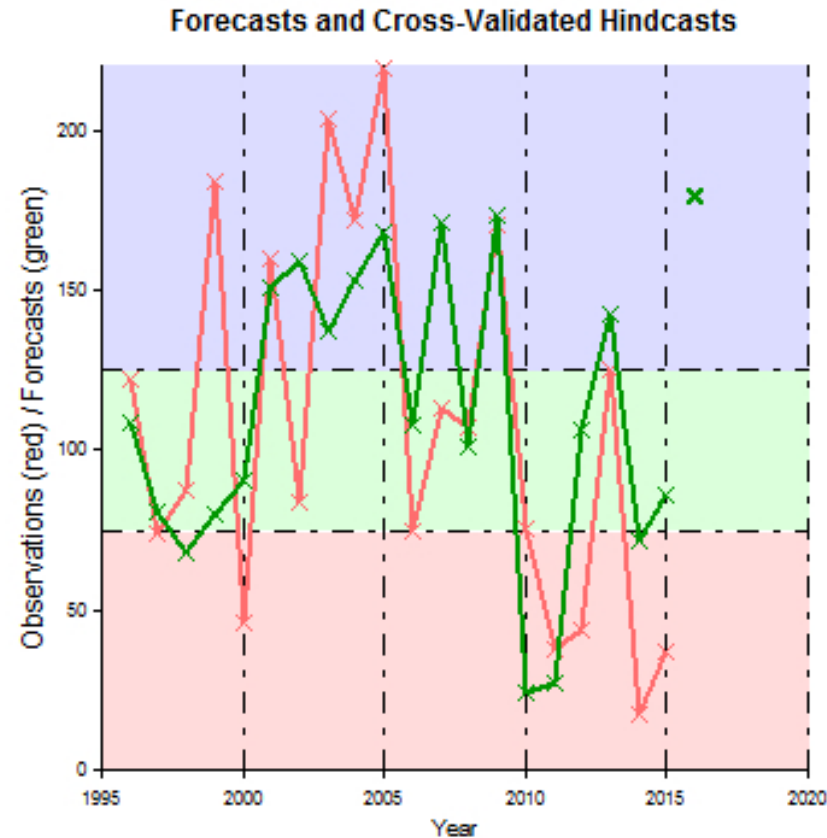
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Current Prediction System/Verification

- Climate Predictability Tools (CPT)
- SASCOF (winter and summer monsoon)
- FODAS (trial)

Prediction for 2016-17 winter season

- CPT
- Observed SST August (1982-2016)
- Goodness Index = 0.442
- Forecast of **above normal** OND rainfall

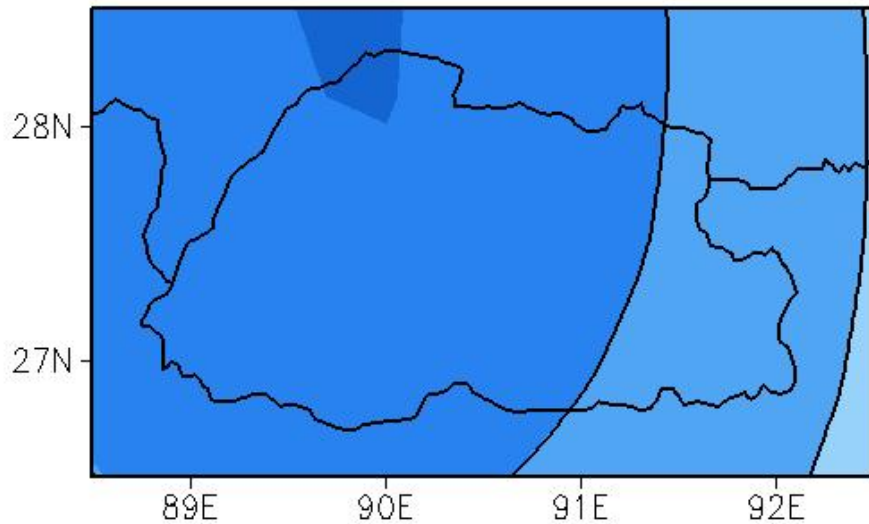


Prediction for 2016-17 winter season

- FODAS –Forecast system On Dynamical and Analogue Skills
- Developed BCC
- Uses BCC_GCM and GPCP
- Post Processing
 1. Systematic error correction
 2. Dynamic-statistic combined forecasting
 3. Average for systematic error correction and dynamic statistic combined forecast

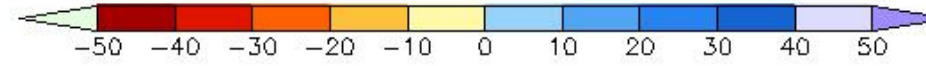
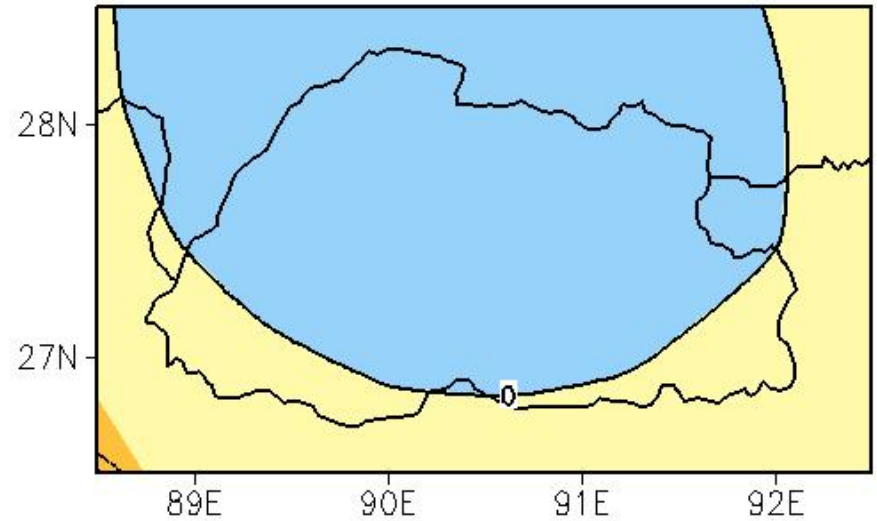
FODAS result

Precipitation OND 2016



Forecast of above normal rainfall

Precipitation DJF 2016/17



Forecast of normal to above normal rainfall

Conclusion

- Forecast of normal rainfall in winter 2015, recorded below normal rainfall in Bhutan
- **This winter 2016-17 forecast of above normal rainfall**

CHALLENGES

- The coeff. of variation for winter precipitation is very large, making difficult to predict
- Challenges in prediction due to complex terrains and localized climate
- Requirement of exploring new tools and methods of predicting winter climate outlook

THANK YOU