Table S-1 MSwM Onset and Withdrawal dates (day of a year) compared to each parameter's MSwM index

	ΔP	ΔU	MFC	TpNet	OLR	Mean	DMH(MEAN)
Onset	135	139	136	132	135	135 (14-May)	139 (17-May)
Withdrawal	273	271	289	267	291	278 (4-Oct)	276 (1-Oct)
Length	139	133	154	136	158	144	138

Table S-2 MSwM indices results of large-scale it onset, withdrawal, and season length.

	Mean	Standard Deviation	Maximum	Minimum
Onset Date	*135 (14-May)*	*5*	*153 (1-Jun)*	*120 (29-Apr)*
Withdrawal Date	*278 (4-OCT)*	*13*	*306 (1-Nov)*	*255 (11-Sep)*
Season Length	*144*	*14*	*168*	*117*

Table S-3 – Correlation values of parameters between variables

	dP	U-Wind	MFC	OLR
TP Net	0.81 (P<0.01)	0.8.2 (P<0.01)	0.8.0 (P<0.01)	- 0.80 (P<0.01)

Table S-4 Yearly onset and withdrawal dates, season length of southwest monsoon over the Myanmar as determine by the MSwM index and that extracted from DMH, Myanmar

Year	Onset		Withdrawal		Season Length	
	MSwM	DMH	MSwM	DMH	MSwM	DMH
1991	151	146	272	270	122	125
1992	135	137	265	275	130	139
1993	134	140	275	285	142	146
1994	144	133	279	276	136	144

1995	132	135	273	276	142	142
1996	127	144	260	276	134	133
1997	132	143	278	251	148	109
1998	137	141	274	268	139	128
1999	138	130	282	273	145	144
2000	130	134	276	265	147	132
2001	122	140	265	275	144	136
2002	129	147	271	273	143	127
2003	131	137	277	268	147	132
2004	129	133	273	266	144	134
2005	145	143	276	249	132	107
2006	134	137	283	274	150	138
2007	125	134	286	282	162	149
2008	128	132	277	275	150	144
2009	138	137	286	281	149	145
2010	138	139	278	272	141	134
2011	140	142	280	283	141	142
2012	130	139	280	285	151	147
2013	136	137	275	286	141	150
2014	131	138	274	287	144	150
2015	134	137	285	286	152	150
2016	137	141	291	287	155	147
2017	150	136	299	286	150	151
2018	141	145	283	278	143	134
2019	137	144	273	270	137	127
2020	142	140	297	292	156	153

Table S-5 List of Abbreviations

MSwM	-	Mainland Indochina Southwest Monsoon
CPM	-	Cumulative Change Point Monsoon Index
SST	-	sea surface temperature
SWJ	-	Subtropical Westerly jet
TEJ	-	Tropical Easterly jet
EASM	-	East Asian summer monsoon
ISM	-	Indian summer monsoon
WNPSM	-	Western North Pacific summer monsoon
MIC	-	mainland-Indochina
ENSO	-	El Niño Southern Oscillation
DMH	-	Department of Meteorology and Hydrology
ECMWF	-	European Centre for Medium-Range Weather Forecasts

MFC	-	moisture flux convergence
SLP	-	sea level pressure
OLR	-	outgoing longwave radiation
HadISST	-	Hadley Centre Sea Surface Temperature
IOD	-	Indian Ocean dipole

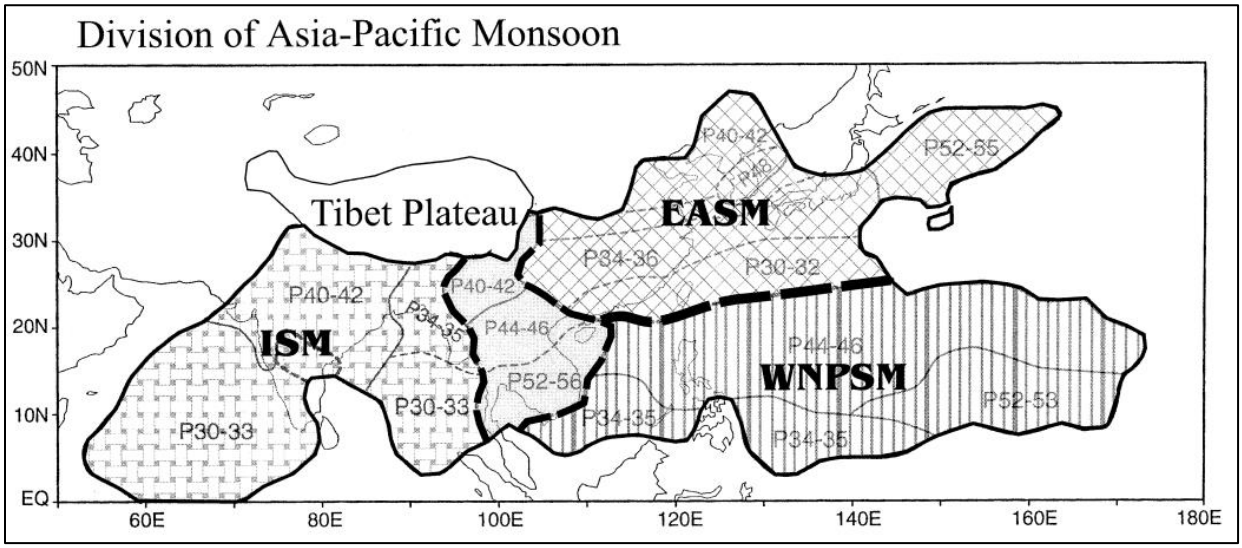

Fig S-1 Three subregions make up the Asian-Pacific monsoon (B. Wang & Ho, 2002)

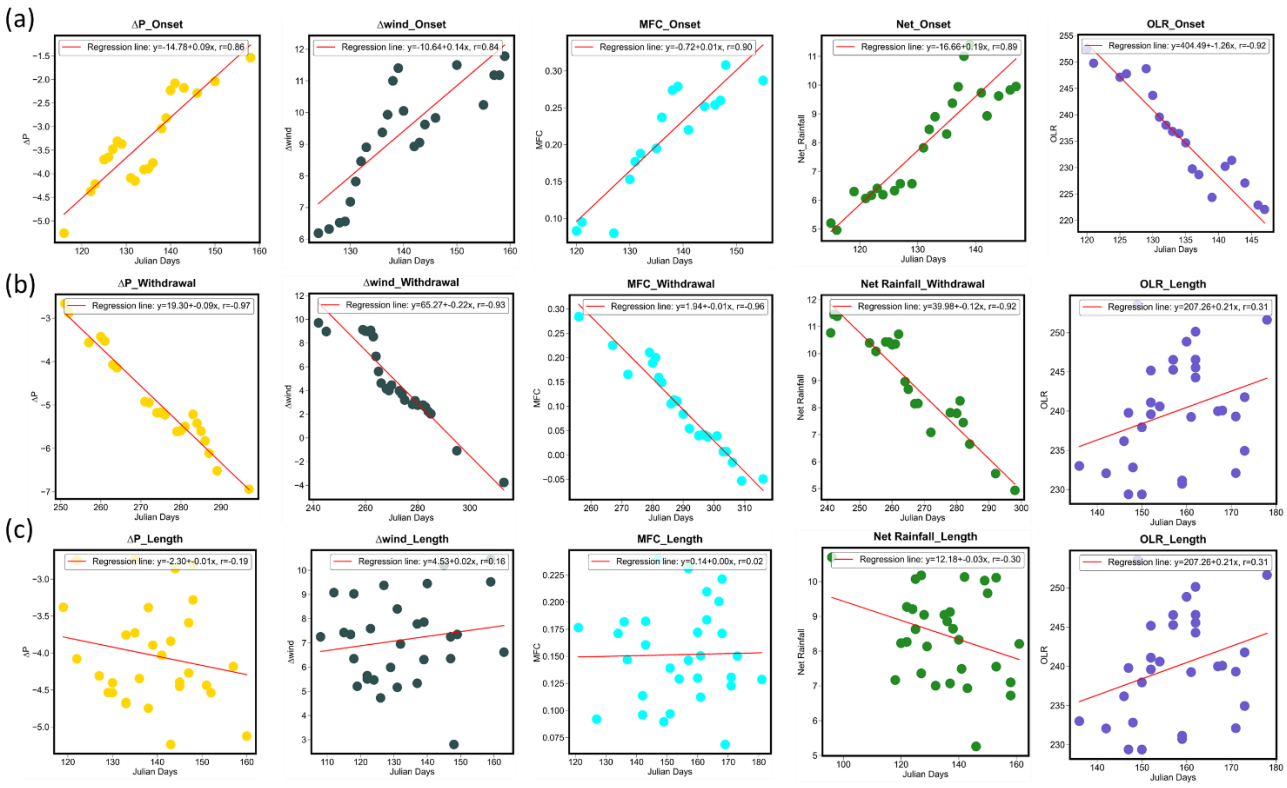

Fig S-2 Regression scatter plots of five variables of MSwM index (as in Eq.2) with monsoon (a) onset dates, (b) withdrawal dates and (c) seasonl length during 1991-2020. This figure was created with Python 3.10 (Matplotlib 3.5.2 [https://matplotlib.org/]).

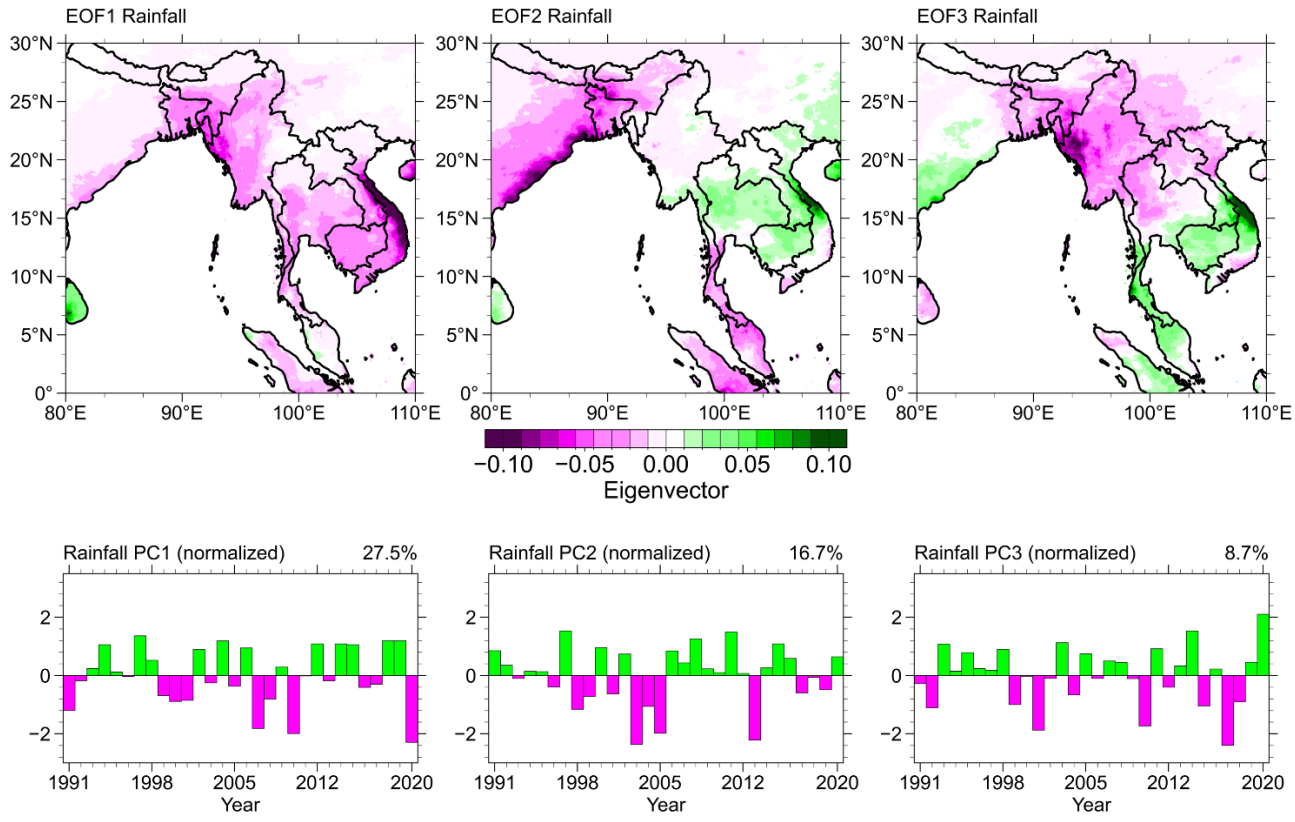

Fig S-3 First three EOF modes of October rainfall and their normalized PCs over the study area, with a focus on rainfall variability in mainland Indochina. This figure was created with Python 3.10 (Matplotlib 3.5.2 [https://matplotlib.org/], Cartopy 0.20.0 [https://pypi.org/project/Cartopy/]).

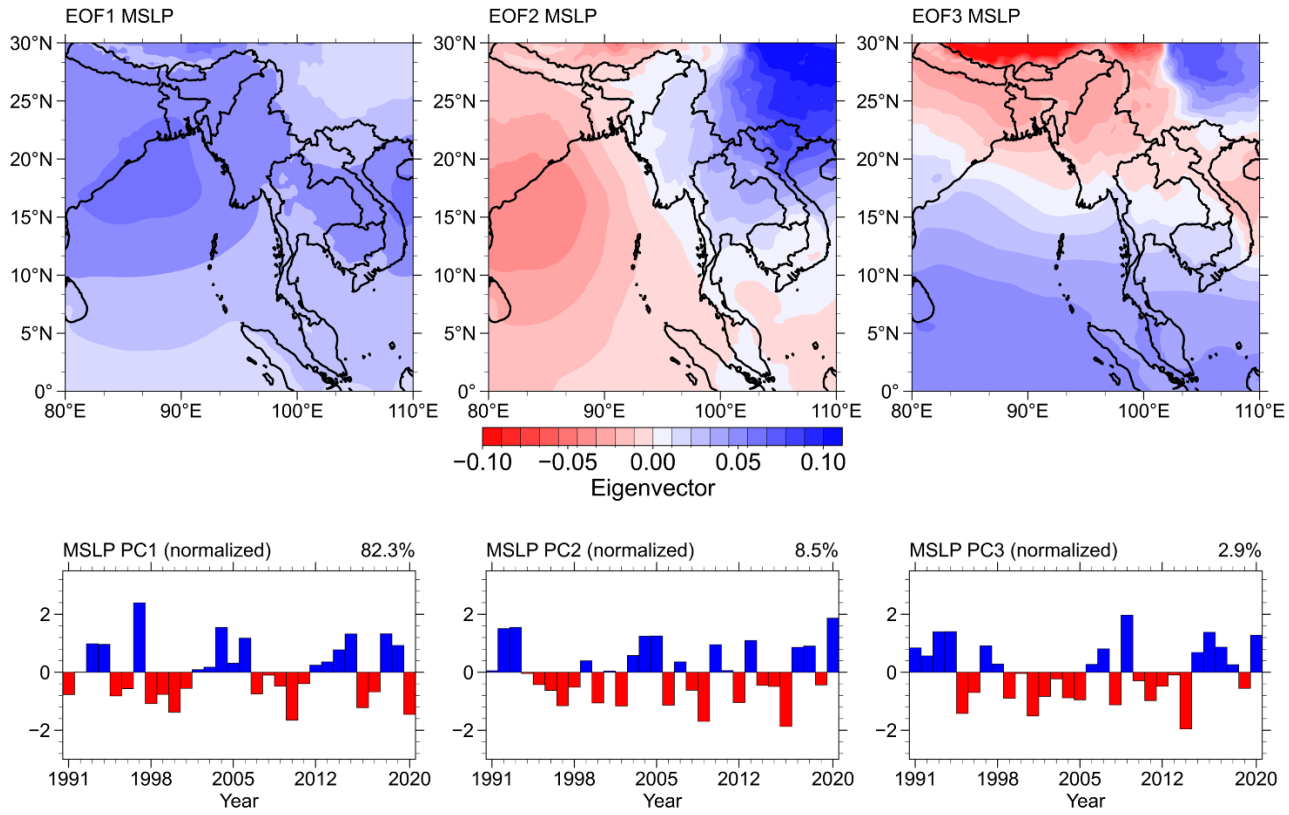

Fig S-4 First three EOF modes of October sea level pressure and their normalized PCs over the study area, focusing on atmospheric circulation variability in mainland Indochina. This figure was created with Python 3.10 (Matplotlib 3.5.2 [https://matplotlib.org/], Cartopy 0.20.0 [https://pypi.org/project/Cartopy/]).

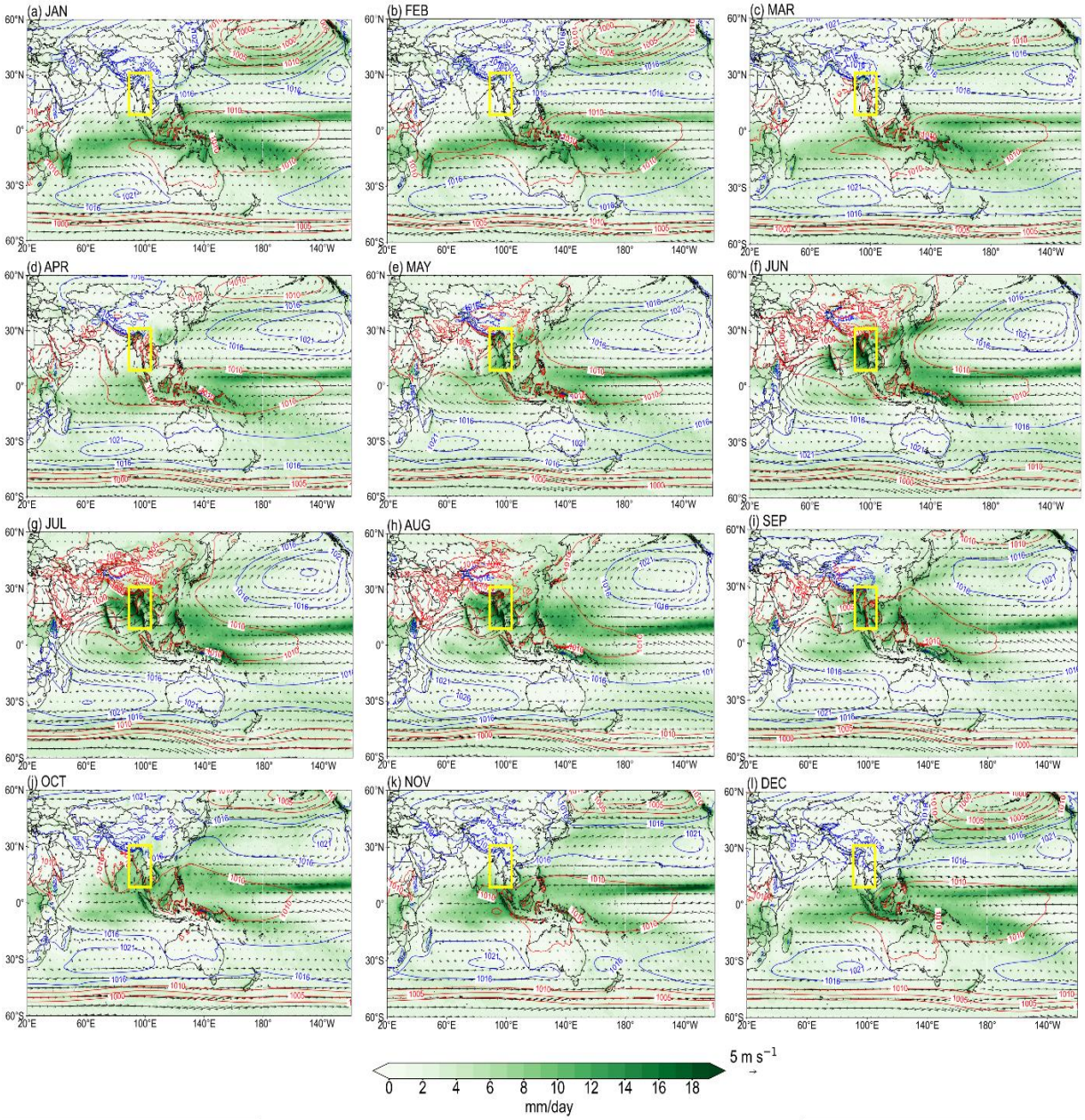

Fig S-5 Climatology intraseasonal variation of rainfall (shade, mm), 850 hPa wind (vector, m/s) and geopotential (contour, gpm). This figure was created with Python 3.10 (Matplotlib 3.5.2 [https://matplotlib.org/], Cartopy 0.20.0 [https://pypi.org/project/Cartopy/]).

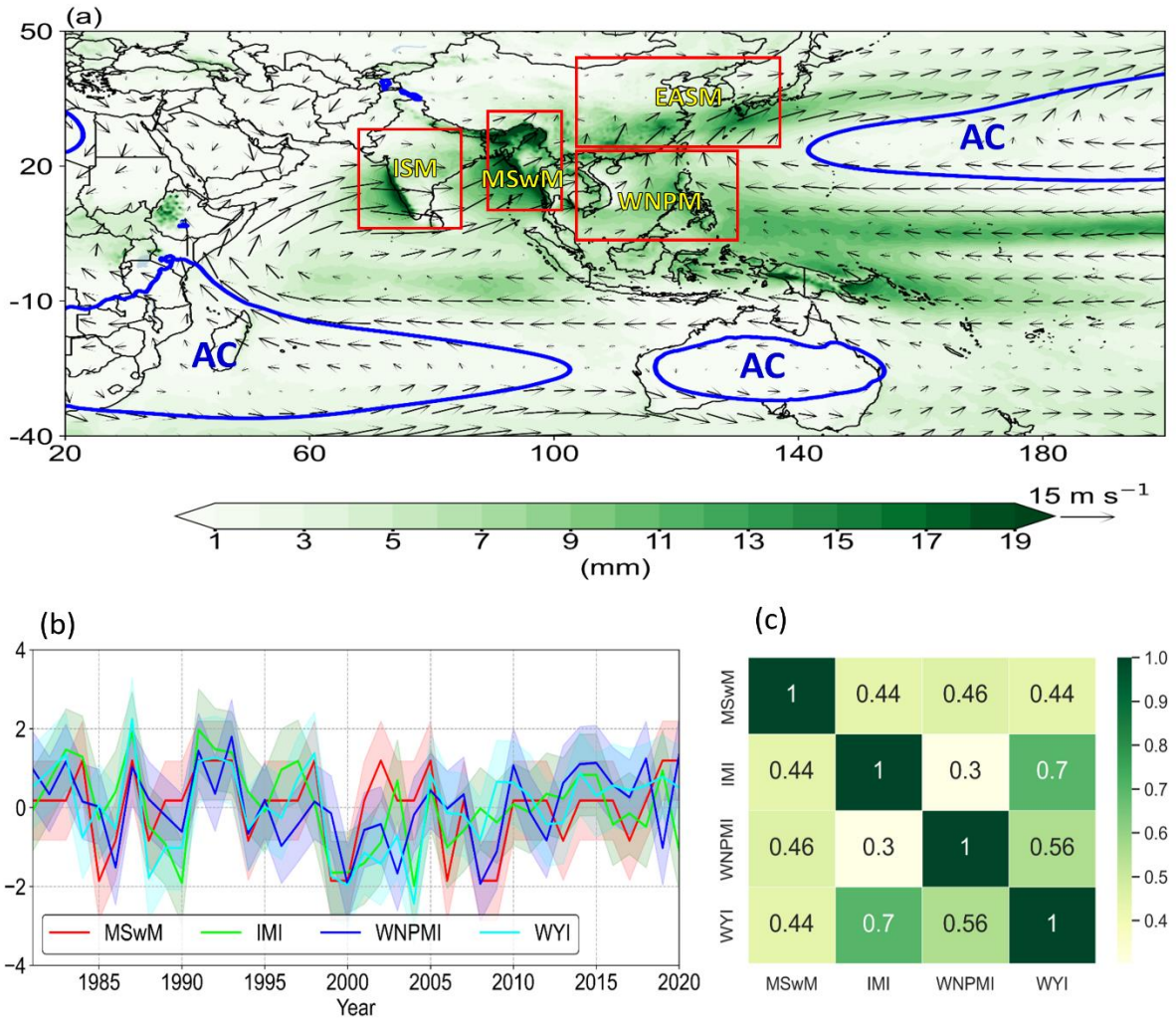

Fig S-6 Four sub-regions of Asian-Pacific monsoon adopted from (Wang & Ho, 2002). ISM, MSWM, and WNPSM are tropical monsoon regions and the subtropical monsoon, EASM by shaded daily rainfall (mm/day) with 850 hPa level wind (m/s) and 15000-gpm geopotential contour blue line. (b) Annual time series of indices and (c) their correlation heatmap. This figure was created with Python 3.10 (Matplotlib 3.5.2 [https://matplotlib.org/], Cartopy 0.20.0 [https://pypi.org/project/Cartopy/]).

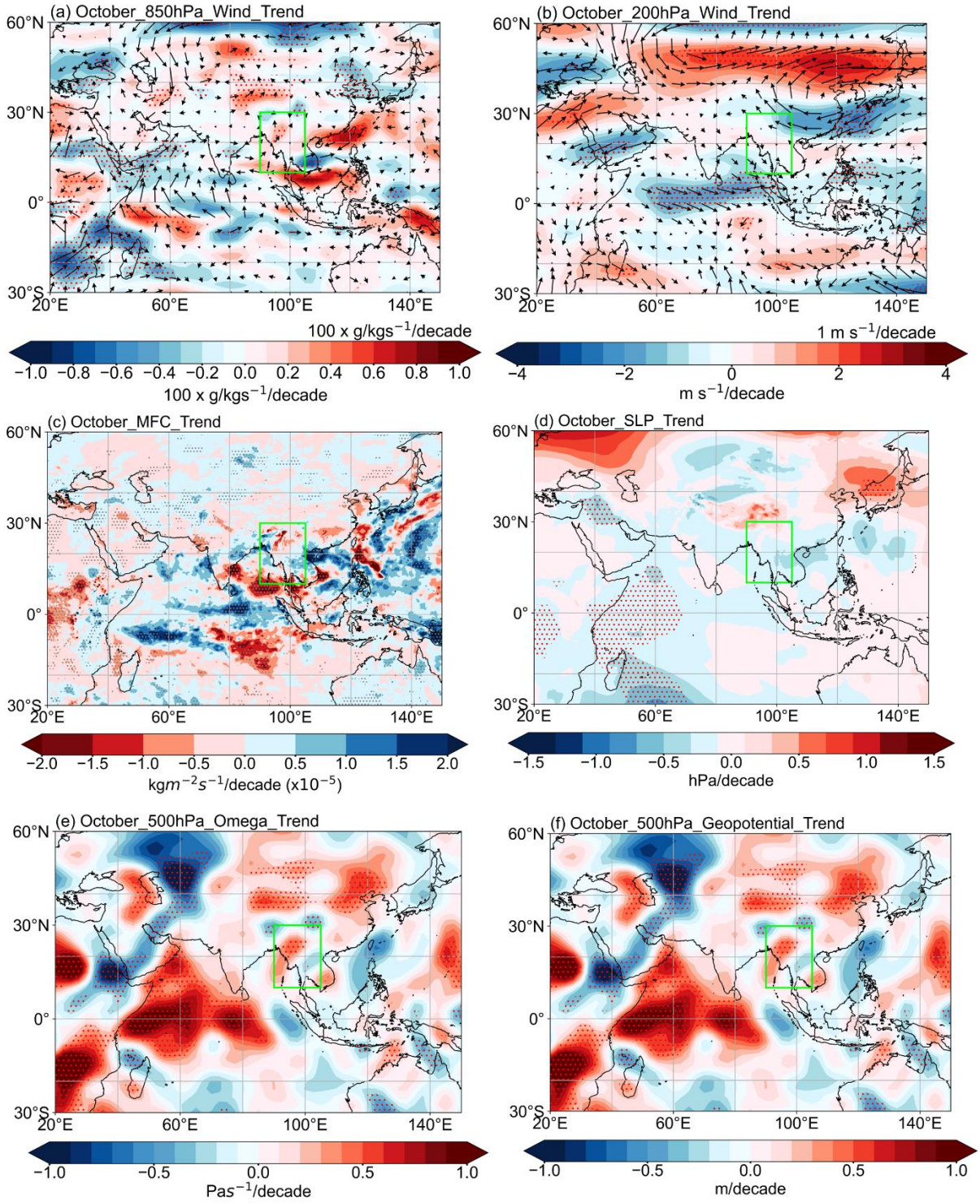

Fig S-7 Spatial trend analysis of October (a) 850 hPa wind, (b) 200 hPa wind, (c) MFC, (d) SLP, (e) 500 hPa Omega, and (f) 500 hPa geopotential, illustrating evolving atmospheric dynamics over mainland Indochina. This figure was created with Python 3.10 (Matplotlib 3.5.2 [https://matplotlib.org/], Cartopy 0.20.0 [https://pypi.org/project/Cartopy/]).

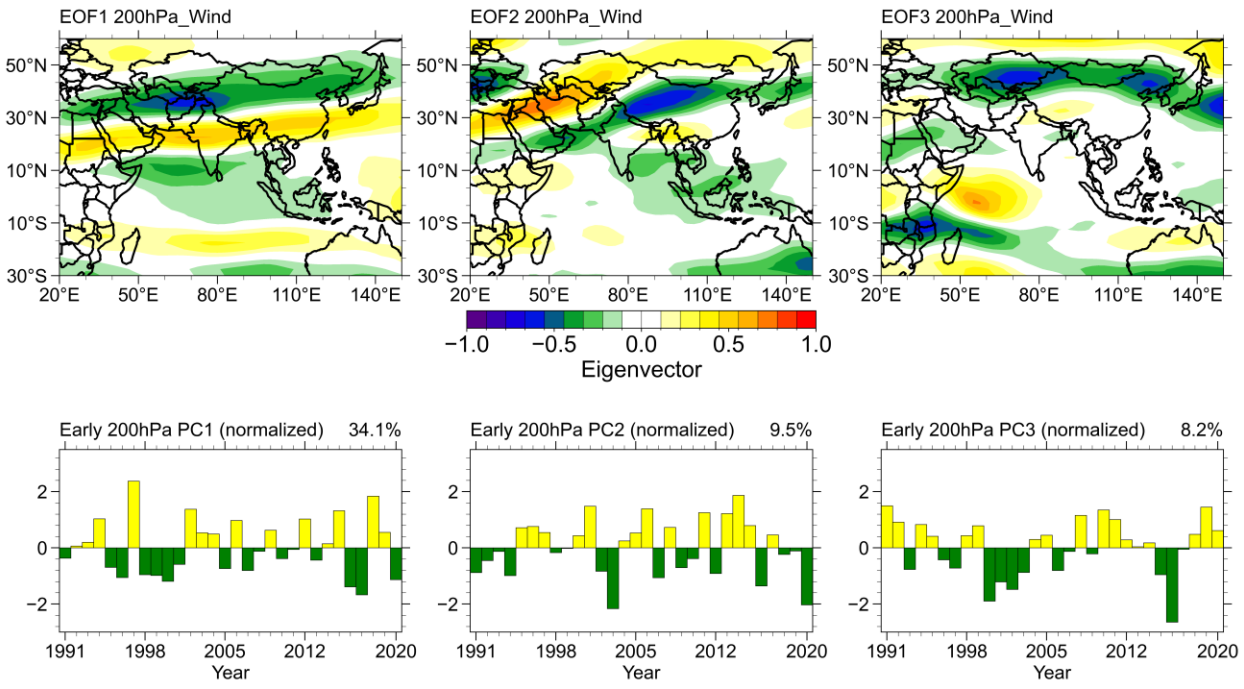

Fig S-8 First 3 EOF modes pf 200 hPa wind over mainland Indochina with their normalize timeseries. This figure was created with Python 3.10 (Matplotlib 3.5.2 [https://matplotlib.org/], Cartopy 0.20.0 [https://pypi.org/project/Cartopy/]).

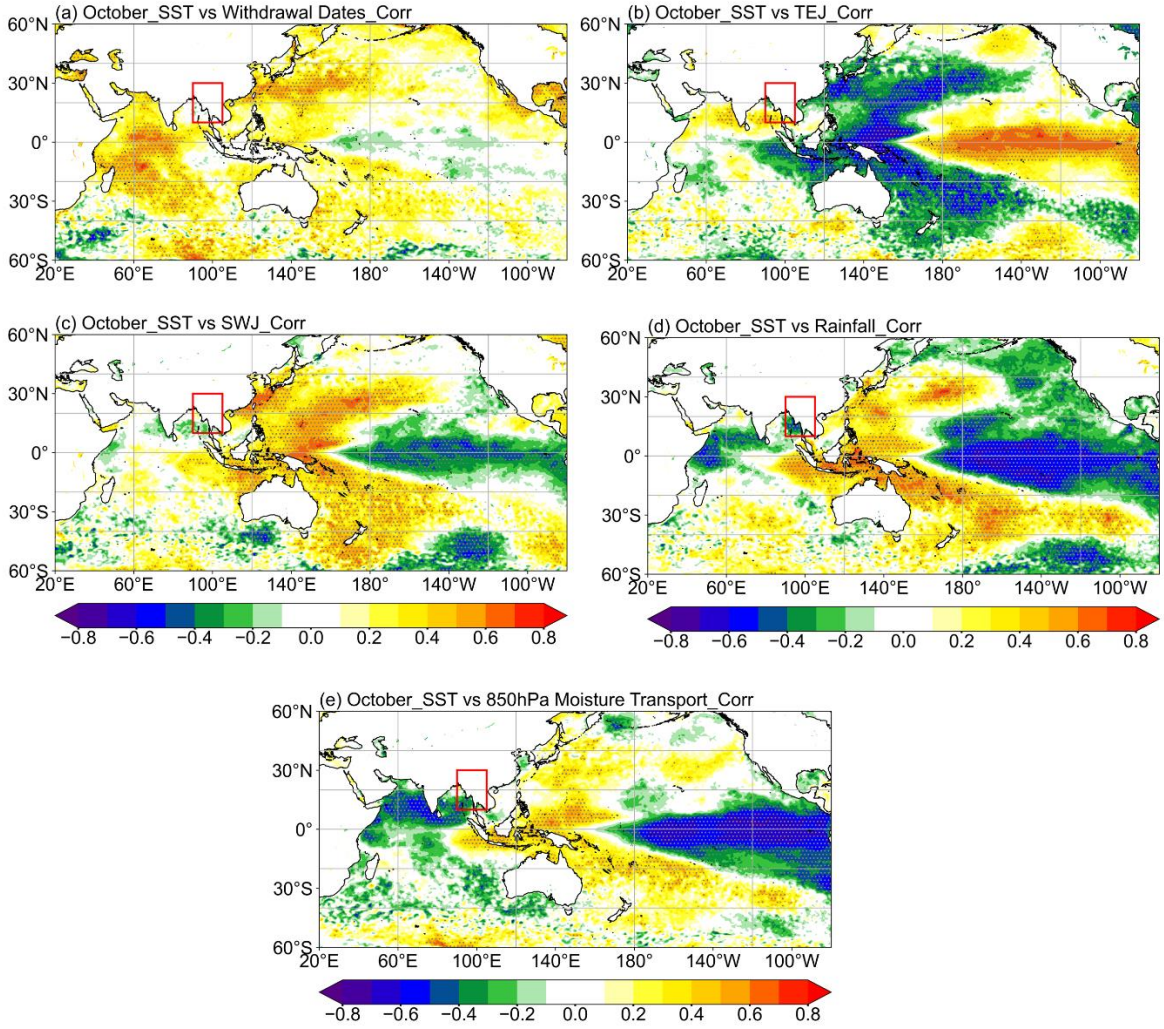

Fig S-9 Correlation between Aug-Sep sea surface temperatures (SSTs) and (a) MSWM withdrawal dates, (b) October tropical easterly jet, (c) October sub-tropical westerly jet , (d) October rainfall over MIC and (e) October 850hPa moisture divergent. Dotted hatches mean 95% confident area by t-test statically. This figure was created with Python 3.10 (Matplotlib 3.5.2 [https://matplotlib.org/], Cartopy 0.20.0 [https://pypi.org/project/Cartopy/]).