Notes on “2024 AGU Fall Meeting”

# Basic Info

Dec 8-13 2024, Washington D.C.

# Notes

## Boundary layer Session

# 8:30am

Riley & Lelory

The idea of defining a “submeso” component in the flow decomposition

Mahrt, L. (2024). Heat Transport by Turbulence and Submeso Structures in the Stable Boundary Layer. *Boundary-Layer Meteorology*, *190*(3), 14.

# 8:40am

Use a technique called: Cross Spectral Budget (CSB)

Idea of maximum sustainable heat flux

ATTO = Amazon Tall Tower Observation

De-correlation timescale

# 9:00am Dr. Tyler Waterman

Devising an improved Monin-Obhukov Theory => accounting for Anisotropy

$$\frac{x}{x\_{\*}}=ϕ\_{x}\left(ζ,y\_{B}\right)$$

#9:35 Brigitta Goger

MrCosts: Multi-coherent spatio-temporal scale separation

#9:45 David Turner from NOAA

Propagation of Information

Averaging Kernel $A=I-\frac{S\_{x}}{S\_{a}}$ where $S\_{x}=$ covariance of retrieval, and $S\_{a}=$ covariance of prior

#10:40 Aditya Aiger and Ghanesh Narasimhan

$$τ\_{tot}=τ\_{t}+τ\_{w}+τ\_{v}$$

Total kinematic stress decomposition into …. $τ\_{w}$ is the wave-related stress

Wind-wave misalignment

Aiyer, A. K., Deike, L., & Mueller, M. E. (2023). A sea surface–based drag model for large-eddy simulation of wind–wave interaction. *Journal of the Atmospheric Sciences*, *80*(1), 49-62.

#10:50 Ghanesh Narashimen

Wind-wave wind-turbine

Viscous Curvilinear Model (Cao, Deng & Shen, 2020)

Cao, T., Deng, B. Q., & Shen, L. (2020). A simulation-based mechanistic study of turbulent wind blowing over opposing water waves. *Journal of Fluid Mechanics*, *901*, A27.

Better pressure seems to contribute to better foam drag

#11:05am

Wind-wave growth 1957 J.F.M John W. Miles

Wave-coherent motions

Hristovet et al, 2003 Nature

Auto encoder on CNN

#11:15

John-Hopkins Turbulence Database (<https://turbulence.idies.jhu.edu/home>)

Scale e budget [scale integrated kolomogrov Hill equation (SIKH)] (Hill 2002)

$$\frac{Dk\_{l}}{Dt}=Φ\_{l}-P\_{l}+D\_{l}-ϵ\_{l}-B\_{l}$$

Where $l$ is the length scale, $Φ\_{l}$ is the cascade rate

The main point of this work: Energy loss due to potential $P\_{l}$

#11:35

Pressure Correlation

Decoupling of the pressure correlation

## Southern Ocean Session (Tuesday)

#2:10pm Hosing exp in Antartica

Dong et al. 2022

Kim et al 2022 ITCZ

#2:20pm Zachary Kaufman

Q: Coupled models don’t capture Southern ocean cooling SST. Why?

FAMIP & SOFIAMIP

P-E and Antarctica meltwater are linked to SST bias

# 2:30 Yushi Morioka (Jamestec person)

SPEAR (Delworth et al 2020)

Sea-ice variability <=> deep ocean variability

#2:40 Feng Li

Ozone recovery affects Southern Ocean SST.

# 2:50 Greg Cesana

Clouds <=> sea-ice variability

Nudging the wind results in better SIC

## Wed Sessions

#2:10pm

Arctic low-level clouds are uncertain in … ?

Mixed-phase clouds (the difference in particle Diameter-concentration distribution)

#2:40pm

Coupled sea-ice melt

Hadgen 3

Coupled models have rapid sea-ice melt within days

Seaice-albedo feedback is too active

#2:50pm Ridge consolidation

$R=\frac{h\_{c}}{h\_{i}}$ where $h\_{c}$= consolidate layer, and $h\_{i}$ is the level of ice

# 3pm assess wind-ice coupling in ECCOv4

ECCO has stronger wind-seaice coupling $α$ defined below:

$$α=\frac{\left|\vec{U}\_{ice}\right|}{|\vec{U}\_{wind}|}$$

#3:10pm Hassan Mason Charney S

Beaufort Gyre.

Baroclinic instability

## Machine learning & oceanography

#4pm Reconstruct streamfunction from satellite observation

Layer-wise relevance propagation

#4:10pm 4D VarNet

Can ML predict marine time continent MJO?

#4:20pm Yingjie Lin, Xiao Fang Li

Reconstruct 3D ocean

AI learning diurnal cycle of SST?

#4:30pm SWOT – precipitation retrieval

Bruno Picard

Colin & Ausson 2024

Random Forecast Algo

#4:40

FCDS

GLORYS low-res (1/12 deg) <=> CNAP high-res (1/24 deg)

OceanNet

Chattopadhyay, A., Gray, M., Wu, T., Lowe, A. B., & He, R. (2024). OceanNet: A principled neural operator-based digital twin for regional oceans. *Scientific Reports*, *14*(1), 21181.

Fujitsu

#5pm Mercator Ocean

Use AI to train how to smooth the convective mixing?

#5:10 Reconstruct High-res SST

Pierra Garcia

Involve SST forecast

ORCA = **O**peration hi-**R**esolution **C**urrent forecast

Nadir UCST => SWOT => Drifter

#5:10 Reconstruct SST hi-res

MAESSTRO

Input IR+Microwave => ResUnet => Output (cloud-free IR\_SST)

Multi-Satellite is better

## MJO session (Thursday)

#8:30 Shinoda

Diurnal cycle, sea-land breeze impact on MJO

Land-sea breeze induced latent heat flux (diurnal) has a contribution in longer time scale

Hudson & Maloney 2023 MJO comp of LHF in Maritime-continent

Hudson, J., & Maloney, E. (2023). The role of surface fluxes in MJO propagation through the maritime continent. *Journal of Climate*, *36*(6), 1633-1652.

Impact moisture Budget

Wind-current difference is not taken into account

Reanalysis data might not have been accurate

#8:40 Leeuwin Current Indonesian Thorough flow Subtropical Gyre

#8:50

Eddy-resolving OGCM COCO

Coastal Trapped Waves

#Bin Wang

Climatological MJO = CMJO

MJO => Moonsoon

CISO = Clim Intraseasonal Oscillation

Phase-locking of CMJO is a point.

#9:30 Cold-Cloud System Identification

ARC center of Excellence for climate extremes

#9:50

EOT = Efficiency of SST

#Chidong-Zhang

Diurnal cycle is not harmonic

Total precip = diurnal cycle + others

Coastal line affect diurnal cycle

Wind-temperature in phase (cause), while Precip lag 1hr (result)

Land-breeze & sea-breeze competition

### GFS Session

GFS Next v17

Res => 9km

JEDI CMEPS

### ML coupled air-sea model

#10:50

ML based coupled model

Can we quantify or use adjoint model to see ENSO prediction barrier?

Can we understand weighting of ML for simple models?

Learn how to simplify complex physics

#Tapio Schneider

Climate prediction Challenge: spread is large

Uncertainties come from small-scale motions

Energy balance

Resolution is not the long-term way to go

success: MOST is kind of successful

less success: convection scheme

ML challenge:

Disentable effect

Aerosol Effect

No Obs Tendencies

Stability

Interpretability (interesting)

CliMA => Hybrid AI

ML: Good in Land Models

Find ML benchmark

### Theoretical Cloud Convection (Thursday)

#2:10pm Hao Fu

Synchronization of Convection

$$I\_{syn}=1-\frac{spatial var}{spatio-temporal var}$$

# Kerry Emanuel

Inertial range ~ 200m

Cloud is 3km

Non-gaussian distribution nature

In-cloud obs != classical entrainment

Inhomogeneous

Warm rain formation = inhomogeneous mixing

# Larissa Baek

WTG has multiple equilibria

Raymond et al 2014

Bernardez & Beck (2024)

Moisture mode (Adames 2019)

Inoue & Back (2015)

Kuang (2012)

Oscillatory equilibrium found in weak temperature gradient simulation

#Mark Rodmell (ECMWF)

“How do mesoscale conv affect downstream bursts”

Langrangian Growth Rate of PV ens Variance : $\frac{1}{σ}\frac{dσ}{dt}$

Q: Does hi-resolution matter for global medium-range weather prediction?

Convection => MCS => Waves, Jet => Burst dropout

#Boualem Khouider

Transition between cloud type

$$R\_{ij}=\frac{1}{τ\_{ij}}F\left(CAPE, CIN, W, H\_{m}\right)$$

SMCM model: No double ITCZ!!

MJO – propagation

#Sarah Shamekh

Conditional distribution of convective vs stratiform cloud

LOOKING for POSTDOC

#Brian Mapes

Evolution theory of convection conditional probability

“Cloud Botany” Shallow convection

Jansson et al. 2023 => Free data

## Ocean-land-atm interaction

#David Neelin

LFT layer

Dry-inhibition regime => moist heatwave

Ducan Ahmed & Neelin 2024

#Thunder Styorm in China & lightning

Night time has more thunderstorm activity