Statistical Analysis of Sea Surface Temperature and Chlorophyll-*a* Concentration Patterns in the Gulf of Tadjourah (Djibouti)

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Abstract

The sea surface temperature (SST) and chlorophyll-*a* concentration (CHL-*a*) were analysed in the Gulf of Tadjourah from two set of 8-day composite satellite data, respectively from 2008 to 2012 and from 2005 to 2011. A singular spectrum analysis (SSA) shows that the annual cycle of SST is strong (74.3% of variance) and consists of warming (April-October) and cooling (November-March) of about 2.5C than the long-term average. The semi-annual cycle captures only 14.6% of temperature variance and emphasises the drop of SST during July-August. Similarly, the annual cycle of CHL-*a* (29.7% of variance) depicts high CHL-*a* from June to October and low concentration from

$$SST(t) = 28.72 + 2.5 \times c(\quad \omega_0 + \frac{\pi}{7} \quad 0.95 \quad (2 \quad t + \omega_0) \quad \frac{\pi}{5} \tag{16}$$

$$CHL\text{-}a(t) = 1.67 + 3.2 \times c \quad t + \omega_0) \quad \frac{\pi}{3} \tag{17}$$

EOF

$E = 0.22$).

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(C)

95%.

Figure 10: SST daily time series compared with the shortwave radiation (Qsw), net surface heat flux (Qsurf) and wind stress.

Feedback factor ( )	JFM	AMJ	JAS	OND
	-3	5.6	2.1	-3.4

Table 3: Estimated atmospheric heat flux feedback factor ( ) over the Gulf of Tadjoura. For each three month, in W/m²/°C, is estimated using consecutive three months of daily data of the net heat flux (Qsurf) and the sea surface temperature (SST) time series.

$$(18)$$

$$(19)$$

$$(20)$$

$$(20)$$

	Mode 1 (M-SSA)			
	r (0 lag)	rmax	phase	t(jours)
SST/Tair	0.97	0.99(-1)	-0.26	15
SST/Qa10	0.97	0.99(-1)	-0.27	16
SST/W10	-0.94	-0.99(-2)	2.79	157
CHL-a/Tair	0.79	0.96(-4)	-0.59	33
CHL-a/Qa10	0.79	0.97(-4)	-0.59	33
CHL-a/W10	-0.74	-0.96(-5)	2.46	138

Table 1: Results from the multichannel singular spectrum analysis (M-SSA) showing the correlation and phases between components.

Time series	Window 1 (FMAM)	Window 2 (JJAS)	Window 3 (ONDJ)
SST/Tair	0.85	0.08	0.88
SST/Qa10	0.85	0.56	0.94
SST/W10	-0.4	0.05	-0.8
CHL-a/Tair	-0.19	0.14	0.92
CHL-a/Qa10	-0.33	-0.33	0.95
CHL-a/W10	-0.14	-0.26	-0.84

Table 2: Results of a windowed cross-correlation using a window length of 120 days (four months) between two ensembles of oceanic and atmospheric parameters.

Acknowledgements

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