Formation mechanisms of temperature inversion in the southeastern Arabian Sea

Jaison Kurian and P. N. Vinayachandran

Centre for Atmospheric and Oceanic Sciences,
Indian Institute of Science,
Bangalore

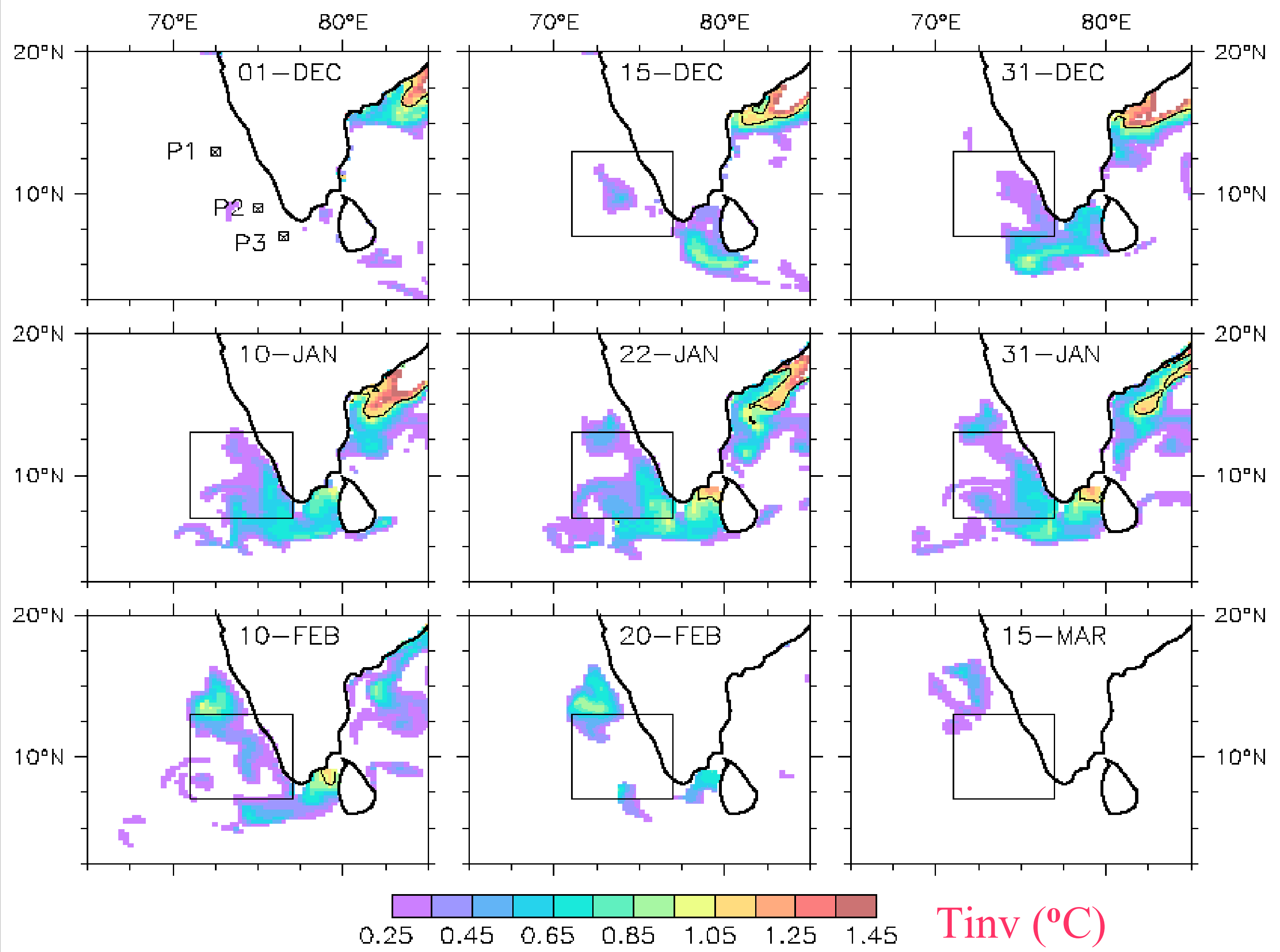
National Workshop on
"ARMEX Data Analysis & Modelling",
April-20, 2006, NIO, Goa

IISc

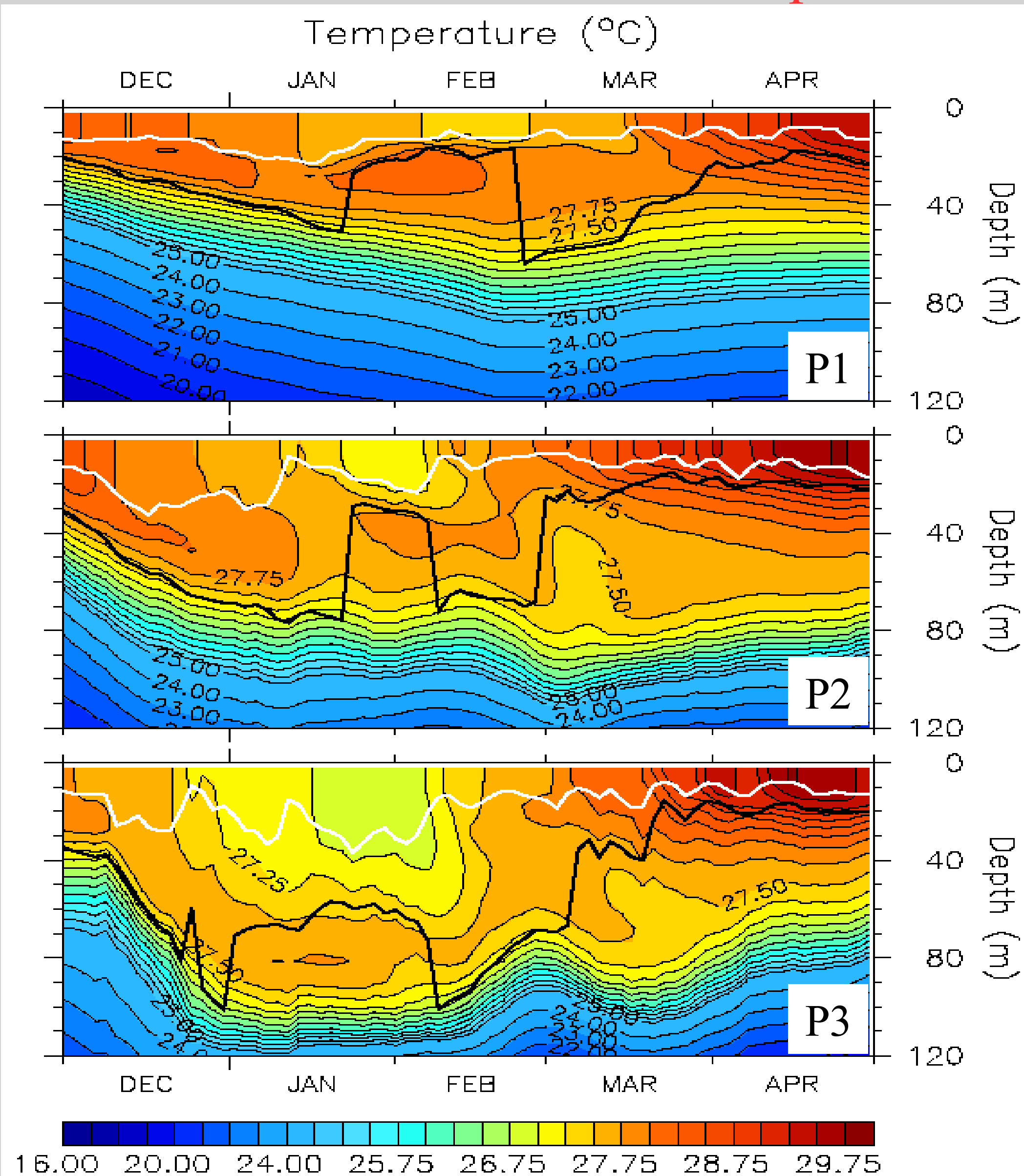
1. Model for Indian Ocean : Configuration

Model	GFDL's recent model MOM4p0	
Model Domain	30ºE-120ºE & 30ºS-30ºN	
Resolution	0.25º in Horiz. & 5 m in the upper 60 m with 40 levels	
Boundaries	solid boundaries on West & North	
	open boundaries with sponge layer on South & East	
Forcing	Wind & Heat Flux	OMIP (from ERA-15), daily Clim.
	Precipitation	CMAP, daily Clim. (from pentad)
	Runoff	UNESCO, monthly Clim.
IC	Clim. Temp. & Salinity during January (Levitus, 1998)	
	with zero velocities	
Simulation	7 year run and results from 7^{th} year is presented here	

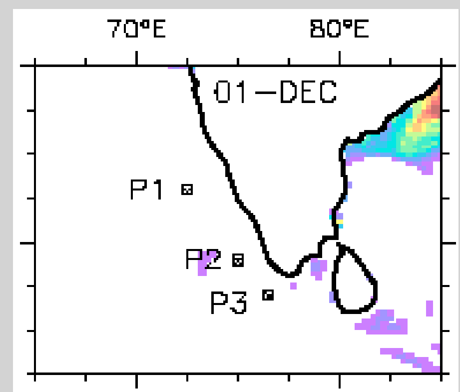
2. Simulated Temp. Inversion



2. Simulated Temp. Inversion



Temp (ºC)



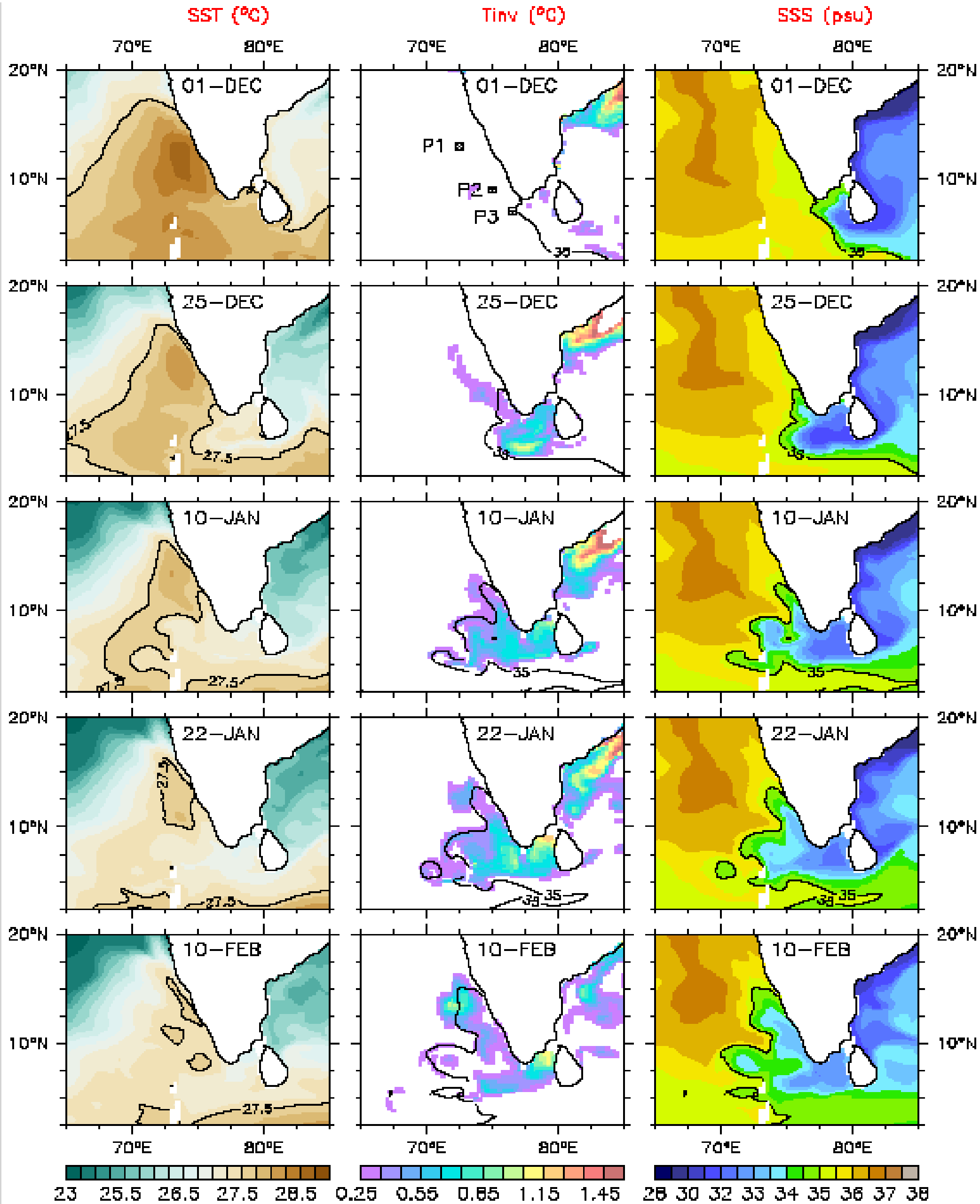
3. Suggested mechanisms for Temp. Inversion

1. Advection of cold low-saline water over warm high-saline water
   (Thadathil and Ghosh, 1994; Shankar et al., 2004;
   Gopalakrishana et al., 2005; Rao and Sikka, 2005)

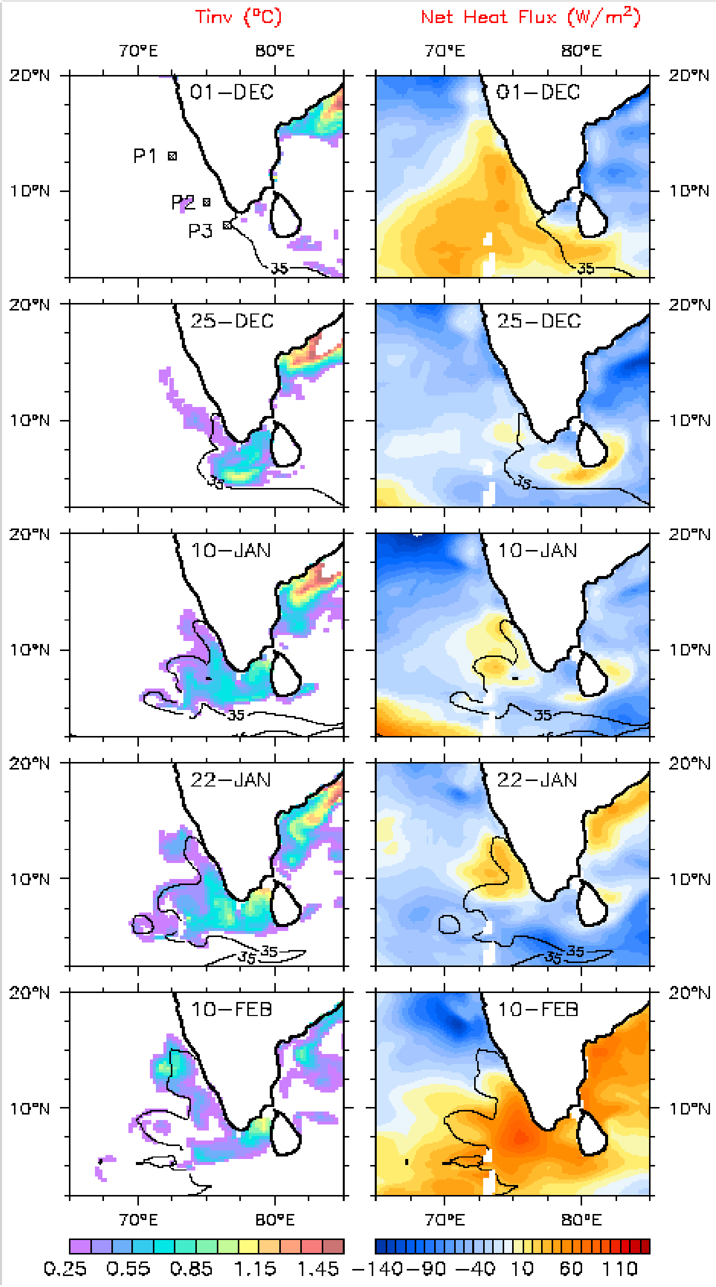
2. Loss of penetrative radiation to barrier layer (Shankar et al., 2004)

3. Winter cooling (Rao and Sikka, 2005)

Mechanisms : Advection



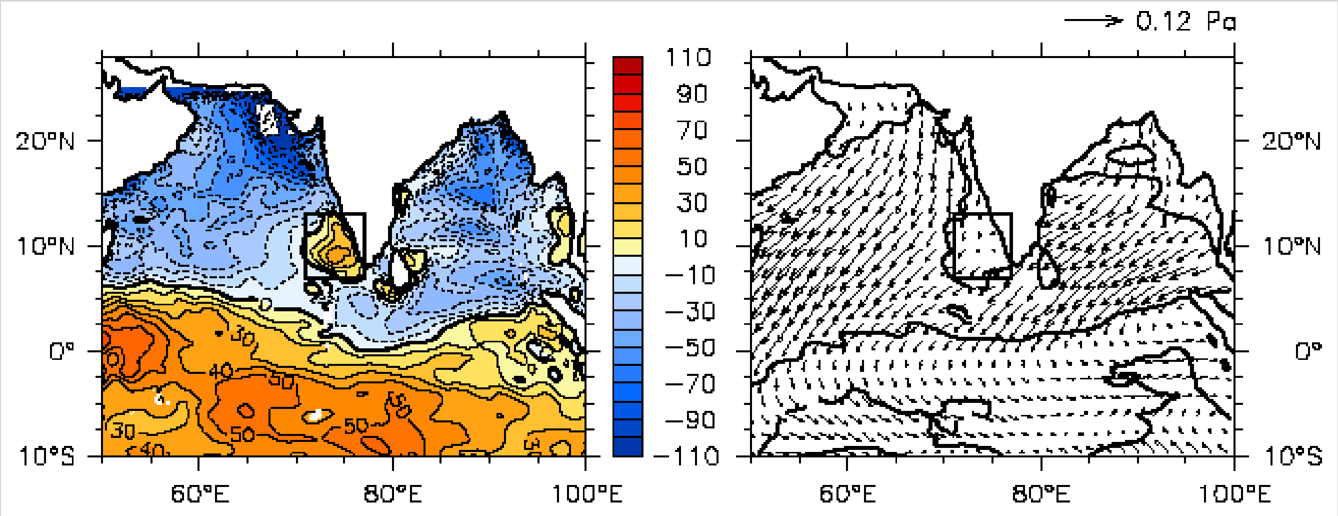
4. Mechanisms : Winter Cooling



4. Mechanisms : Winter Cooling

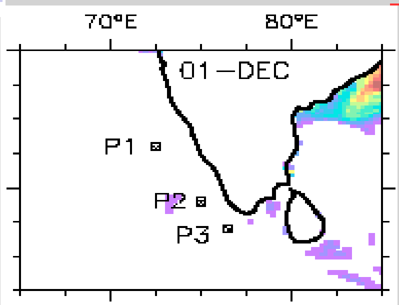
Net Heat Flux (W/m2)

Wind Stress (Pa)

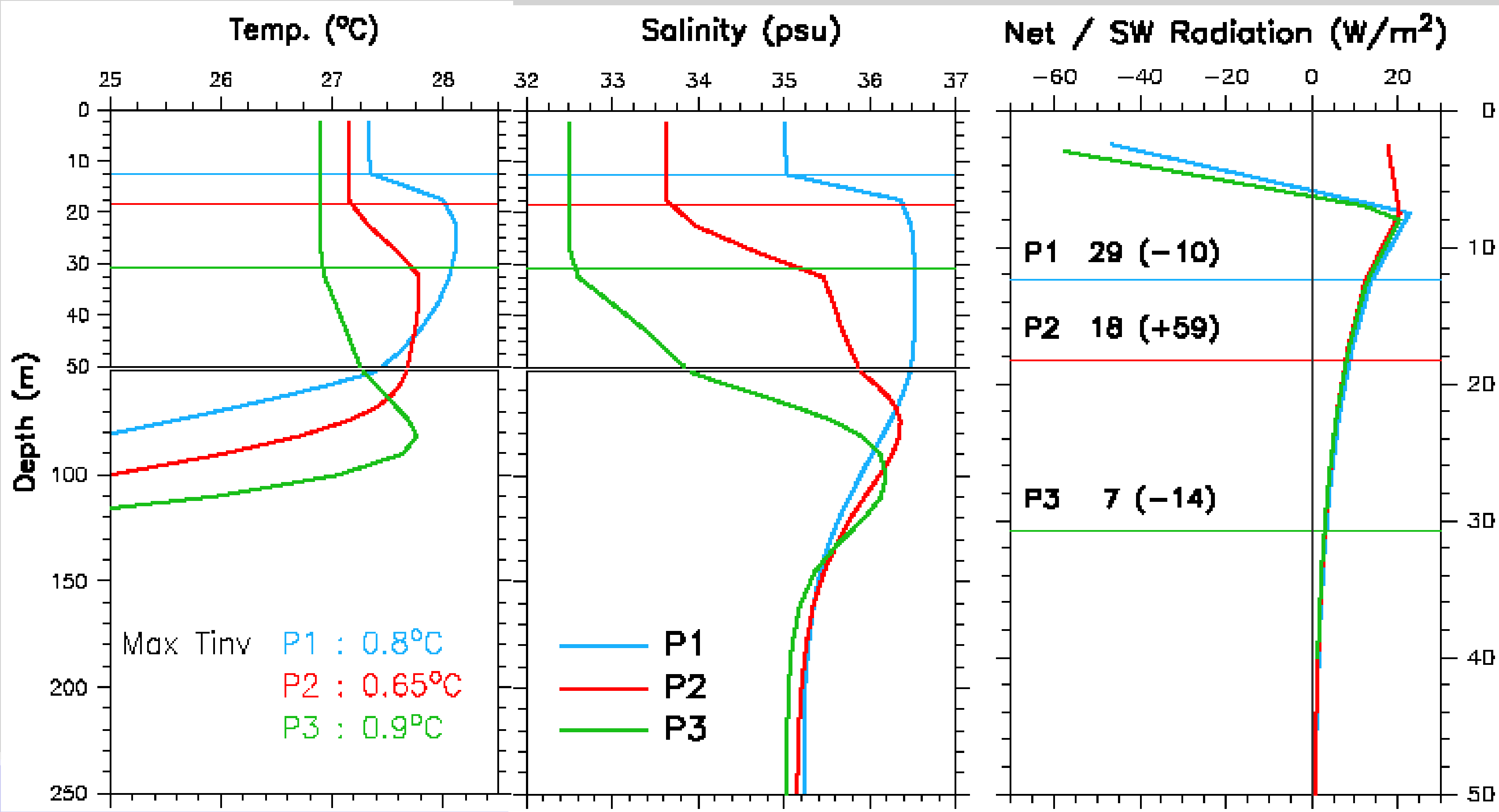


Fields averaged over 15-Dec:15-Feb period

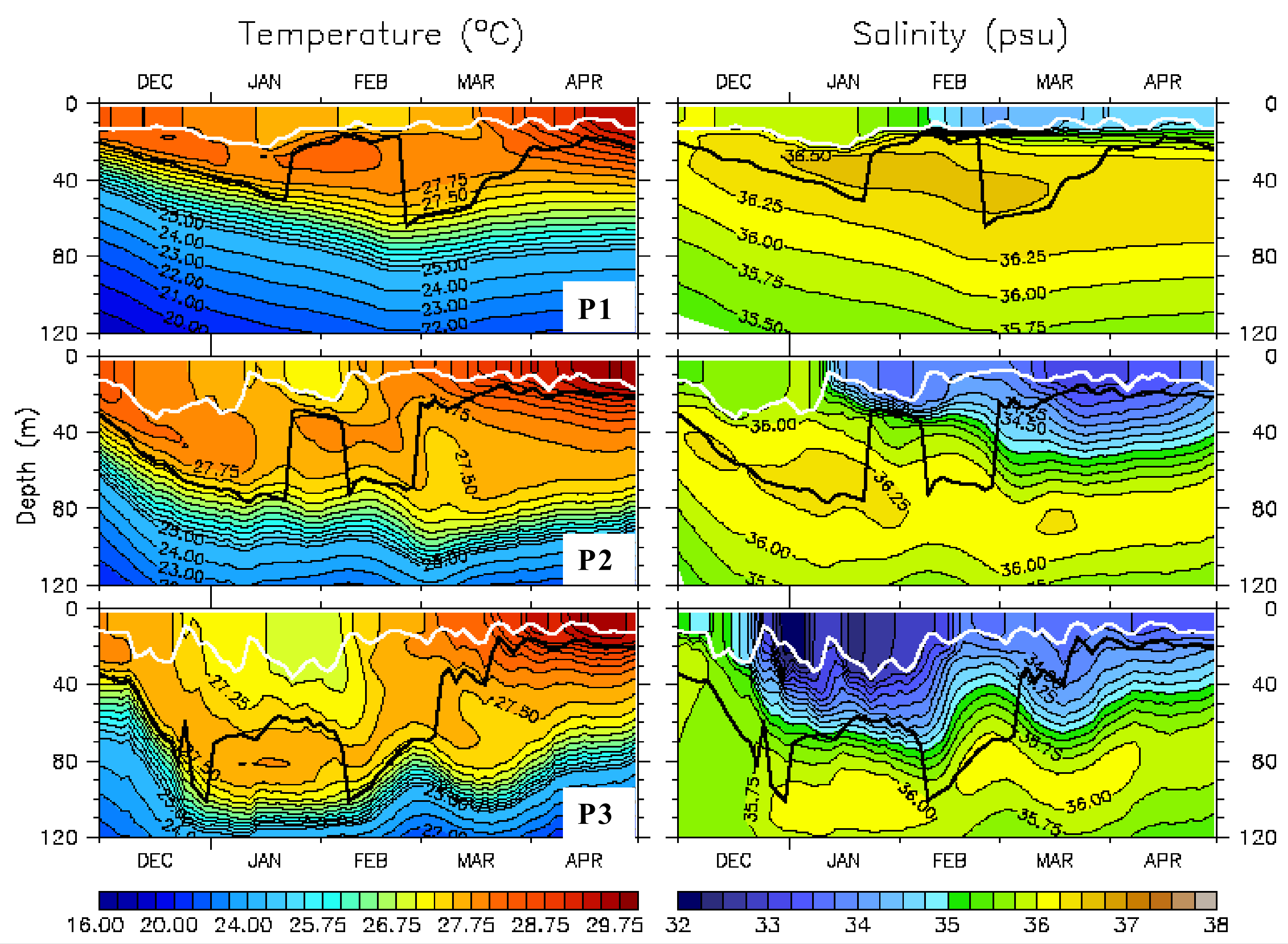
4. Mechanisms : Loss of penetrative radiation



P1 : 09-FEB, P2 : 28-JAN, P3 : 22-JAN



4. Mechanisms : Loss of penetrative radiation



4. Results

1. Over seasonal time scale advection and loss of penetrative radiation controls the formation of temperature inversions

2. Over daily-weekly time scale surface cooling can also contribute towards the formation of inversions

3. Advective effects are important at southern part.

4. Penetrative radiation is important at northern part.

5. Salinity stratification (low-salinity & high-salinity) is necessary for the formation of inversions

THANK YOU

SWFLX:	248.4	223.3	228.9				
NET :	18.7	76.4,	-6.7				
2.5 :	-46.59130	17.65295	-66.27800				
7.5 :	22.73816	20.40178	21.21295				
12.5 :	13.80186	12.39690	12.78164		-10	58.8	-14.4
17.5 :	9.26436	8.33702	8.47387		-28.7	17.6	7.7
22.5 :	6.27354	5.65683	5.66401				
27.5 :	4.25133	3.84109	3.78837				
32.5 :	2.88113	2.60833	2.53399				
37.5 :	1.95255	1.77122	1.69496				
42.5 :	1.32325	1.20277	1.13374				
47.5 :	0.89677	0.81676	0.75835				
52.5 :	0.60775	0.55463	0.50725				
57.5 :	0.41187	0.37663	0.33930				
62.5 :	0.29043	0.26613	0.23608				
68 :	0.20763	0.19067	0.16638				
74 :	0.15035	0.13841	0.11855				
81.5 :	0.10085	0.09311	0.07802				
90 :	0.05993	0.05552	0.04534				
100 :	0.05686	0.05306	0.04106				