

TRAVEL REPORT FORM

출장보고서

결 재	선임연구 원	팀장	팀장	원장
	10/30	10/30	대결 10/31	10/31
협 조	우성호	이우섭	김선태	정홍상

I. Reporter 보고자

Department 소속	Position 직위(직급)	Name 성명	Travel Date 날짜	Note 비고
기후예측팀	선임연구원	우성호	10/22~28	

II. Major Activities 주요업무 수행내용

1. Main Contents and Activities 주요내용 및 활동

-주요 활동

: NOAA(National Oceanic and Atmospheric Administration) CPC (Climate Prediction Center) 주관의 기후 진단 및 예측 워크샵 (Climate Diagnostics and Prediction Workshop)에 참석 및 연구결과 발표

-일시/장소 : 2017.10.23.~26 (4일) / 미국 오클라호마주 Norman (National Weather Center)

-발표 제목 : Development of statistical model and discovery of predictor for seasonal prediction of winter temperature over the Korean Peninsula

2. Relevance to APEC Climate Center's Activities 결론 및 소감

NOAA CPC(Climate Prediction Center)는 전 세계적으로 기후 예측을 선도하는 기관 중 하나로 미국 계절 예측 현업 업무뿐만 아니라 ENSO를 포함한 전지구 기후 감시 및 예측 정보를 생산하고 제공한다. Climate Diagnostics and Prediction Workshop은 CPC에서 매년 개최하며 주로 현업기관들이 관심을 가지는 최근 이슈사항이나 계절 예측관련 주제에 대한 연구 발표와 토론이 이루어 진다.

이번 42번째 워크샵에서는 2017년 ENSO, Atmospheric river, 캘리포니아 가뭄 해소 등의 최근 이슈사항에 대한 분석 결과와 Subseasonal to Seasonal(S2S) 예측성에 대한 연구결과들이 집중적으로 발표되었다. S2S 예측의 경우에는 최근 이 시간규모에서의 높은 예측성에 대한 요구가 높아지고 있어 CPC가 예측성 향상을 위해 노력하고 있는 분야이다. 특히 미국의 경우에는 최근 몇 년 간 캘리포니아 가뭄과 화재 그리고 최근 텍사스와 미국 동부 지역 홍수 등으로 인해 큰 피해가 기록되어 향후 강수량의 예측성 향상을 위해 노력해야 함을 강조하였다. 또한 이상기후(extreme climate)의 S2S 시간규모 예측에 대해서도 연구들도 진행되었는데, 역학 모델들의 2주 이상 예측성은 매우 낮으므로 통계적 후처리를 통해 예측에 활용하고자 하는 노력이 있었다.

우리센터에서도 최근 WMO 선도센터 자료를 활용하여 S2S 양상불 예측 정보를 생산하고 이를 1개월 현업

예보에 활용하고 있는 것은 전 세계적인 연구 및 현업의 방향에 일치한다고 할 수 있으며 **매우 바람직하고 고무적**이라 생각된다. 우리나라도 최근 폭염의 빈번한 발생 및 가뭄의 장기화 등 극한 현상이 많이 발생하고 있고 이를 S2S 시간 규모에서 높은 정확도로 예측한다면 미리 준비하고 피해를 경감시킬 수 있을 것이다. **향후 센터와 기상청 모두 예측성 향상 위한 여러 측면에서 노력**(모델의 예측 특성 분석, 관측 기반 기후 인자와의 통계적 상관성 활용 및 역학 모델의 예측성 향상, 모델 예측 정보의 재생산 등)이 필요할 것으로 생각된다.

또 중요하게 다루어진 주제는 극지역 기후와 중저위도(lower-latitude) 기후의 관련성 섹션이었다. 극지역은 다른 지역에 비해 강한 온난화(Arctic warming)를 겪고 있으며 그와 연관된 대기순환 등으로 북반구 전역의 날씨와 기후에 영향을 미치고 있다. 이 섹션에서는 S2S 시간 규모에서의 **역학 모델이 극지역의 대기 변동(성층권 돌연승은 포함) 및 해빙 변동의 예측성에 대한 연구 결과가 발표** 되었다. NMME(North American MultiModel Ensemble)에서의 **성층권 돌연승은 및 AO의 예측성은 모델마다 성능의 차이는 있지만 약 10일 정도되는 것으로 나타났다**. 우리나라 기후 또한 해빙의 감소에 따른 블로킹 발생 및 극지역 변화에 따른 성층권 돌연승은과 북극진동에 의해 영향을 받으므로, **우리 센터에서도 해빙, 북극지역 대기 변동 및 그와 연관된 우리나라 주변에서의 순환장 변화를 얼마나 잘 모의하는지 그리고 예측성이 얼마나 되는지에 대한 분석이 필요할 것으로** 생각된다. 이는 모델 예측을 활용하는데 정보를 제공하여 현업 예측에서 의사결정에 도움을 줄 수 있을 뿐만 아니라 겨울철 동아시아 기온 및 순환장의 역학모델의 예측성이 낮은 원인 중에 하나일 가능성이 있으며 **향후 예측성 향상을 위한 실마리를** 제공해 줄 가능성도 있다고 생각된다.

우성호 박사는 해빙, 해수면온도, 눈덮임 등의 정보를 활용하여 우리나라 겨울철 월별 기온을 예측하는 통계모델 개발 결과를 발표하였고 관심을 나타낸 참석자들과 연구 토론하였다. 특히, Dr. Chelliah와 디스커션을 통해 개발된 통계모델의 예측성을 검증하는 방법에 대해 조언을 받았으며 복귀 후 테스트 할 계획이다.



(좌) 학회장 모습 (우) 우성호 박사 발표 및 디스커션 모습

III. References 참고사항

(with attachment of any information or report in case of attendance of conferences, workshops and meetings) 학술대회, 워크숍, 회의 등 참석 시 관련 정보 및 문서 첨부

1. Presented and Collected Materials 주요 수집자료

발표 자료 등은 향후 워크샵 웹사이트를 통해 제공될 예정입니다

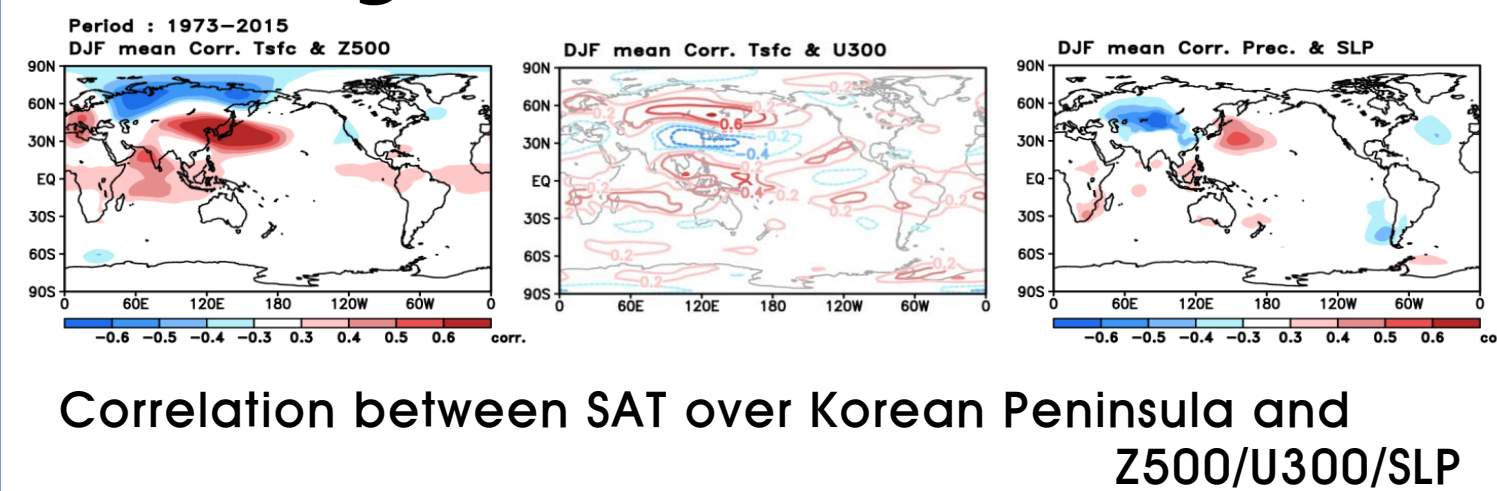
2. Suggestions and Remarks 건의사항

Development of statistical model and discovery of predictor for seasonal prediction of winter temperature over the Korean Peninsula

Sung-Ho Woo¹, Seongeun Lee², So-Young Yim² and Dong-Joon Kim²

¹APEC Climate Center, Korea (APCC) and ²Korea Meteorological Administration (KMA)

1. Background



Correlation between SAT over Korean Peninsula and Z500/U300/SLP

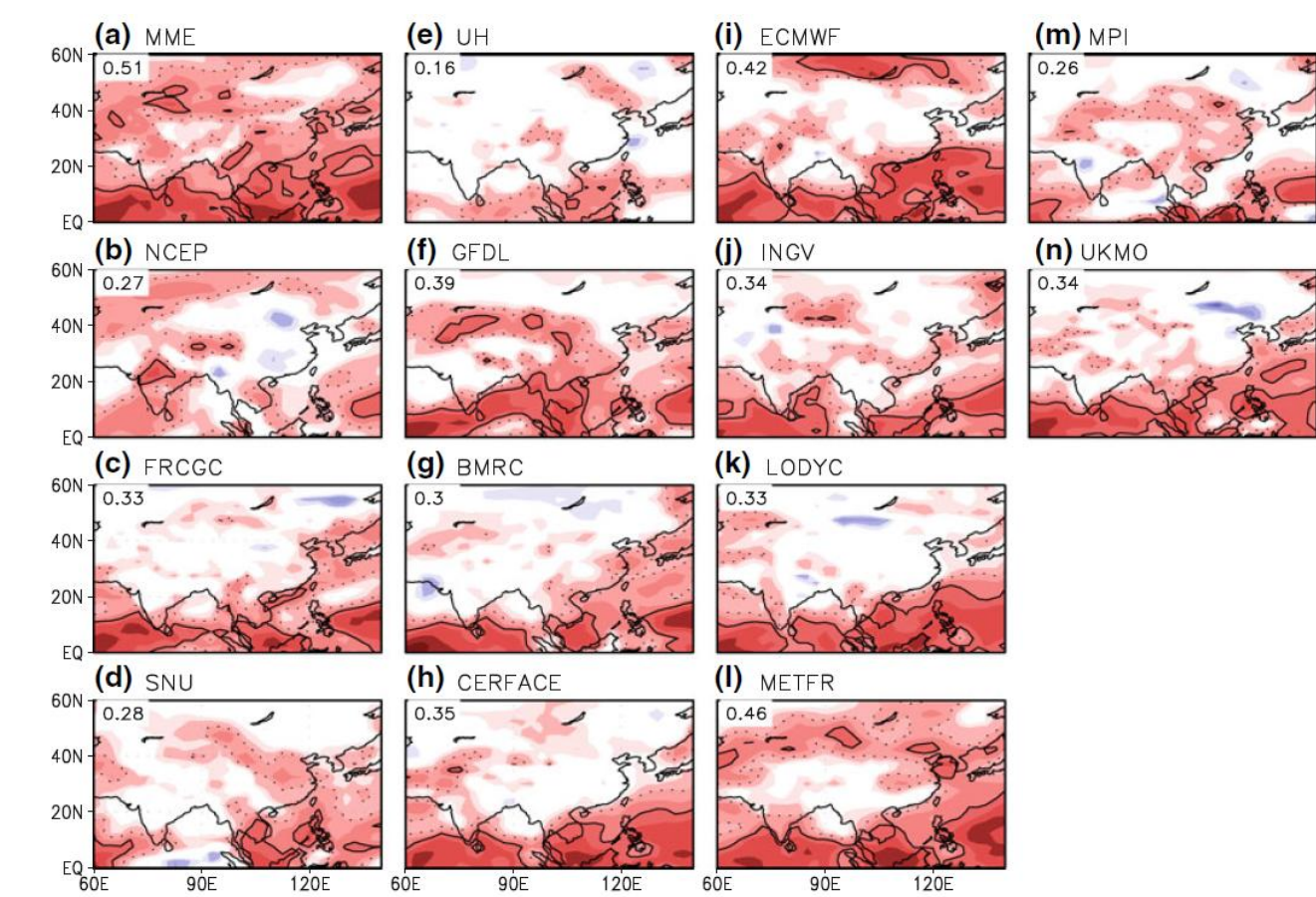
*East Asian winter monsoon(EAWM)

→ Surface air temperature(SAT) variation over East Asia including the Korean Peninsula(hereafter, KP)

Warm condition over East Asia including the Korean Peninsula.....

- Upper-level : Flat East Asian climatological trough & Weak mid-latitude Jet stream
- Lower-level : Weak Siberian high & westward expansion of Aleutian low
- Weak lower-level northerly wind
- Anomalous warm winter

2. Motivation and Objective



Corr. skill for 1month-lead DJF Prediction of SAT over mid-latitude Eurasia

- Unreliable predictability for wintertime SAT of the dynamic model over Eurasia
- Support to operational seasonal -prediction of monthly mean SAT over the Korean Peninsula

5. For January, Statistical Model & Predictor (Continued)

Less SIC & its related atmospheric circulation pattern → Vertically much wave propagation into strato.(dominant Wave 1, Kim et al. 2014) → Weak strato. polar vortex → Tropospheric impact → Negative AO → Cold condition in the KP

Pos.(Neg.) tendency of SST over Eastern (Western) Pacific from Sep. to Oct. → Large possibility of El-Nino developing (El-Nino like pattern of SST & Dry condition over tropical and sub-tropical western Pacific) → Pos. Z500 ano. over East Asia (Flattening of East Asian Trough) → Weakening of northerly wind → Warm condition over the KP

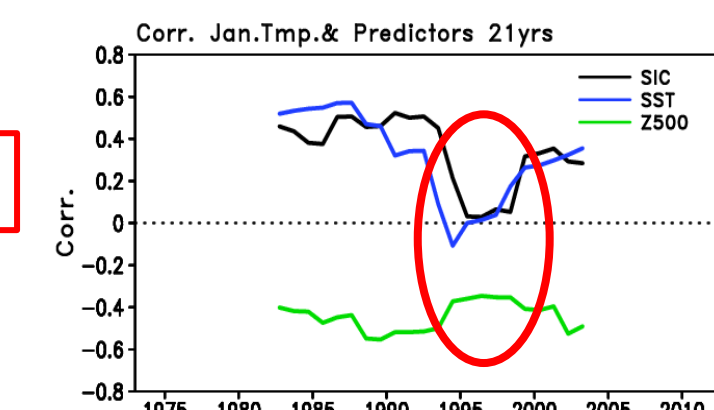
Quite similar mechanism with Predictor, SIC over Kara Sea But, Tamyir Z500 is not significantly correlated to SIC over Kara Sea! (Just 0.25).

* Statistical Model for January

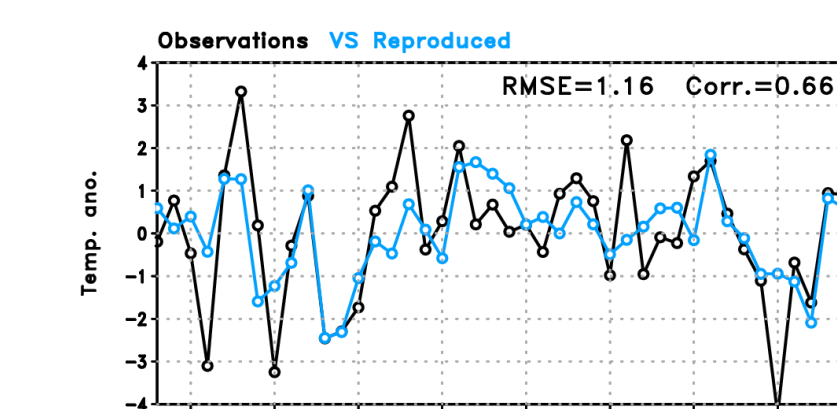
$$\text{SAT(Jan.)} = 0.41 \cdot \text{SIC} + 0.61 \cdot \text{ENSO} - 0.48 \cdot \text{Z500}$$

Correlation btw. predictors and SAT in Jan. / Correlation among the predictors

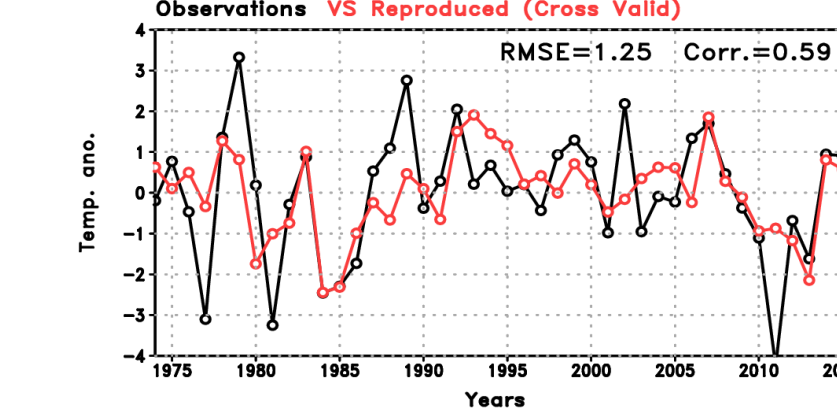
Predictors	SIC Kara Sea	Zonal gradient of SST tendency in tropical Pacific (Oct. - Sep.)	Z500 over Tamyir Pen. in Oct.
Jan. SAT in the KP	0.46**	0.50**	-0.42**
SIC Kara Sea	x	0.22	-0.26
Zonal gradient of SST tendency in tropical Pacific (Oct. - Sep.)	x	x	-0.12



→ Unusual SSW during the 1990s → Lower corr. btw predictor over polar and SAT in the KP → Dropping the corr. skill



Training corr. skill : 0.66



Cross valid. corr. Skill : 0.59

3. Data and Method

* Analysis period and Data

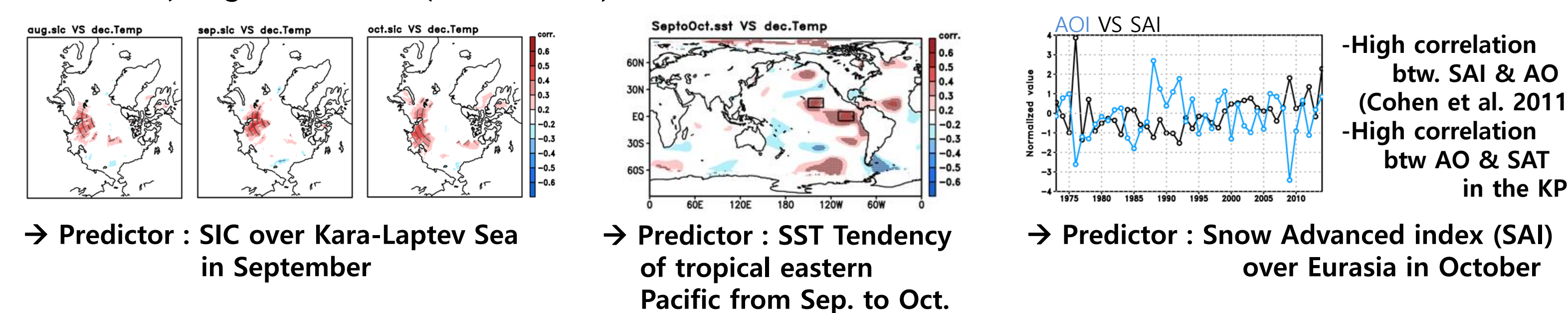
- Training periods : 1973-2015 (Boreal winter, Dec. to Feb.) (Considered the temporal coverage of observational SAT data over the KP)
- NCEP/NCAR R1 circulation (U, GPH, omega) and temperature
- NCEP/NCAR R1 Sea ice concentration (Validated with HadISIC)
- ERSST v4
- NOAA Snow cover (Validated with IMS 24km data set)
- CMAP precipitation (Validated with GPCP)
- Observational SAT data at 45 surface station over the KP

*Predictors discovery :

- Lag correlation between individual month and climate factors
- Understanding Physical and Dynamical linkage between the predictor and SAT in the KP
- For operational prediction, Predictor data should be available until 2nd week in November, considering the production schedule of seasonal prediction

4. For December, Statistical Model & Predictor

* Predictors, Lag correlation(detrended) with SAT in the Korean Peninsula in Dec.



→ Predictor : SIC over Kara-Laptev Sea in September

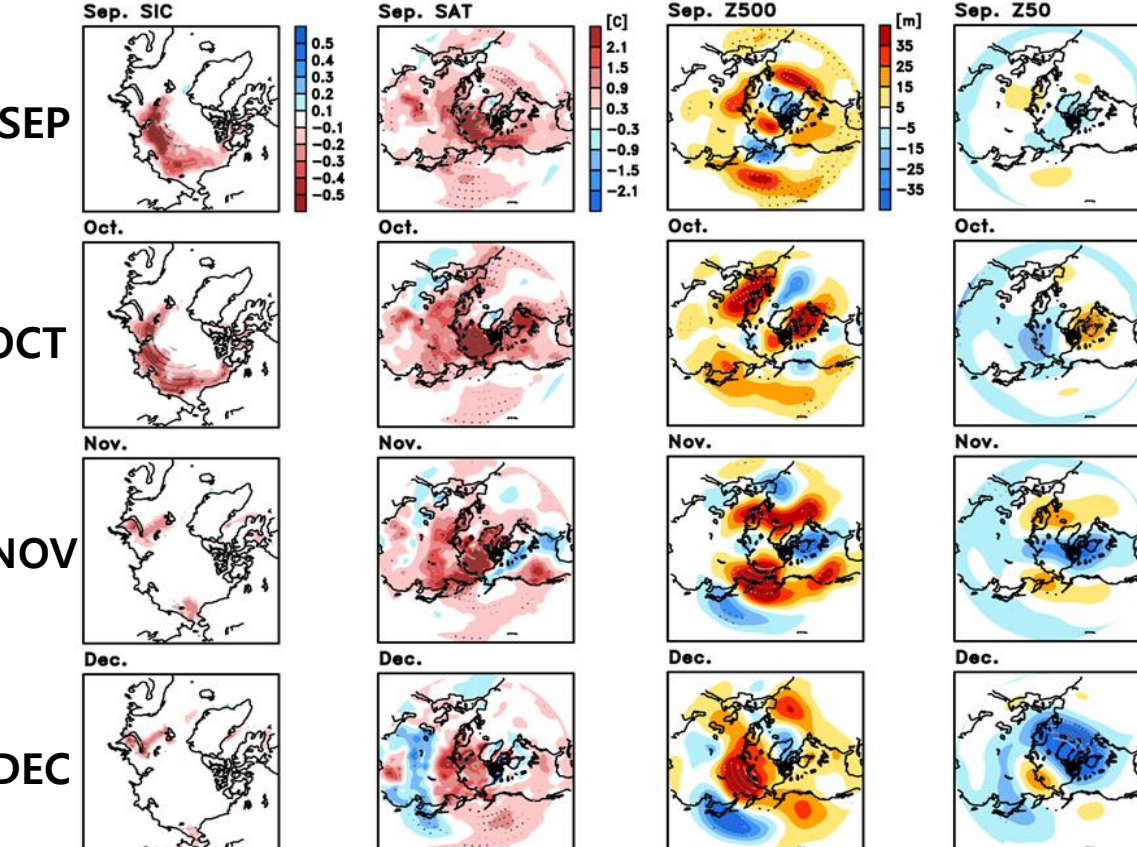
→ Predictor : SST Tendency of tropical eastern Pacific from Sep. to Oct.

→ Predictor : Snow Advanced index (SAI) over Eurasia in October

* Predictor-related atmospheric/surface conditions

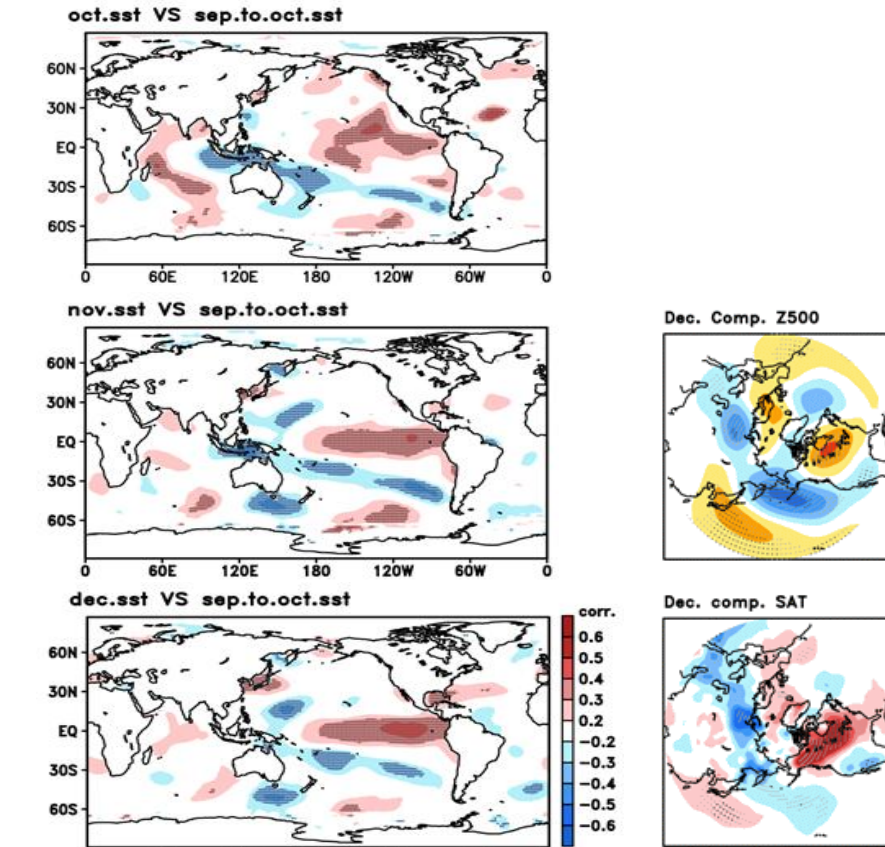
Lag composite

As less SIC over Kara-Laptev



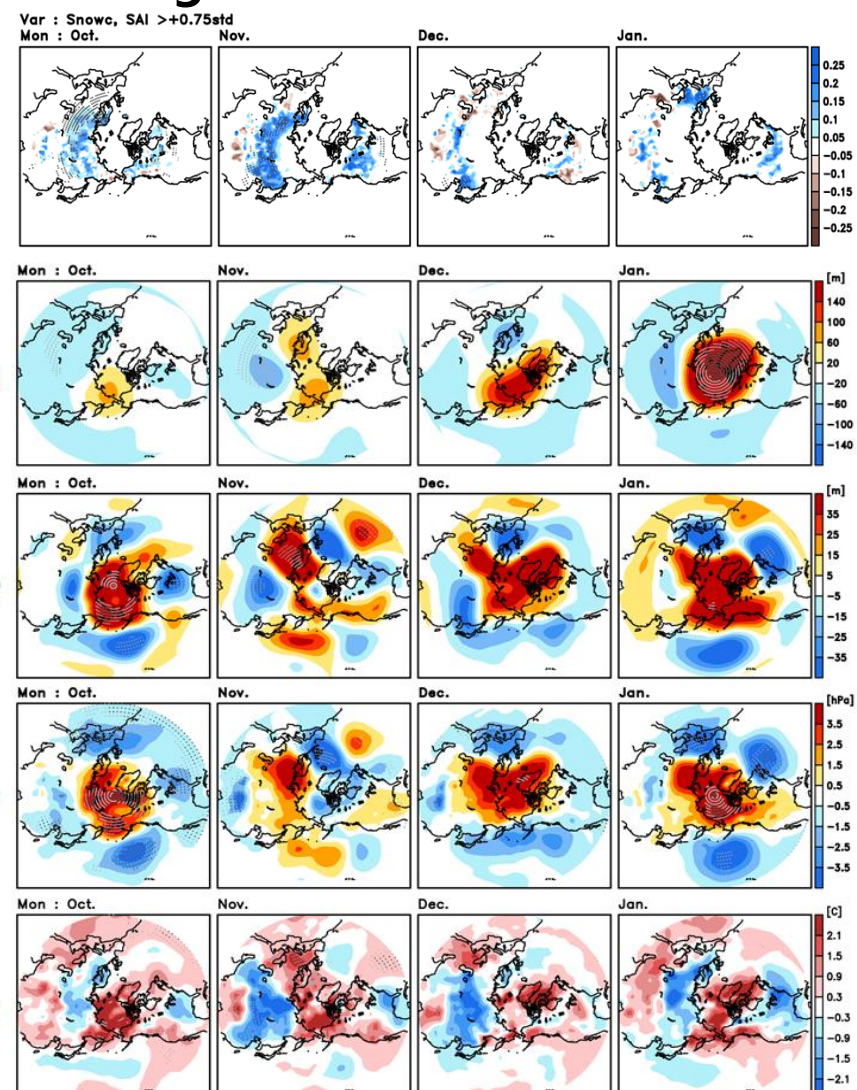
Strong pos. Z500 ano. over Eastern part of Ural Mt. & Northern Siberia → Neg. Z500 ano. over the KP and Japan (Deepening East Asia trough, Honda et al. 2009; Mori et al. 2014; Kug et al. 2015) → Strengthening northerly wind → Cold winter in the KP

As positive tendency of SST....



Large SST tendency in eastern Pacific → Developing El-Nino related SST pattern → Kuroshio anomalous high over northwest Pacific(Son et al. 2013; Kim et al. 2015) → Weak northerly wind → Warm winter in the KP

As large SAI in October



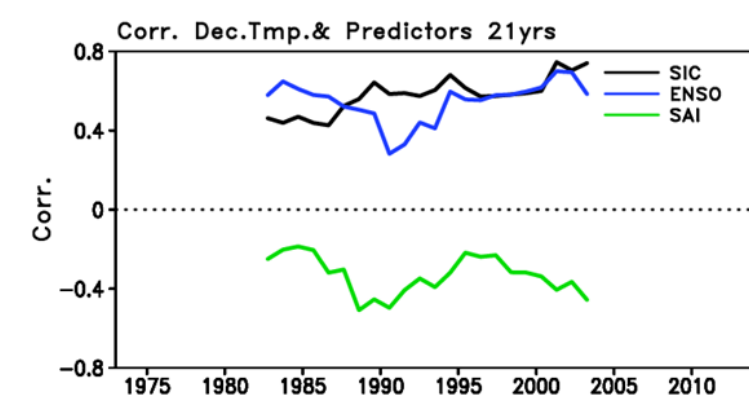
Rapidly snow-covered Eurasia → Vertically much wave propagation into strato. → Weak strato. polar vortex → Tropospheric impact → Negative AO → Cold condition in the KP

* Statistical Model for December

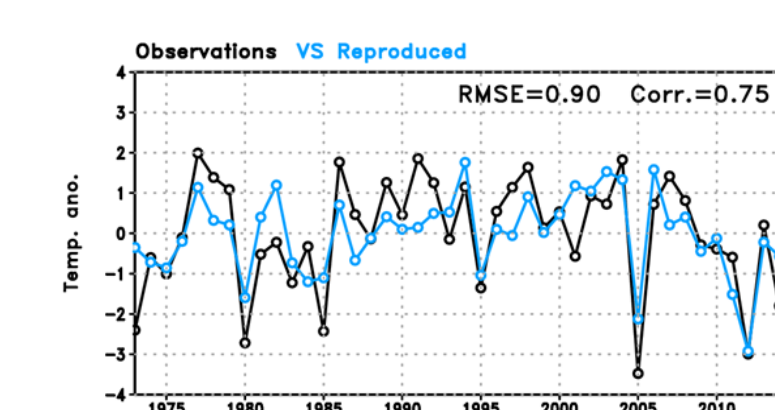
$$\text{SAT(Dec.)} = 0.62 \cdot \text{SIC} + 0.62 \cdot \text{ENSO} - 0.27 \cdot \text{SAI}$$

Correlation btw. predictors and SAT in Dec. / Correlation among the predictors

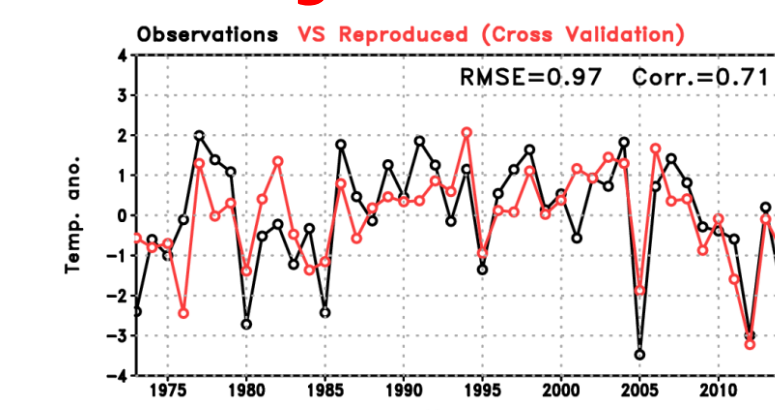
Predictors	SIC Kara-Laptev	SST tendency in tropical eastern Pacific (Oct. - Sep.)	Snow Adv. Idx. over Eurasia in Oct.
Dec. SAT in the KP	0.61**	0.58**	-0.31*
SIC Kara-Laptev	x	0.22	-0.22
SST tendency in tropical eastern Pacific (Oct. - Sep.)	x	x	-0.08



→ Stable correlation between predictor and SAT in training period



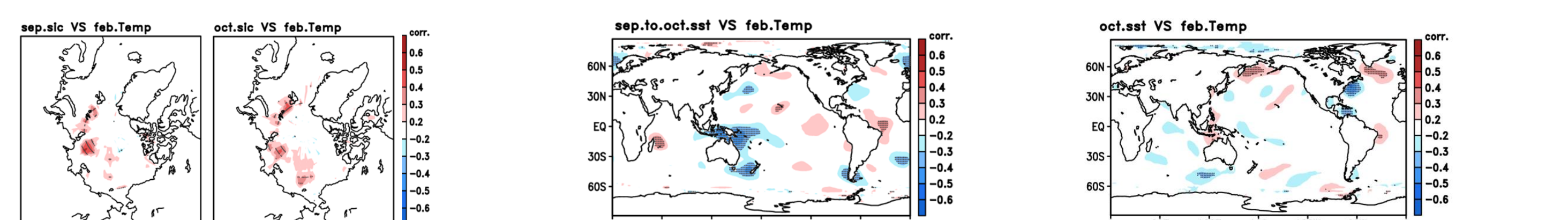
Training corr. skill : 0.75



Cross valid. corr. Skill : 0.71

6. For February, Statistical Model & Predictor

* Predictors, Lag correlation(detrended) with SAT in the Korean Peninsula in Feb.



→ Predictor : SIC over Barents Sea in Oct.

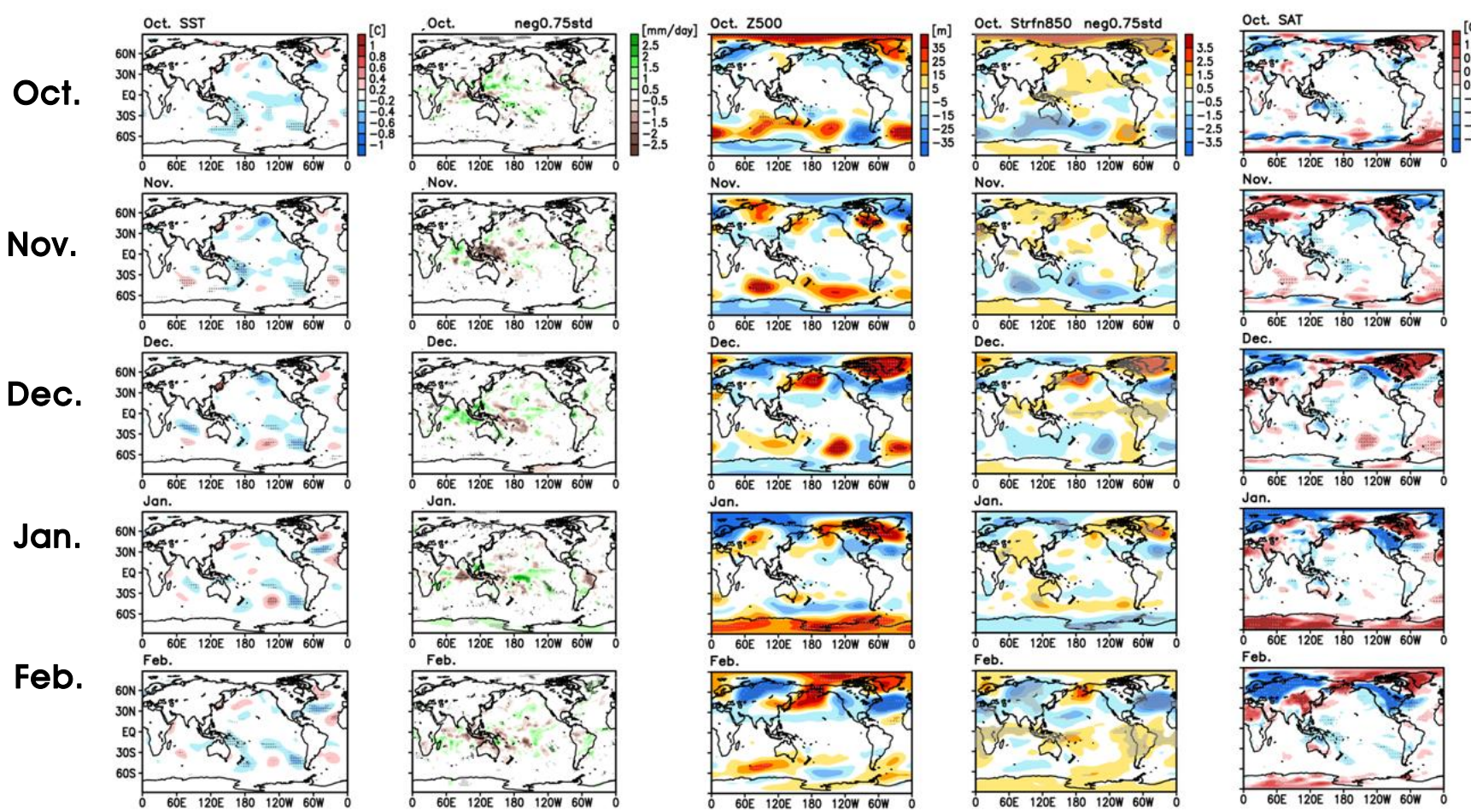
→ Predictor : SST Tendency over North Sea of Australia from Sep. to Oct.

→ Predictor : SST ano. over Gulf stream in Oct.

* Predictor-related atmospheric/surface conditions

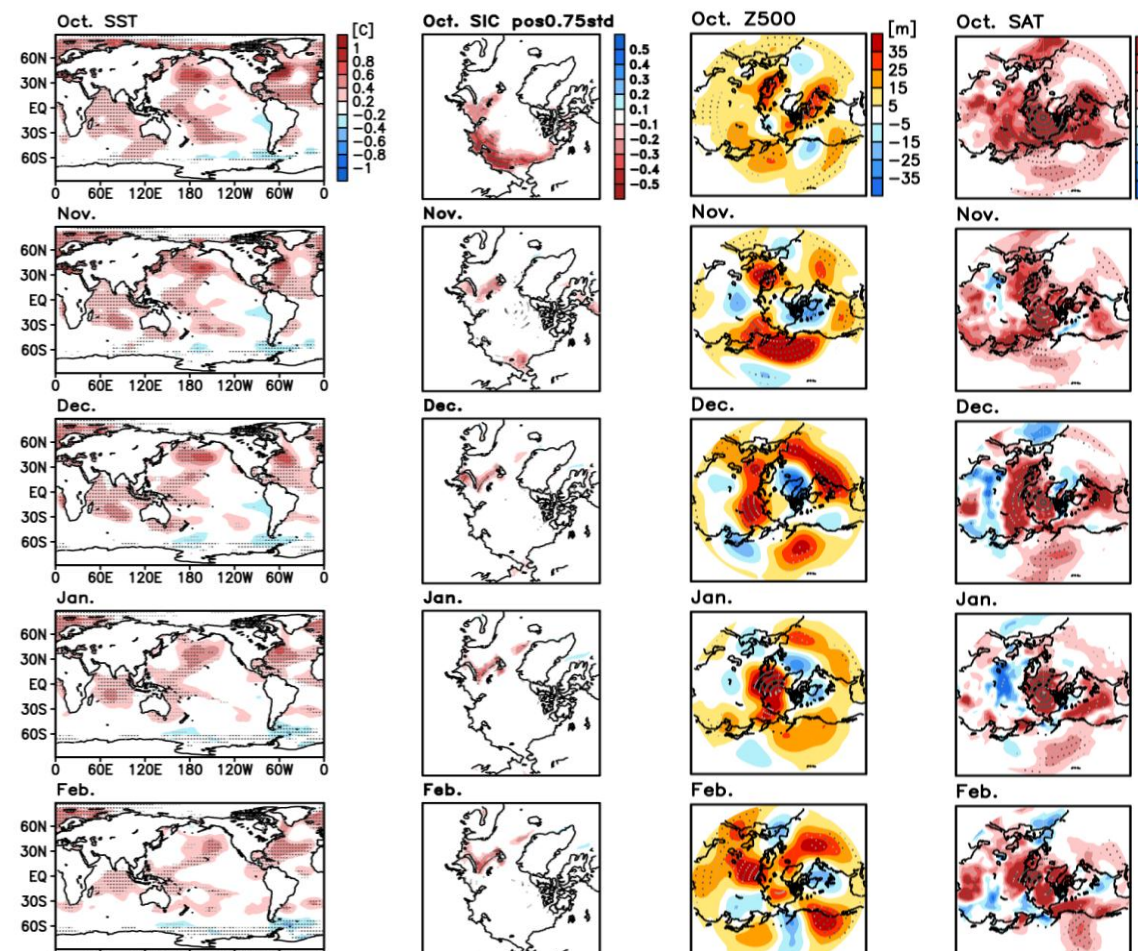
Lag composite

As Neg. SST tendency over North Sea of Australia



Negative SST tendency in north sea of Australia → Enhanced westerly and divergent flow over Tropical western Pacific → Suppressed convection (not clear El-Nino related SST pattern) → Atmospheric teleconnection into East Asia → Anomalous high over northwest Pacific → Strong southerly wind → warm winter in the KP

As pos. SST ano. over Gulf stream....



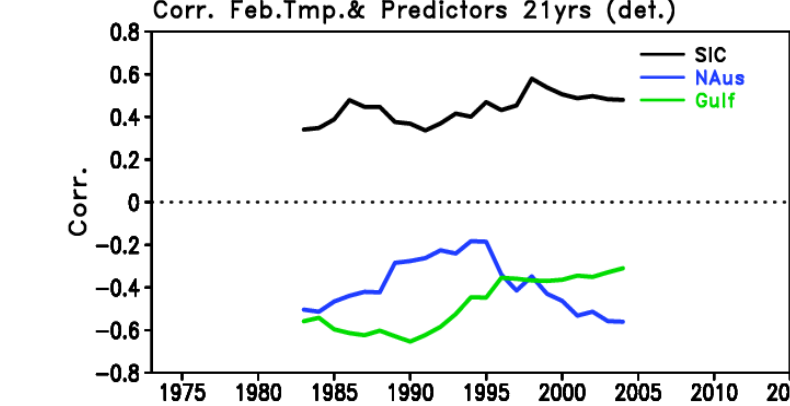
Pos. SST ano. in Gulfstream → Atmospheric teleconnection and oceanic heat transport into Kara-Barents sea → Preventing of freezing the sea ice (Neg. SIC ano.) (Sato et al. 2014; Ok et al. 2017) → Favorable condition for strong pos. Z500 ano. over Ural Mt. & Northern Siberia → Neg. Z500 ano. over the KP and Japan (Deepening East Asia trough) → Strengthening northerly wind → Cold winter in the KP

* Statistical Model for February

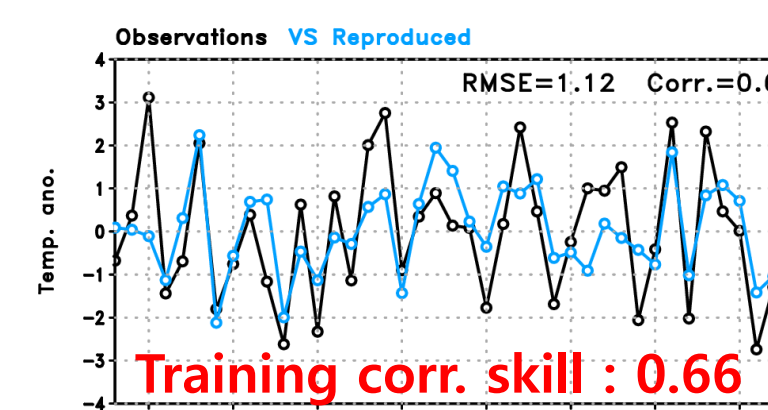
$$\text{SAT(Feb.)} = 0.41 \cdot \text{SIC} - 0.54 \cdot \text{SST}_{\text{Aus}} - 0.52 \cdot \text{SST}_{\text{Gulf}}$$

Correlation btw. predictors and SAT in Feb. / Correlation among the predictors

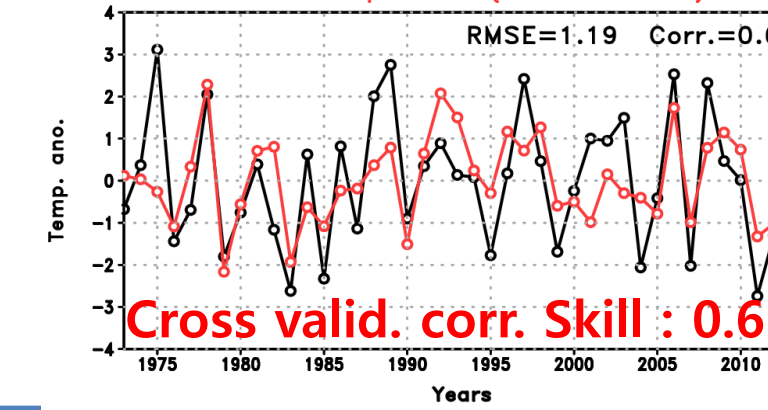
Predictors	SIC Barents Sea	SST tendency over north sea of Australia (Oct. - Sep.)	SST ano. in Gulf stream in Oct.
Feb. SAT in the KP	0.43**	-0.52**	-0.46**
SIC Barents Sea	x	-0.26	-0.25
SST tendency over north sea of Australia (Oct. - Sep.)	x	x	0.22



→ Not high correlation between predictors and SAT in the KP during the training period



Training corr. skill : 0.66



Cross valid. corr. Skill : 0.61

7. Summary

Predictors

Month	Predictors
December	SIC over Kara-Laptev in Sep.(SIC _{KL}), SST tendency in tropical eastern Pacific (Oct. - Sep.) (ENSO), Snow advanced index over Eurasia in Oct. (SAI)
January	SIC over Kara in Oct.(SIC _K), Zonal gradient of SST tendency in tropical Pacific (East - West) (ENSO _z), Z500 over Tamyir Peninsula in Oct. (Z500 _{TP})
February	SIC over Barents in Oct.(SIC _B), SST tendency over north sea of Australia (Oct. - Sep.) (SST _{Aus}), SST ano. over Gulf stream in Oct. (SST _{Gulf})

Models

Month	Statistical prediction model (Simple multiple regression)
December	$SAT_{pred, Dec} = 0.62 \cdot SIC_{KL} + 0.62 \cdot ENSO - 0.27 \cdot SAI$
January	$SAT_{pred, Jan} = 0.41 \cdot SIC_K + 0.61 \cdot ENSO_{z} - 0.48 \cdot Z500_{TP}$
February	$SAT_{pred, Feb} = 0.41 \cdot SIC_B - 0.54 \cdot SST_{Aus} - 0.52 \cdot SST_{Gulf}$

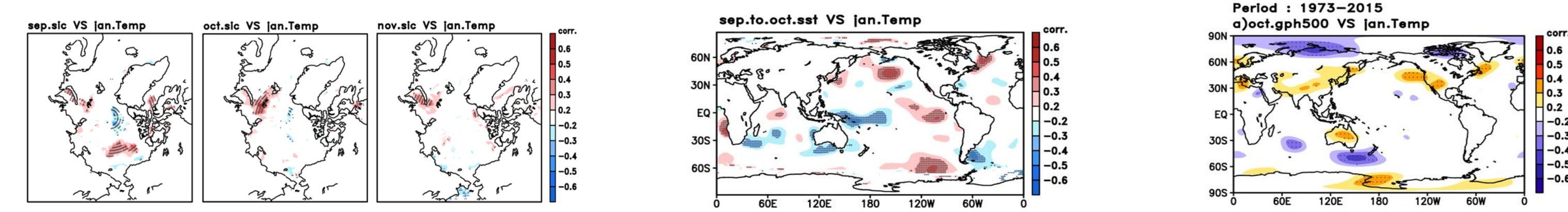
- Predictors dynamically-physically related to the variability of wintertime SAT
- Useful models for operational seasonal prediction

Skill

Training-period skill	Cross valid skill
0.75	0.71
0.66	0.59
0.66	0.61

5. For January, Statistical Model & Predictor

* Predictors, Lag correlation(detrended) with SAT in the Korean Peninsula in Jan.



→ Predictor : SIC over Kara Sea in Oct.

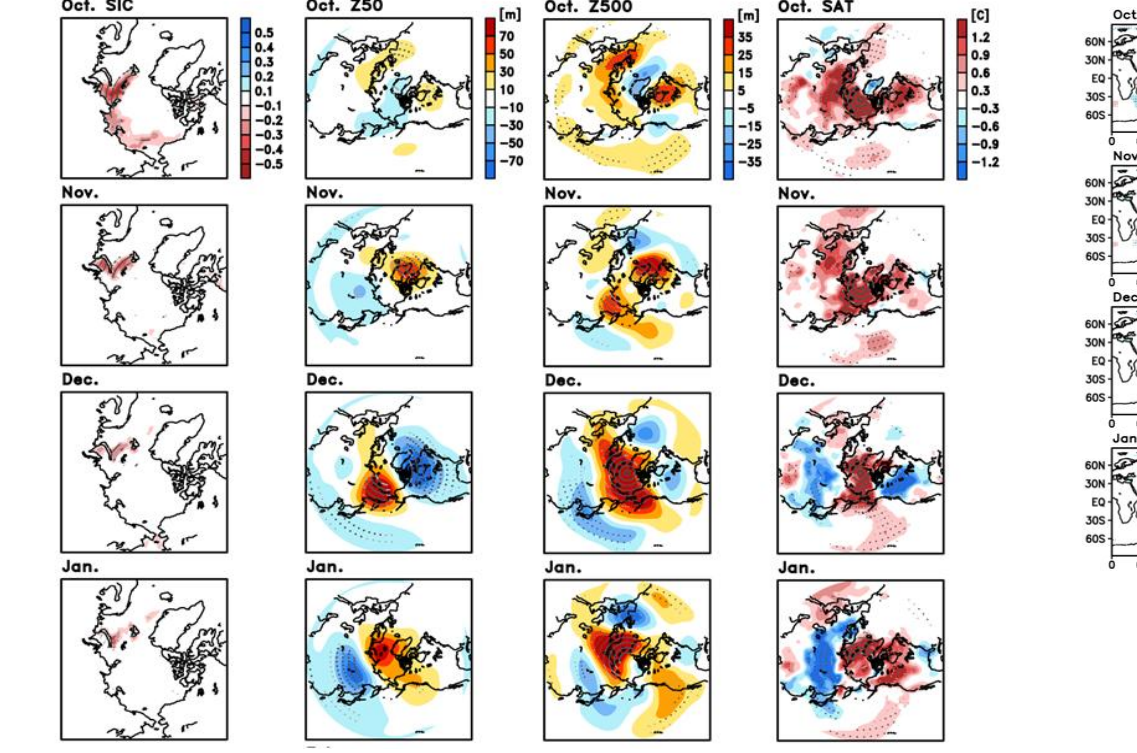
→ Predictor : Zonal gradient over tropical Pacific of SST Tendency from Sep. to Oct.

→ Predictor : Z500 ano. over Tamyir Peninsula in Oct. (Kryjov 2015)

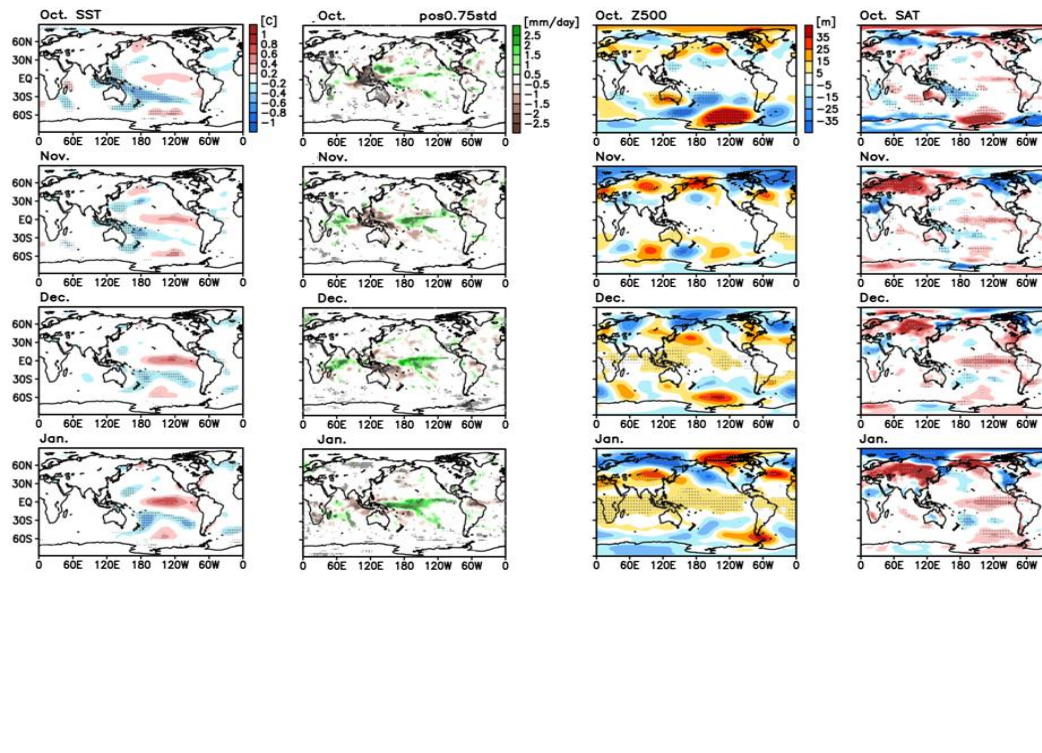
* Predictor-related atmospheric/surface conditions

Lag composite

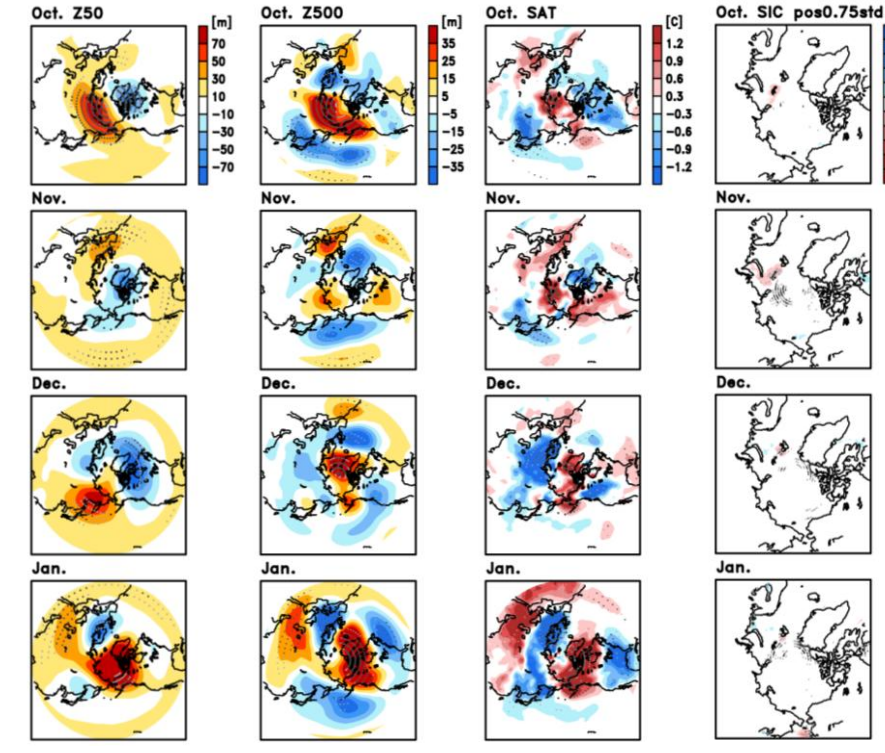
As less SIC over Kara Sea



As positive zonal gradient of SST tendency over tropical Pacific



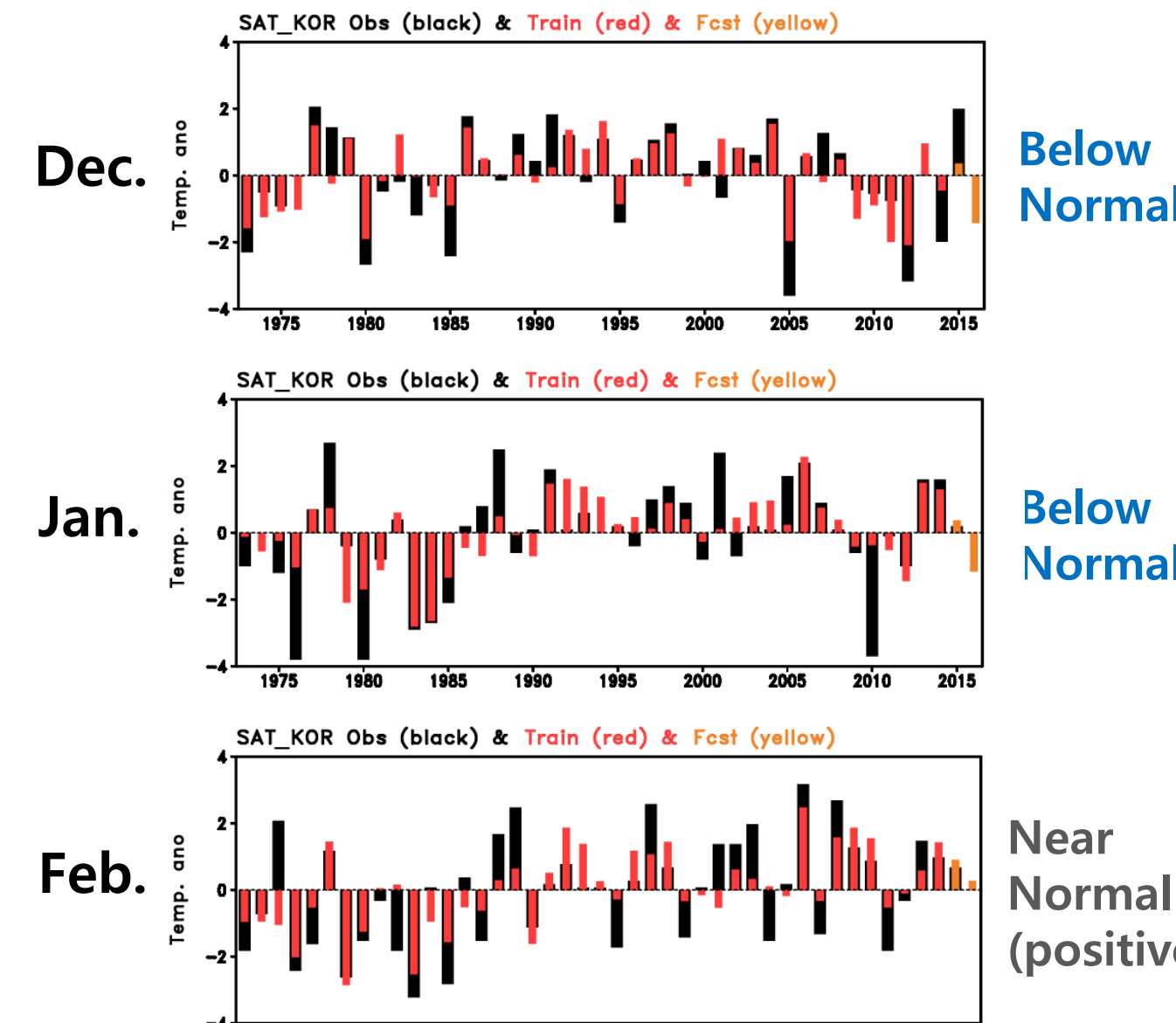
As large positive Z500 ano. over Tamyir Peninsula in October



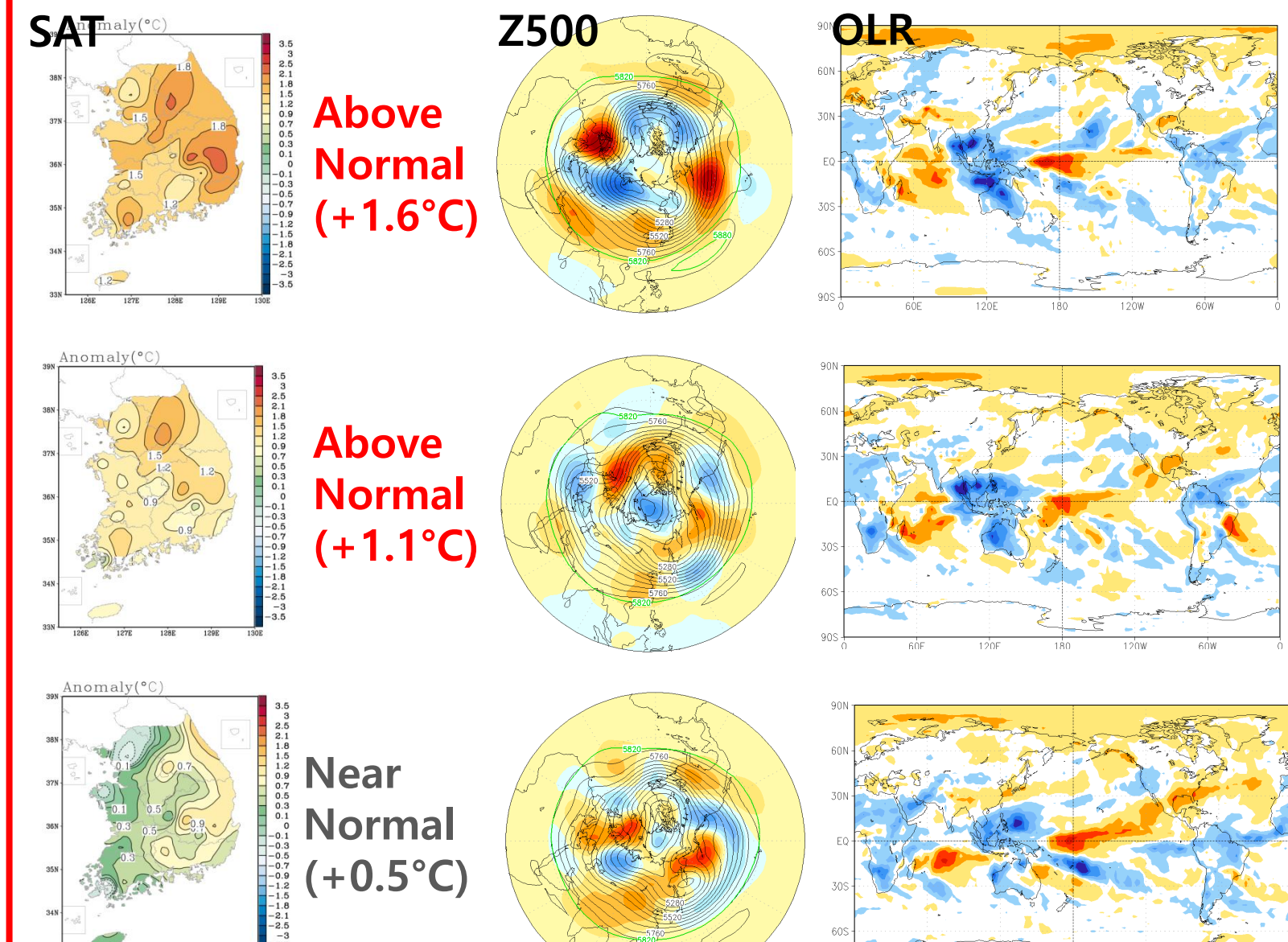
8. Operational Seasonal Prediction for 2016-2017 wintertime

- We applied these models for 2016-2017 wintertime prediction
- Long term trend for operational prediction is considered in each month

Prediction



Observation (Validation)



- No atmospheric circulation related to Sea Ice over the Kara-Barents and Laptev appeared during the winter season
- Pos. ano. over Europe and neg. ano. over Ural Mt. is dominant during whole winter → East Asia located in its downstream had experienced the positive Z500 anomalies over the East Asia, which represents the flattening of East Asian trough
- Generally warm winter season in the KP
- Teleconnection from deep convection over the western Pacific related the La-Nina during just Jan-Feb (Less-organized convection over Philippine sea during December)
- Relatively less warm in January and February than December

Program for the 42nd Annual Climate Diagnostics and Prediction Workshop
Norman, Oklahoma, October 23-26, 2017
Updated 10/18/17

Monday, October 23, 2017

7:30 – 9:30 **Registration**

8:30 – 9:30 **Welcoming Remarks**
- Various Speakers including University of Oklahoma Provost Kyle Harper

Session 1: Recent Events I
Chair: Dave DeWitt, NOAA CPC

9:30 – 9:50 *California from drought to deluge: Dipole reversal and S2S forecast*
Simon Wang, **Emily Becker**, Jinho Yoon, Rob Gillies, Utah State University,
GIST Korea, NOAA/CPC, Utah State U

9:50 – 10:10 *Diagnosing the atypical extreme precipitation events under weakly forced
synoptic setting: The West Virginia flood (June 2016) and beyond*
Binod Pokharel, S.-Y. Simon Wang, Yen-Heng Lin, Lin Zhao, and Robert
Gillies, Utah State University

10:10 – 10:40 **Break**

Session 2: Recent Events II
Chair: Dave DeWitt, NOAA CPC

10:40 – 11:00 *Changes in the statistics of U.S. tornado reports (INVITED)*
Michael K. Tippett, Columbia University

11:00 – 11:20 *The role of anomalous wave activity in high-impact weather events during the
2015-16 winter*
Samuel Lillo, David Parsons, School of Meteorology, University of Oklahoma

11:20 – 11:40 *An Overview of the 2016-17 La Niña and return to Neutral conditions*
Michelle L'Heureux, NOAA CPC

11:40 – 12:00 *Relation between a Rossby Wave-Breaking Event and Enhanced Convective
Activities over the western North Pacific observed in August 2016*
Kazuto Takemura, Yutaro Kubo and Shuhei Maeda, Tokyo Climate Center,
Japan Meteorological Agency

12:00 – 1:15pm **Lunch**

Session 3: Recent Events III
Chair: Emily Becker, NOAA CPC

1:15 – 1:35 *The sudden onset of the current 2017 Northern High Plains Drought*
Muthuvel Chelliah and David Miskus, NOAA CPC

- 1:35 – 1:55 *The Australian climate of 2016; A strong negative Indian Ocean Dipole dominates*
Catherine Ganter, BoM Australia
- 1:55 – 2:15 *Causality and sub-seasonal predictability of the 2016 Yangtze River extreme rainfall*
Xing Yuan, Shanshan Wang, Zeng-Zhen Hu, Institute of Atmospheric Physics, Chinese Academy of Sciences; Institute of Arid Meteorology, CMA; NOAA/CPC
- 2:15 – 2:35 **Break**
- Session 4: S2S Extremes: General Session I**
Chair: Jason Furtado, University of Oklahoma
- 2:35 – 2:55 *Advancing Atmospheric River Forecasts into Subseasonal-to-Seasonal Timescales (INVITED)*
Cory Baggett, Elizabeth Barnes; Eric Maloney; Bryan Mundhenk, Colorado State University
- 2:55 – 3:15 *Multi-model global assessment of subseasonal-to-seasonal atmospheric river prediction skill*
Michael J. DeFlorio, NASA Jet Propulsion Laboratory/California Institute of Technology
- 3:15 – 3:35 *Evaluating the Joint Influence of the MJO and the Stratospheric Polar Vortex on Northern Hemisphere Winter Weather Patterns*
Matthew R. Green, The University of Oklahoma
- 3:35 – 3:50 **Discussion (Facilitator: Cory Baggett, Colorado State University)**
- 4:00 – 5:00 **National Weather Center tours**
- 5:30 – 7:30 **Ice Breaker**

Tuesday, October 24, 2017

- Session 5: S2S Extremes: Severe Weather**
Chair: Arun Kumar, NOAA CPC
- 8:30 – 8:50 *The Impact of ENSO on Winter and Early Spring U.S. Tornado Outbreaks (INVITED)*
Ashton Robinson Cook, NOAA NWS Storm Prediction Center
- 8:50 – 9:10 *Developing a Experimental Week 2-4 Severe Weather Outlook for the United States*
Hui Wang, Alima Diawara, Arun Kumar, and Dave DeWitt, NOAA/NWS/NCEP/CPC

- 9:10 – 9:30 *Gulf of Mexico Influence on Sub-seasonal and Seasonal Severe Thunderstorm Frequency*
Maria J. Molina, John T. Allen, Vittorio A. Gensini, Department of Earth and Atmospheric Sciences, Central Michigan University, Department of Geographic and Atmospheric Science, Northern Illinois University
- 9:30 – 9:50 *Developing seasonal predictions of lightning potential for Alaska with application to the summer wildfire season*
Peter Bieniek, University of Alaska Fairbanks
- 9:50 – 10:10 **Discussion** (*Facilitator: Ashton Robinson Cook, NOAA SPC*)
- 10:10 – 10:40 **Break**
- Session 6: S2S Extremes: General Session II**
Chair: Michael Tippett, Columbia University
- 10:40 – 11:00 *Short-term climate extremes using the North American Multi-Model Ensemble*
Emily Becker, CPC/INNOVIM
- 11:00 – 11:20 *Are the more extreme seasonal climate conditions easier to predict?*
Cheng-Ta Chen, Teng-Ping Tseng, and Shou-Li Lin, National Taiwan Normal University, Department of Earth Sciences
- 11:20 – 11:40 *Evaluating the MJO forecast skill in the NCEP GEFS 35-day Experiments*
Wei Li, Xiaqiong Zhou, Yuejian Zhu, Malaquias Peña, Dingchen Hou, Hong Guan, Eric Sinsky and Christopher Melhauser, EMC/NCEP
- 11:40 – 12:00 *Progress in dynamical model tools for forecasting heat waves in week 2*
Evan Oswald, Jon Gottschalck, CPC/INNOVIM
- 12:00 – 1:20pm **Lunch**
- Session 7: S2S Extremes: Tropical Cyclones**
Chair: Daniel Harnos, NOAA CPC
- 1:20 – 1:40 *Impacts of Extratropical Rossby Wave Breaking on Atlantic Tropical Cyclones (INVITED)*
Zhuo Wang, University of Illinois at Urbana-Champaign
- 1:40 – 2:00 *Influence of Convectively Coupled Equatorial Waves, the MJO, and ENSO on the Environment of Tropical Cyclones in Coupled Atmosphere-Ocean Subseasonal Prediction Systems*
Matthew A. Janiga, UCAR

- 2:00 – 2:20 *Evaluations of Western North Pacific Tropical Cyclone Forecasts from the NCEP GEFSv11 Reforecasts*
Hsiao-Chung Tsai, Pang-Cheng Chen, Tzu-Ting Lo, Meng-Shih Chen, and Ren-Feng Liu, Department Water Resources and Environmental Engineering, Tamkang University and Central Weather Bureau, Taiwan
- 2:20 – 2:40 *Machine Learning Approaches for Diagnosis of Tropical Cyclone Errors*
Michael B. Richman and Lance M. Leslie, University of Oklahoma
- 2:40 – 3:10 **Break**
- Session 8: Climate Services**
Chair: Mike Halpert, NOAA CPC
- 3:10 – 3:30 *Relationship between El Niño strength and Southern Africa precipitation: Forecasting applications and decision-making*
Catherine Pomposi, University of California Santa Barbara
- 3:30 – 3:50 *Delivering Impact-Based Seasonal Outlooks for South Central Texas*
Larry Hopper, Mark Lenz, Ty Dickinson, Austin-San Antonio NWS WFO
- 3:50 – 4:10 *Improving Impact-Based Seasonal Outlooks for South Central Texas*
Ty Dickinson, Larry Hopper, Mark Lenz, University of Oklahoma
- 4:10 – 4:30 *Regional drought early warning, impacts, and assessment for water and agriculture in the Lower Rio Grande Valley, 2016-2017*
David Brown, USDA Southern Plains Climate Hub
- 4:30 – 4:50 *Assessing User Needs and Model Accuracy of Seasonal Climate Forecasts for Winter Wheat Producers in the Southern Great Plains*
Toni Klemm; Renee McPherson, Ph.D., University of Oklahoma / South Central Climate Science Center
- 4:50 – 5:30 **Break**
- 5:30 – 7:30 **Poster Session**

Wednesday, October 25, 2017

Session 9: High Latitude Variability I
Chair: Sara Strey, University of Oklahoma

- 8:30 – 8:50 *Diagnosing extremes and trends of seasonal temperatures in Alaska (INVITED)*
John E. Walsh and Brian Brettschneider, University of Alaska, Fairbanks
- 8:50 – 9:10 *Searching for Arctic Temperature Trends and Extremes from Original Station Records*
Taneil Uttal, NOAA

9:10 – 9:30 *New pathway of tropical influences on Arctic subseasonal warming events in the troposphere*
Yen-Heng Lin, S.Y. Simon Wang, Department of Plants, Soils and Climate, Utah State University

9:30 – 9:50 *Predictability of Sudden Stratospheric Warmings in Operational Subseasonal-to-Seasonal Forecasting Models*
Jason C. Furtado, School of Meteorology, University of Oklahoma, Judah Cohen, Emily Becker, Dan Collins

9:50 – 10:10 *Stratospheric Influence on the Mechanisms of MJO-AO Teleconnections in the S2S models*
Laura M. Ciasto, NOAA Climate Prediction Center and INNOVIM, LLC

10:10 – 10:40 **Break**

Session 10: High Latitude Variability II
Chair: John Walsh, University of Alaska- Fairbanks

10:40 – 11:00 *Processes associated with air-sea ice coupling biases in CMIP5 (INVITED)*
Qinghua Ding, Michelle L'Heureux, Kirstin Harnos, Nathaniel Johnson, and Mitch Bushuk, USCB, CPC/NOAA, GFDL/NOAA

11:00 – 11:20 *Potential Impacts of New Arctic Air-Ice-Ocean Interaction Processes on Climate Diagnostics*
Ola Persson, CIRES/Univ. of Colorado/NOAA/ESRL/PSD

11:20 – 11:40 *Seasonal Arctic sea ice in the North American Multimodel Ensemble*
Kirstin Harnos, Michelle L'Heureux, Qin Zhang, and Qinghua Ding, NOAA Climate Prediction Center and Innovim LLC

11:40 – 12:00 **Discussion (Facilitator: Qinghua Ding, Univ. of California, Santa Barbara)**

12:00 – 1:20pm **Lunch**

Session 11: Drought and Pluvial Events I
Chair: Muthuvel Chelliah, NOAA CPC

1:20 – 1:40 *Subseasonal prediction of warm season drought in North America (INVITED)*
Hailan Wang, Siegfried D. Schubert, Yehui Chang, Randal D. Koster, NASA Global Modeling and Assimilation Office

1:40 – 2:00 *An Empirical Method to Generate Probabilistic Drought Intensification Forecasts over Sub-Seasonal Time Scales*
Jason Otkin, University of Wisconsin-Madison / CIMSS / SSEC

2:00 – 2:20 *Predicting Global Drought Conditions using the North American Multi-Model Ensemble*
Jeremy P. Anthony, US Air Force

- 2:20 – 2:40 *Investigation of Land Atmosphere Feedbacks in Oklahoma using Local Coupling Metrics*
Ryann Wakefield, University of Oklahoma School of Meteorology
- 2:40 – 3:00 *Diagnosing extreme drought characteristics across the globe*
Ehsan Najafi, Indrani Pal, Naresh Devineni, Reza Khanbilvardi, NOAA-Cooperative Remote Sensing Science and Technology Center (NOAA-CREST), City University of New York
- 3:00 – 3:30 **Break**
- Session 12: S2S Predictability**
Chair: Michelle L’Heureux, NOAA CPC
- 3:30 – 3:50 *The Subseasonal Experiment (SubX)*
Kathy Pegion, GMU/COLA
- 3:50 – 4:10 *An evaluation of weeks 3&4 through extended NCEP GEFS*
Yuejian Zhu, NWS/NCEP/EMC
- 4:10 – 4:30 *CFS Hindcast Skill and MJO Propagation across the Maritime Continent*
Carl Schreck, Anantha Aiyer, Matthew Janiga, Cody Yearly, NCICS/NCSU, NCSU, UCAR, and NCSU
- 4:30 – 4:50 *Ensemble-based revision forecasting tool*
Malaquias Peña, University of Connecticut
- 4:50 – 5:10 *Assesment of NMME Skill over Southwest Asia and Horn of Africa*
Ryan D. Smith, Robb M. Randall, Ray B. Kiess, Jeremy P. Anthony, 14th Weather Squadron, USAF
- 6:00 – 8:00 **Banquet at the Sam Noble Oklahoma Museum of Natural History**
Keynote: Harold Brooks (NSSL)

Thursday, October 26, 2017

- Session 13: Drought and Pluvial Events II**
Chair: David S. Gutzler, University of New Mexico
- 8:30 – 8:50 *Improving CPC’s Handling of Long-term Trends in Seasonal Forecasts*
Stephen Baxter, NOAA/NWS/NCEP/CPC
- 8:50 – 9:10 *Future Projections of U.S. Drought and Pluvial Events Characteristics*
Elinor R Martin, University of Oklahoma
- 9:10 – 9:30 *Primary Atmospheric Drivers of Pluvial Years in the United States Great Plains*
Paul X. Flanagan, University of Oklahoma; School of Meteorology

9:30 – 9:50	<i>Long-term Variation of US Land Surface Hydrological Extremes</i> Yun Fan and Huug van den Dool, NOAA/NWS/NCEP/CPC
9:50 – 10:10	<i>Seasonal and interannual variability of land-atmosphere coupling across the Southern Great Plains of North America</i> Jeffrey B. Basara and Jordan I. Christian, School of Meteorology, University of Oklahoma
10:10 – 10:40	Break
Session 14: Climate Diagnostics, Prediction, and Analyses Chair: Stephen Baxter, NOAA CPC	
10:40 – 11:00	<i>Warm Season Forecast Experiments with Different Treatments on Ground Water and Evaporative Parameterizations in the NCEP Coupled Forecast System</i> Rongqian Yang and Mike Ek, EMC/NCEP
11:00 – 11:20	<i>Modulated impact of heavy snowpack on 2017 streamflow in Southwestern rivers</i> David S. Gutzler , University of New Mexico
11:20 – 11:40	<i>Projections of U.S. Summer Heat Waves out to 2040</i> Anthony G. Barnston , IRI, and Bradfield Lyon, University of Maine
11:40	Workshop Adjourns

Program for the 42nd Annual Climate Diagnostics and Prediction Workshop

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Tuesday, October 24, 2017

5:30-7:30pm Poster Session

Recent Events

The Philippines' Impacts of and Responses to 2015-2016 El Niño, Ms. Edna L. Juanillo, Ana Liza S. Solis and Joseph Basconillo, Philippine Atmospheric, Geophysical and Astronomical Services Administration (PAGASA)

Understanding long-lead ENSO predictions within the framework of recent ENSO events, Boniface Fosu, S.-Y. Simon Wang, Utah State University

The Atmospheric and Ocean conditions during the 2017 Summer of the Southern Hemisphere: Climate Catastrophe over the coast of Peru, Guillermo F Almeyda, Tax Service & Atmospheric Research

Subseasonal-to-seasonal (S2S) Hazards

Using An Improved Procedure of Generating Initial Conditions for Multi-Week MJO Hindcast During DYNAMO Period, Meng-Pai Hung, Chinese Culture University, Taipei, Taiwan, Chien-Ming Wu, Wei-Ting (Anne) Chen, National Taiwan University, Shih-Hao Su, Chinese Culture University, Hsi-Yen Ma, Lawrence Livermore National Laboratory, Livermore, CA

Improving Multimodel Medium Range Forecasts over the Greater Horn of Africa Using the FSU Superensemble, Oliver Kipkogei, Intergovernmental Authority on Development (IGAD) Climate Prediction and Application Centre

Application of a Hybrid Dynamical-Statistical Model of Week 1 to 4 Forecasts of Tropical Cyclone Activity in the Northern Hemisphere, Christina Finan, Innovim/NOAA CPC

The Dominant Modes of Anomalous Precipitation over Eastern China during the Heavy Rainy Season of South China and Possible Causes, QingYun Zhang, Institute of Atmospheric Physics, Chinese Academy of Sciences

Influence of Seasonal and Subseasonal Variability on Extreme Rainfall in California, Kristine Chen, Samuel Lillo, David Parsons, Veronica Falls, School of Meteorology, University of Oklahoma

Developing a Framework for Seamless Prediction of Sub-Seasonal Extreme Precipitation Events in the United States, Derek Rosendahl, South Central Climate Science Center, University of Oklahoma

Application of NMME seasonal forecasts to Alaska fire potential using Canadian Forest Fire Indices with Quantile Mapping bias corrections, Akila Sampath, University of Alaska Fairbanks

The Role of the Subtropical North Atlantic Water Cycle in Recent US Extreme Precipitation Events, Laifang Li, Raymond W. Schmitt, Caroline C. Ummenhofer, Duke University/ Woods Hole Oceanographic Institution

Drought/Pluvial

The 2014/15 snowpack drought in Washington state and its climate forcing, Boniface O. Fosu, Shih-Yu Wang, Utah State University

Examining the Evaporative Stress Index as an Indicator for Flash Drought Across the United States Using the North American Regional Reanalysis, Jordan I. Christian, University of Oklahoma

Drought characteristics in two agro-climatic zones in Sub-sahara Africa, Ayansina Ayanlade, Department of Geography, Obafemi Awolowo University, Nigeria.

Probabilistic drought forecasts based on the Northern American Multi-Model Ensemble (NMME), Li Xu and Kingtse Mo, NOAA CPC/Innovim

High Latitude

Development of statistical model for seasonal prediction of boreal wintertime temperature over the Korean Peninsula, Sungho Woo, Seongeun Lee, Soyoung Yim, and Dongjun Kim, APEC Climate Center, Korea Meteorological Administration

The central role of Greenland blocking on the unusually early 2013 melt of Baffin Bay ice cover, Thomas J Ballinger, Department of Geography, Texas State University

Multi-week prediction skill assessment of Arctic sea ice variability in the CFSv2, Yanyun Liu, Wanqiu Wang, Arun Kumar, NOAA CPC

Multi-scale prediction with CESM-CAM-MPAS, Nicholas Szapiro, University of Oklahoma

Climate Services

Different Flavors of Normals: Accounting for ENSO and Climate Change, Carl Schreck, CICS-NC, North Carolina State University

Examining the stationarity assumption for statistically downscaled climate projections of precipitation, Adrienne Wooten, South Central Climate Science Center

The need for a robust aviation impact variable climatological database, Casey Crosbie, NWS/FAA

Evaluating the performance of numerical ENSO forecasts for June-August 2017 and discussing various market-moving impacts, Thomas Walsh and Isaac Hankes, Thomson Reuters

Evaluation of a Regional NMME Climate Forecast Tool for Application to Seasonal Hydrologic Prediction in the Great Lakes Basin, Deanna Apps, United States Army Corps of Engineers

Tracking Progress on NOAA's MAPP-CTB Projects: Accelerating Transition of Research Advances into Improved Operational Capabilities, Jiayu Zhou, NWS/OSTI, and David DeWitt, NOAA CPC

Other Topics

Impact of high vertical resolution in an oceanic general circulation model on sea surface temperature simulation, Ying Zhang, Wanqiu Wang, Arun Kumar, NOAA CPC, ESSIC/UMD

Empirical teleconnection-based standards for U.S. temperature and precipitation predictability at Weeks 3 and 4, Daniel Harnos, Laura Ciasto, Nathaniel Johnson, Michelle L'Heureux, Cristiana Stan, Adam Allgood. NOAA CPC

Investigating the Potential for Seasonal Snowfall Forecasts at CPC, Stephen Baxter, NOAA CPC

Toward an ENSO Index for a Changing Climate, John W. Nielsen-Gammon and Scott Meyer, Texas A&M University

Extratropical-tropical Interactions over Ethiopia, Endalkachew Bekele and Wassila Thiaw, UCAR and NOAA/CPC

Developing a probabilistic seasonal forecast tool based on NMME, Mingyue Chen, Arun Kumar, and David DeWitt, NOAA CPC

Benchmark statistical model for seasonal prediction of temperature and precipitation, Daniel Barandiaran and Stephen Baxter, NOAA CPC and INNOVIM

Seasonal prediction of North American temperature and precipitation using the Calibration, Bridging, and Merging (CBaM) method, Sarah Strazzo, NOAA CPC/IMSG

Progress on the Subseasonal Experiment (SubX) Forecasting Weeks 3-4, Emerson LaJoie and Dan Collins, NOAA CPC/IMSG