On the activities in KIOST’s ocean and climate prediction system development

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1. Regional Ocean Prediction System (OPEM)

2. Climate Prediction System

3. Assim. of Sea Ice Interface Temperature
1. Regional Northwest Pacific Prediction System (OPEM)

Numerical Model

- System title: OPEM (Ocean Predictability Experiment for Marine environment)
- Based model: GFDL-MOM5
- Domain: 5-63°N, 99-170°E
- Resolution: 1/24°×1/24° (Arakawa B-grid) & 51 layers (z-star coordinate system)
- Data Assimilation: Ensemble Optimal Interpolation

Model domain and bottom relief

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<tr>
<td>2nd phase of the “Development of the Korea Operational Oceanographic System (KOOS)”</td>
<td>Pilot operation of the OPEM prediction</td>
<td>Launch the user data service</td>
<td>Generating OPEM reanalysis data (since 1993-) applying SSH assimilation</td>
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Major history of the OPEM development
1. Regional Northwest Pacific Prediction System (OPEM)

Data Service

- Data service to internal users, domestic agencies, university and companies.
- Providing analysis/prediction data through a limited FTP server, not through a website.
2. Climate Prediction System applying by KIOST-ESM

Framework adopted from GFDL CM2.5

Applying new physics
Some of them have been newly developed

Convection Scheme
(Park, 2014)

PBL Scheme
(Bretherton and Park, 2009)

Dynamic Vegetation
(Kim et al., 2018)

Ocean D. Assim.
(Kim et al., 2015)

MLD scheme
(Noh et al., 2016)

CMIP6 participation (Kim et al., 2020) !!!
2. Climate Prediction System applying by KIOST-ESM

- Big Improvement in southern warm bias
- More realistic MJO and ENSO

SST Bias in AR5 models (Wang et al. (2014, Nature CC))

Pak et al. (2021)
2. Climate Prediction System applying by KIOST-ESM

New climate reanalysis by KIOST-ESM !!!
Arctic Sea Ice Interface Temperature retrieved from Satellite data !!!

**AMSR-E 6.9 GHz-retrieved ice temperature [K]**

**SSM/I 19.4 GHz-retrieved ice temperature [K]**

**Difference [K]**

**Scatterplot**

Correction factor (CF)

Emissivities ($\varepsilon_V$, $\varepsilon_H$)

Ice temperature ($T_s$)

$R = 0.9545$

Bias = -0.27 K

RMSE = 1.72 K

Lee et al., 2018 (RS)
3. SIIT Assimilation to KIOST-ESM (Plan)

- The SIIT can be calculated by the function of ice thickness, snow depth, surface snow temperature.
- Observation operator for SIIT is given by applying thermal conduction equation !!!

The SIIT equation conserved heat transfer

\[ \frac{k_{\text{ice}}}{h} \frac{\partial T_{\text{ice}}}{\partial z} = \frac{k_{\text{snow}}}{h} \frac{\partial T_{\text{snow}}}{\partial z} \]

Where \( k \) is thermal conductivity

\[ T_{\text{ice}} = \frac{k_{\text{snow}} HT_{\text{surface}} + k_{\text{ice}} h T_{\text{water}}}{k_{\text{snow}}H + k_{\text{ice}}h} \]
Thank You