The summer monsoon intensity variability at the Eastern Asia coast in 1976-2006

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Introduction

- The Eastern Asia summer monsoon difficult current in the common atmospheric circulation. It shows in two stages, determined by the thermic mesosclale contrasts (the outlying seas – coast) and macrosclale (the Asian continent – the Pacific Ocean). In the first stage the monsoon is the cold aerial current, and in the second one it is the very warm and moist sea aerial one.

- The part of common Asian Depression (AD), situated above the north-eastern China and joined by the Amur and Mongolia, is called the Eastern Summer Depression (FSD). It continues from April to September and is the most important link in the Far Eastern summer circulation.

- In the given work there is parameters variability (place, intensity and mean values of surface pressure and geopotential H500), Hawaiian Anticyclone (HA), Asian (AD), Far Eastern (ESD) depressions, and their influence on the Far Eastern climate.

Investigation data and methods

- Data for AFC parameters were taken from Reanalysis archives of the atmospheric pressure middle month fields at the sea level and geopotential H500 in the regular system knots 2,5x 2,5 1948-2006.
- The following borders of the territories were chosen for depressions and anticyclone centers place determination :
- for the AD: 13°-35° N, 60°-100° E
- For the FSD: 40°-55°N, 115-135°E
- For the HA: 30°-45°N, 185°-235° E
- In the frames of the mentioned borders the surface pressure (δPo) and geopotetial (δH) mean values were counted on.
- For definition of the monsoon intensity the differences between fixed meaning were accounted.

Fig. 1 **The territories borders for the definition of depressions and anticyclones centers position**

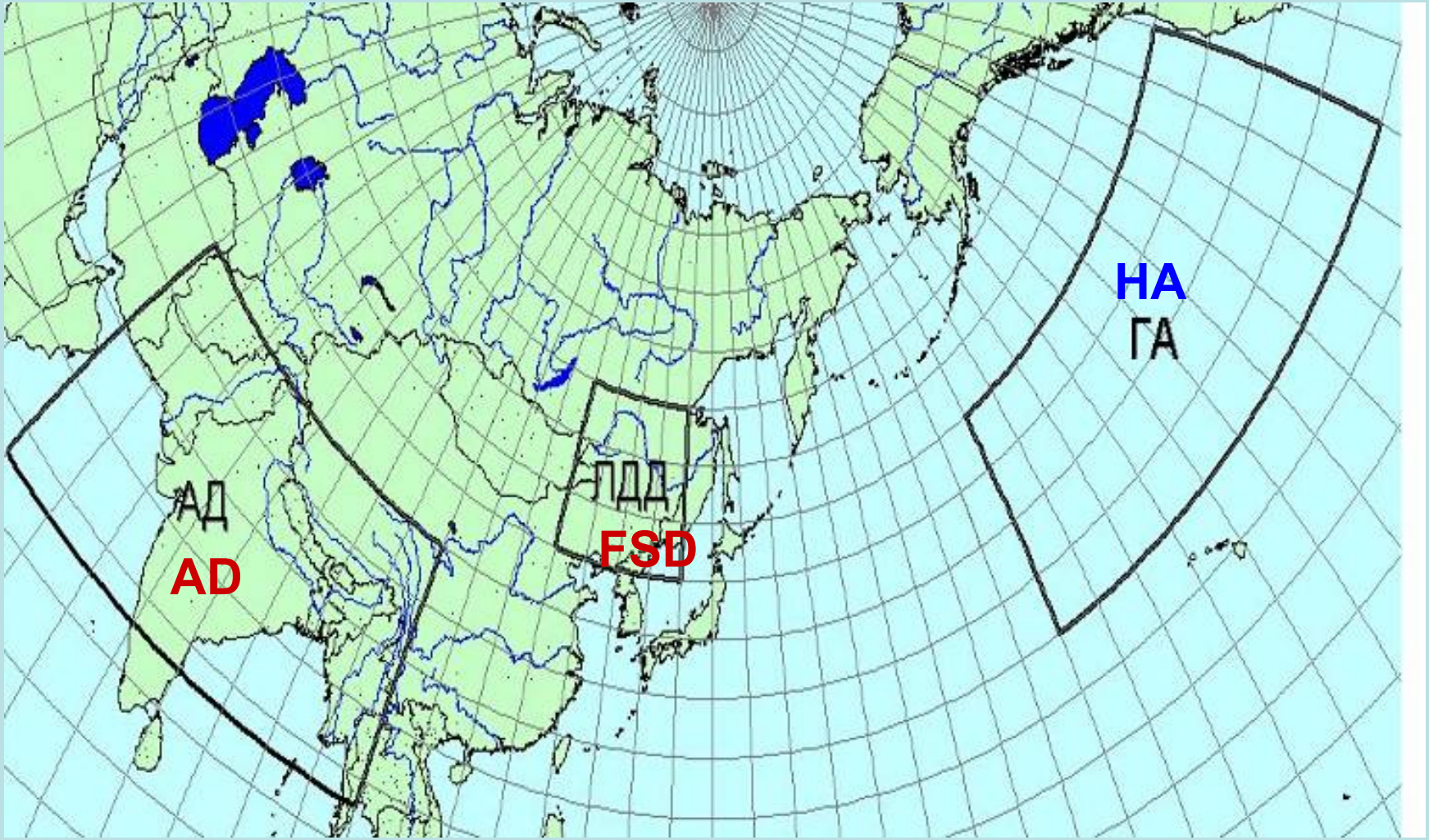
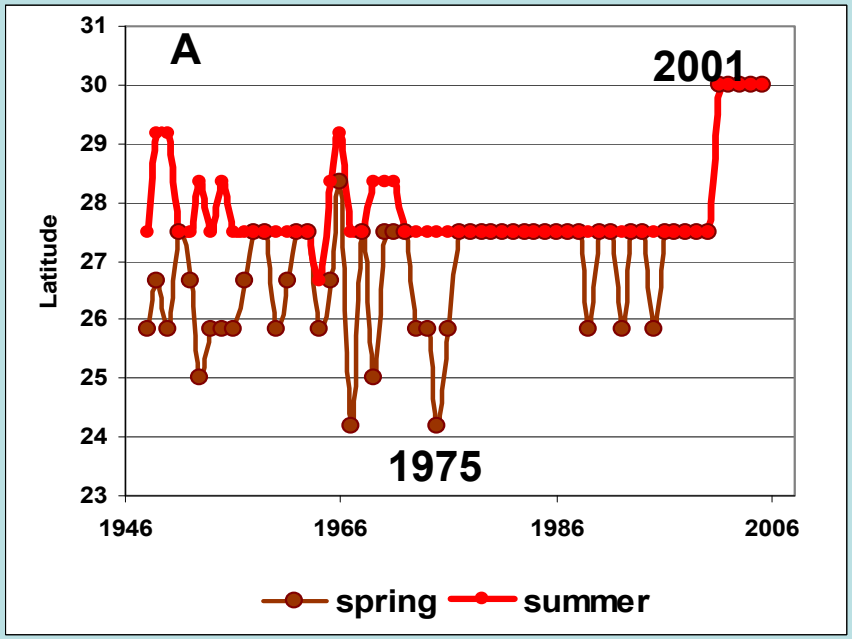
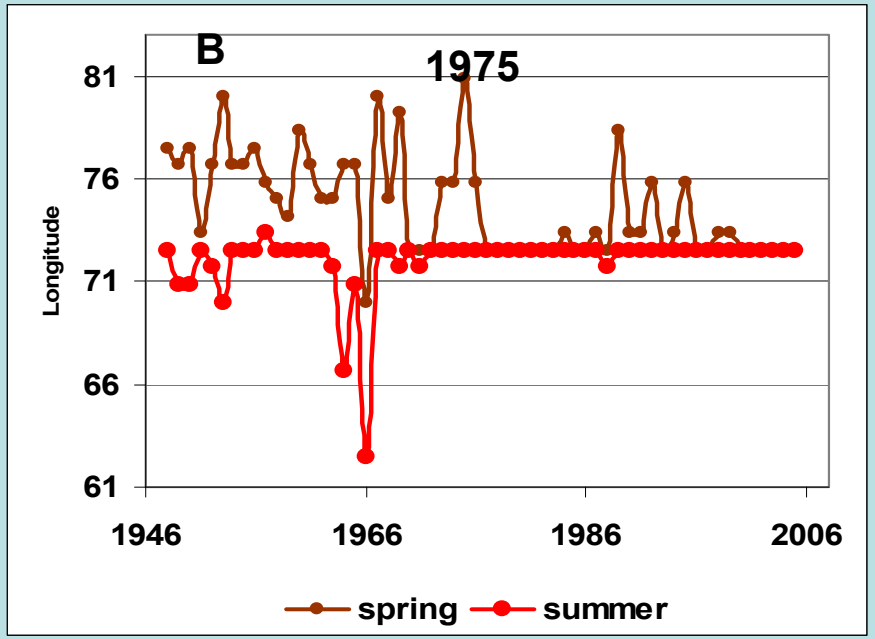
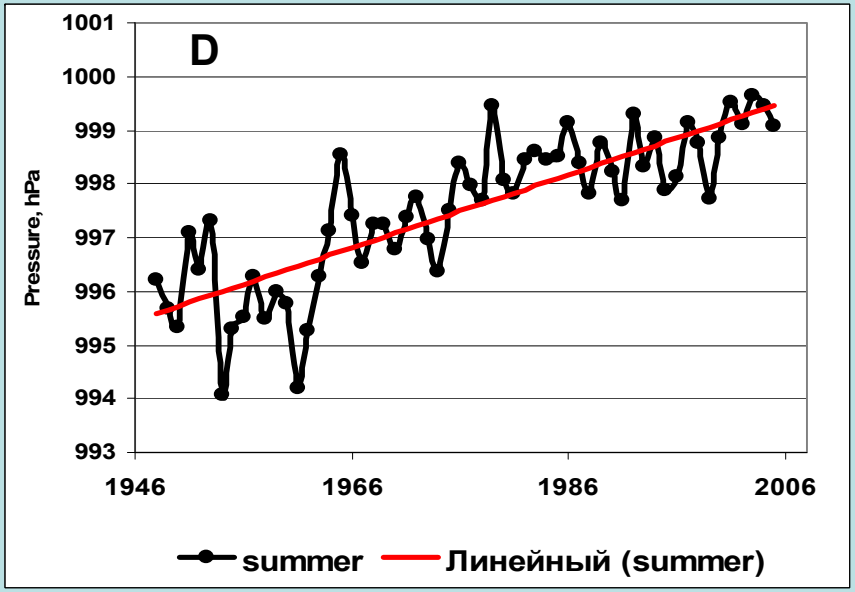


Fig. 2. AD parameters in spring and summer

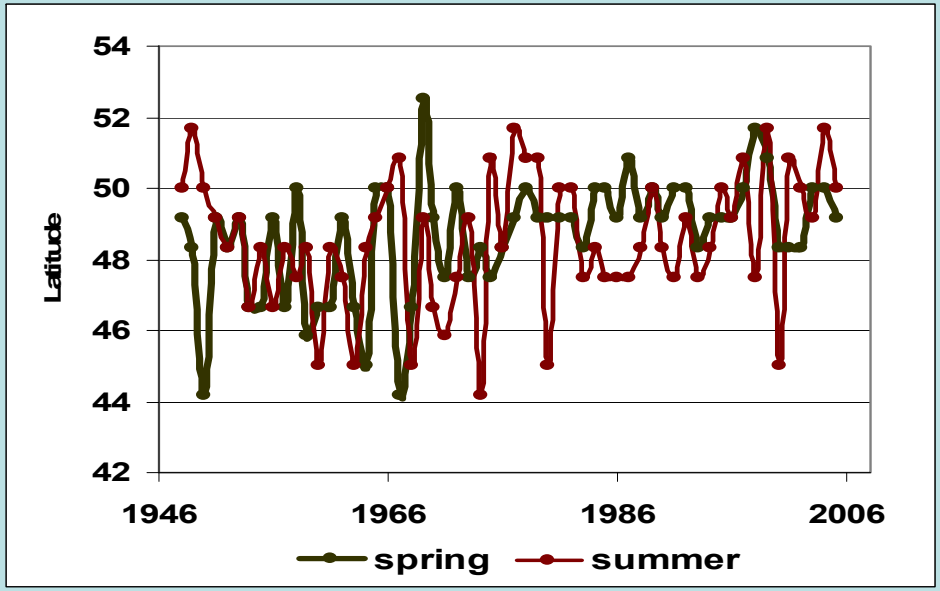


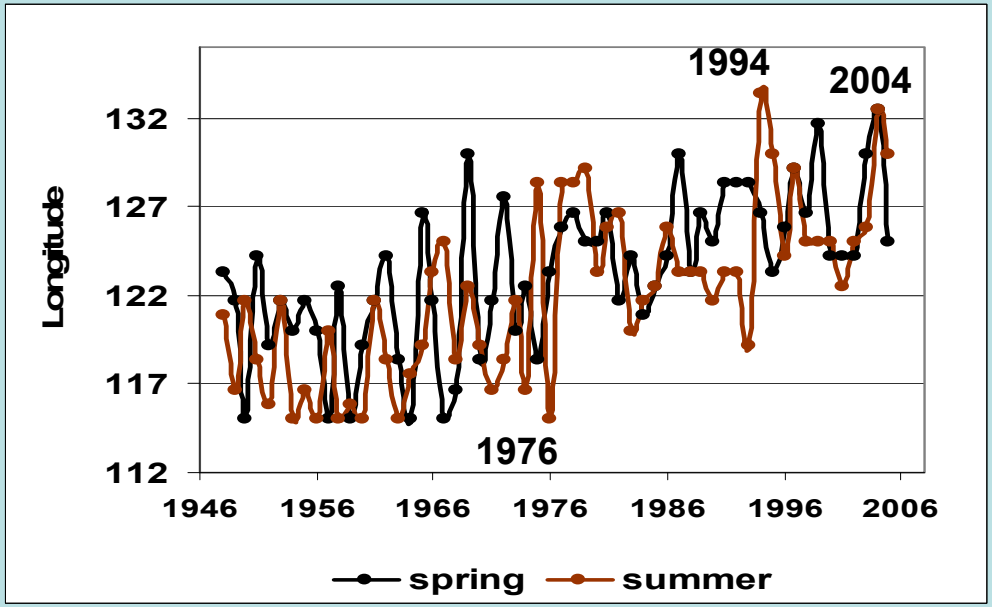


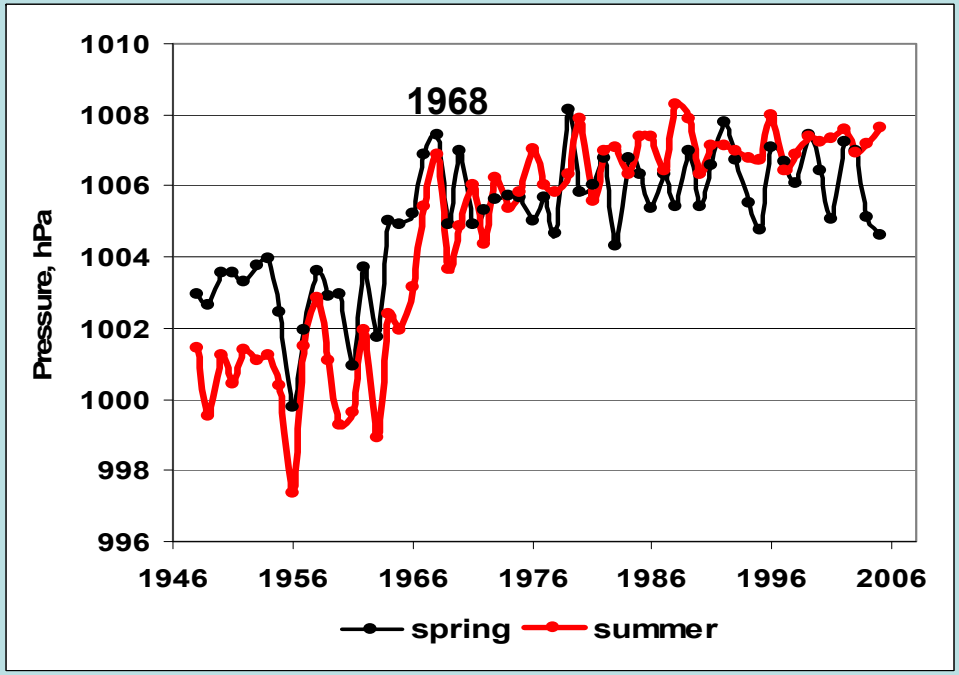


The centers position differs according to the seasons. Center position is especially steadily in summer. The growth is noted well in the center pressure. Two periods are as follows: 1948-1978 (the low pressure) and 1979-2005 (the high one).

Fig. 3. FSD center parameters

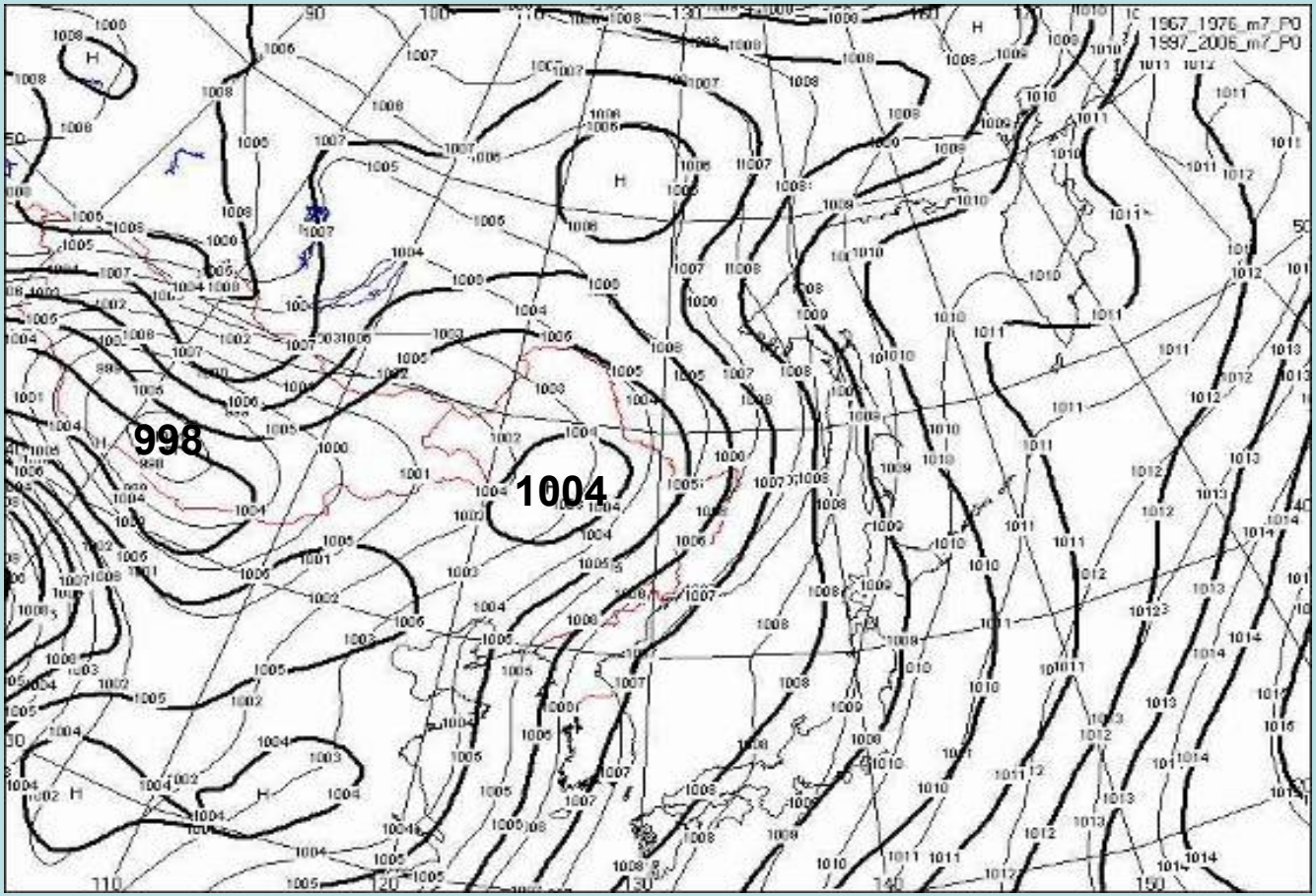






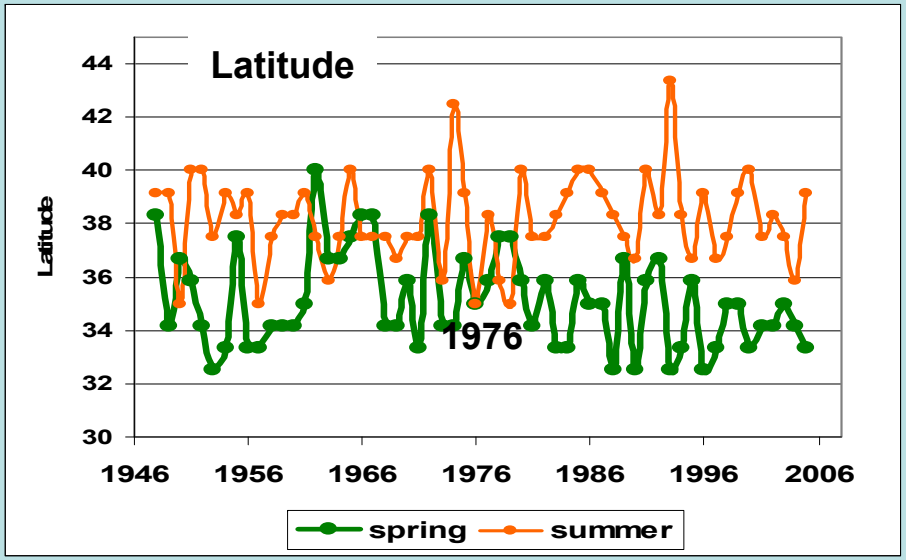
FSD center shift is noted to the north and east. The growth has been observing in the centre pressure from 1968.

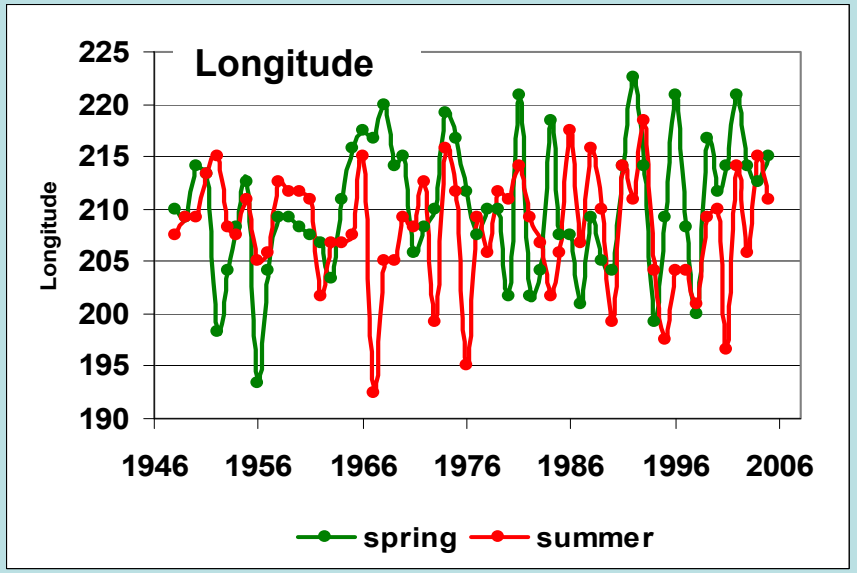
. Fig.4. An average map of the surface pressure in July 1967-1976 (a thin line) and 1997-2006 (a thick one)

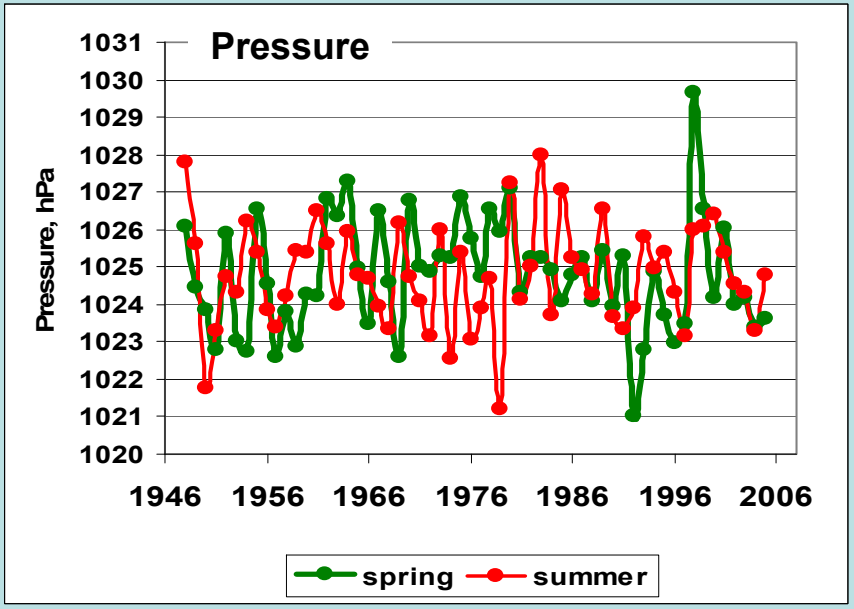


Significant circulation reformations are observed in FSD regime. In 1967-1976 the centre with 998 hPa pressure was situated in the west of the underlined region: in the modern period of time the second depression center, situated in the East with 1004 hPa pressure.

Fig. 5. Hawaiian anticyclone (HA) center parameters

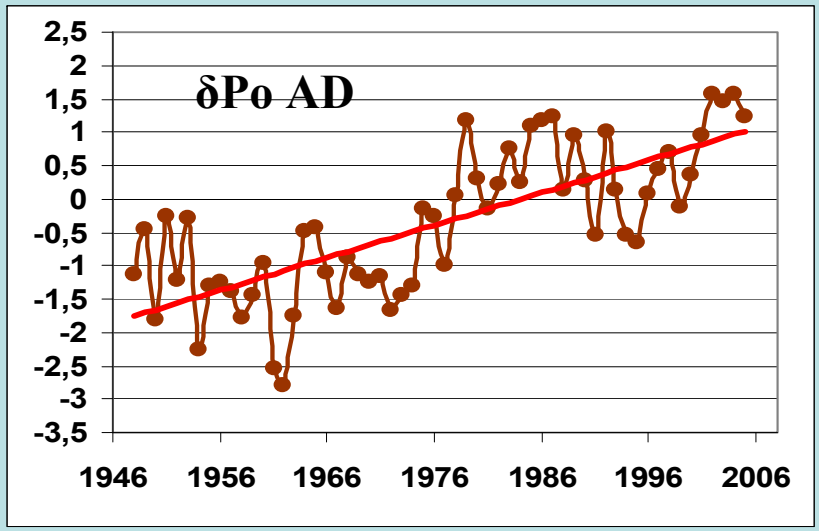


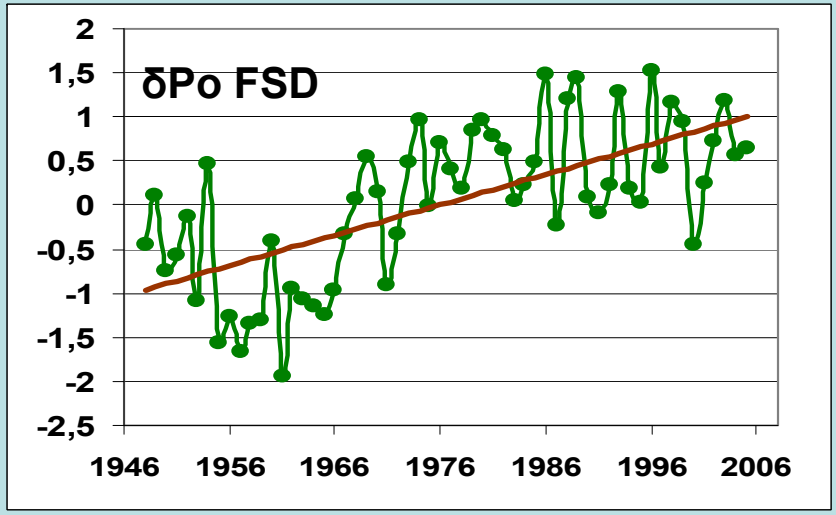


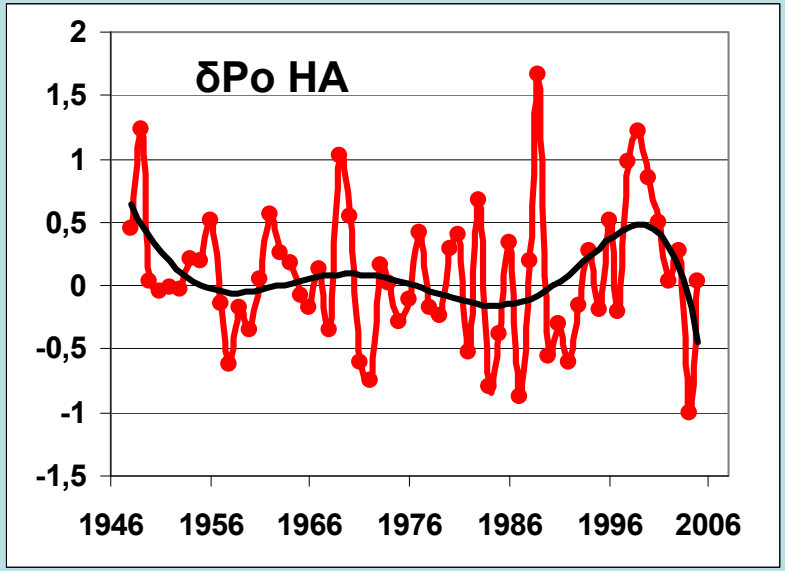


HA center has no such noticeable shifts, as Asian one.

- **Fig. 6. Average fixed meanings of surface pressure (δPo) over depressions and anticyclone in July**

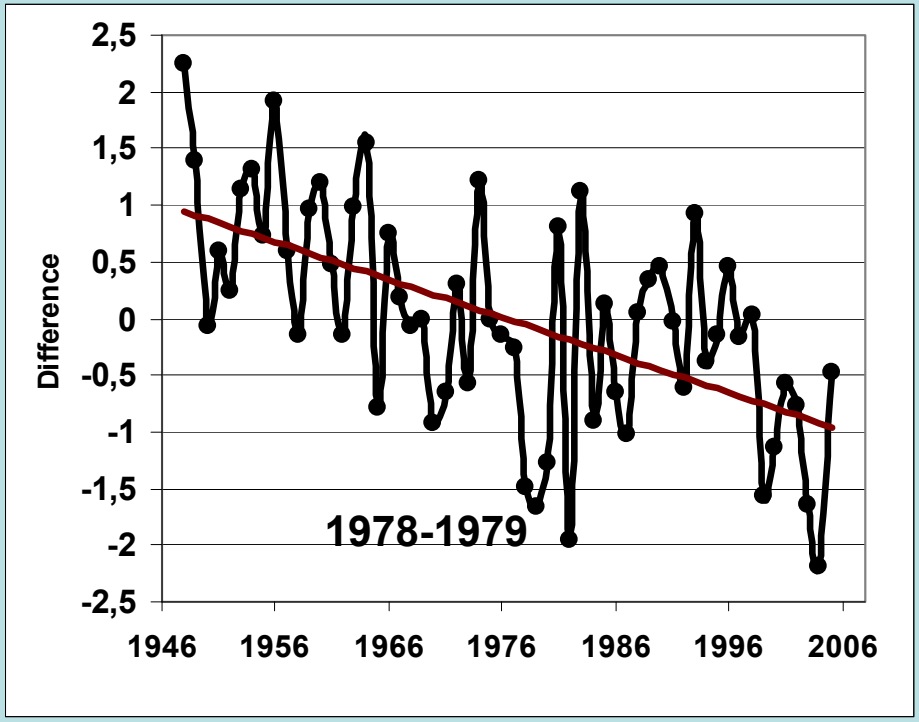


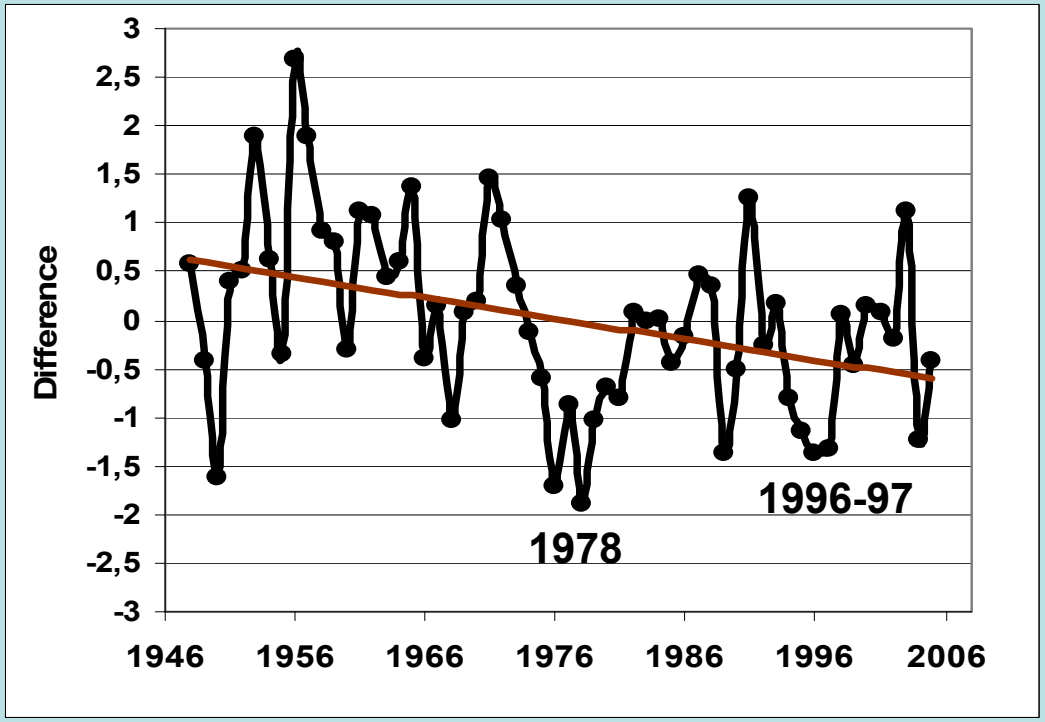




Regime shift, exposed for AD center, after 1976-1978 was expressed for δPo average fixed meanings. After 1967-1968 δPo shift was observed for FSD.

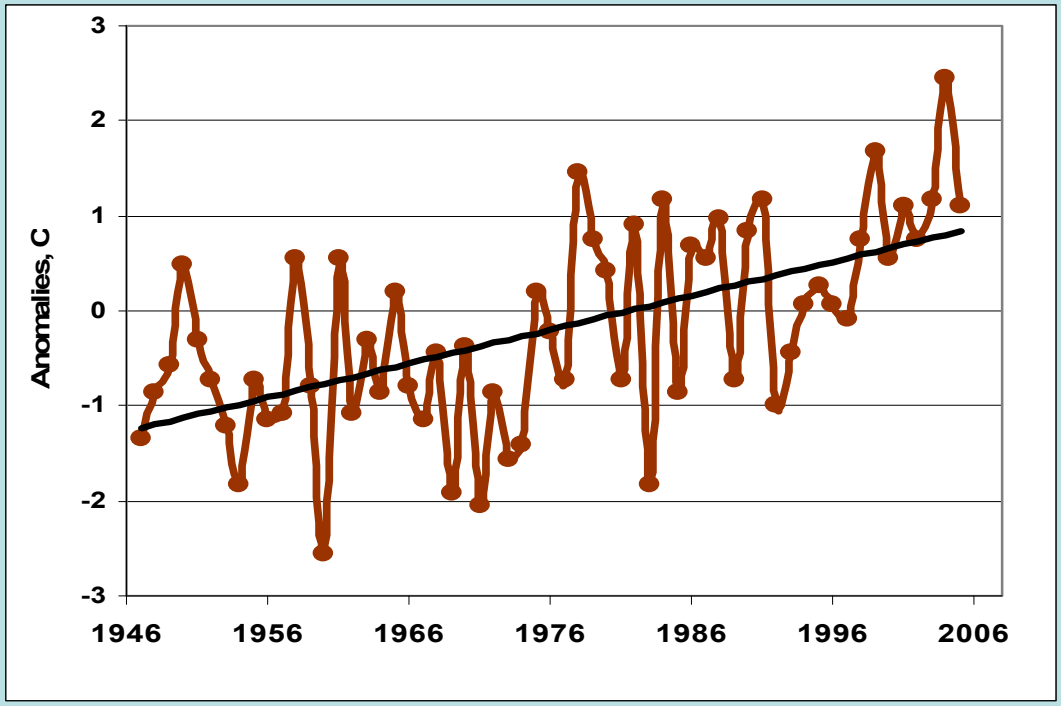
Fig. 7 Difference of average fixed surface pressure meanings δPo between the Okhotsk sea and FSD region (mesoscale pressure gradient) in June and July

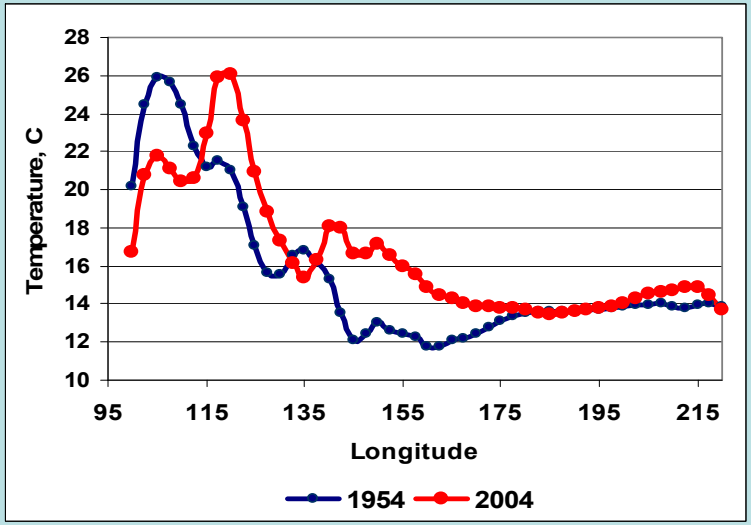


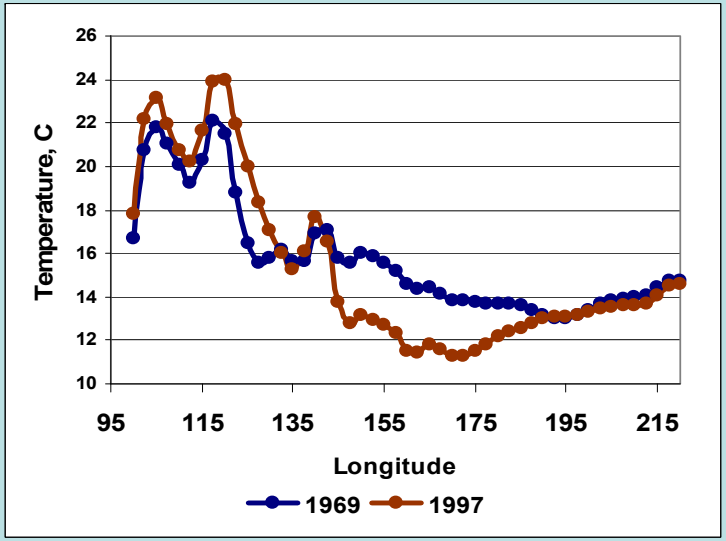


Mesoscale baric gradient between the Eastern Asia and the Okhotsk sea continental regions dicreases. Cold air masses carrying out intensity from the Okhotsk dicreases too.

Fig. 8. Air temperature anomalies motion at the station Terney (the northern coast of Primorye Region) and by 40 N 1954, 2004, 1969, 1997

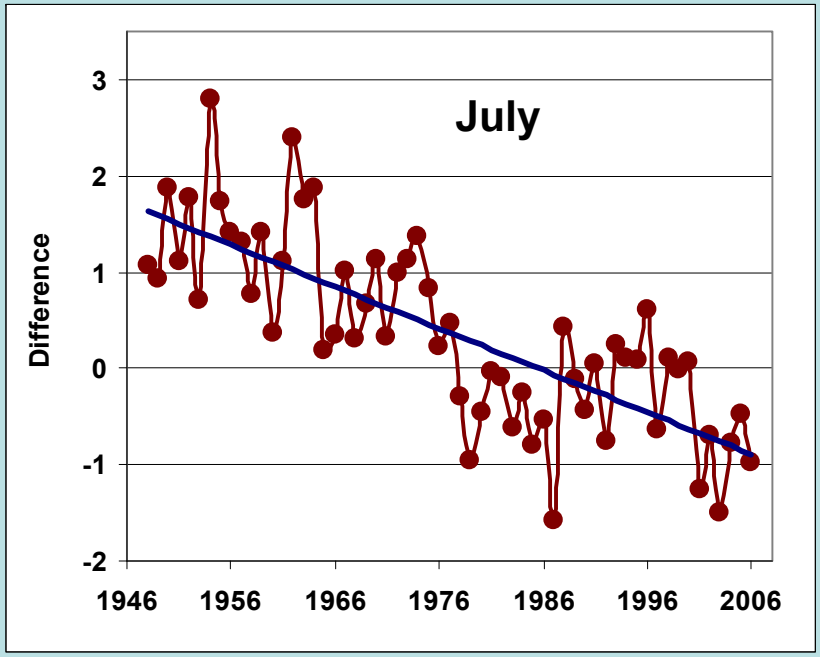


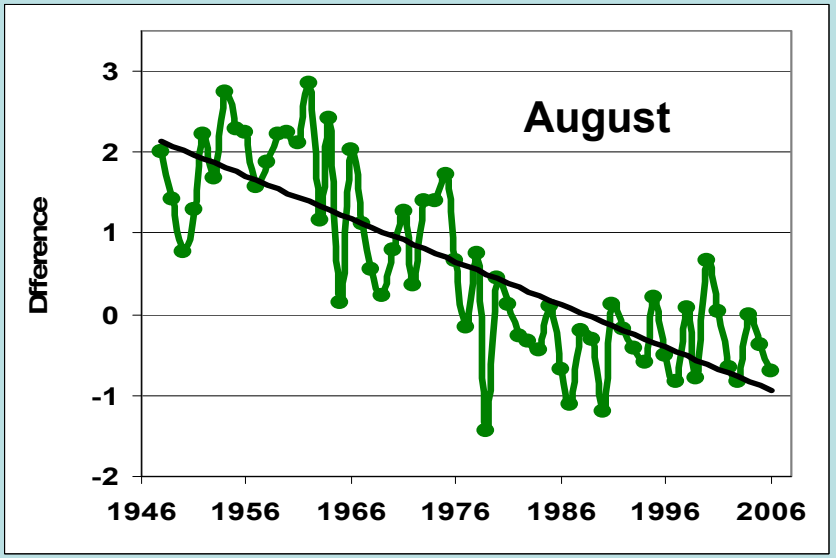


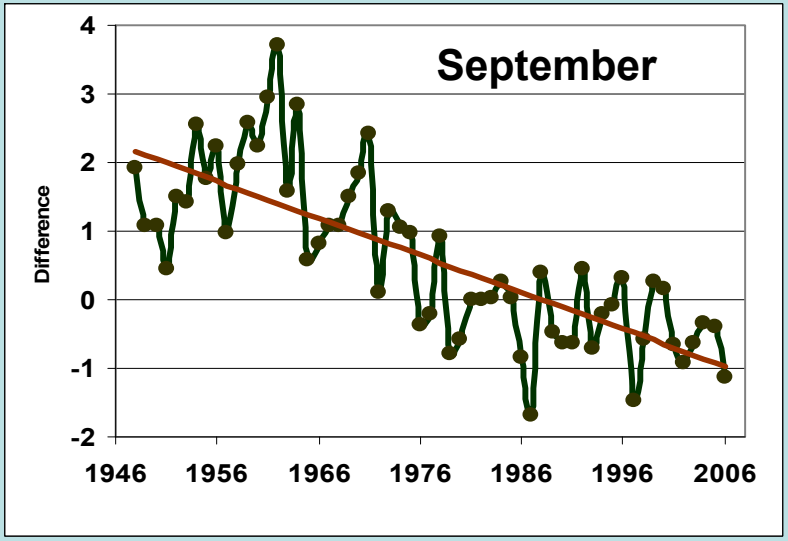


Since 1976 air temperature growth has been noticed, and it was connected with weak cold air carryed out from the Okhotsk sea.

Fig. 9. Difference between average fixed geopotential 500 hPa (δH) meaning over HA and AD regions in July, August and September (large-scale baric gradients)

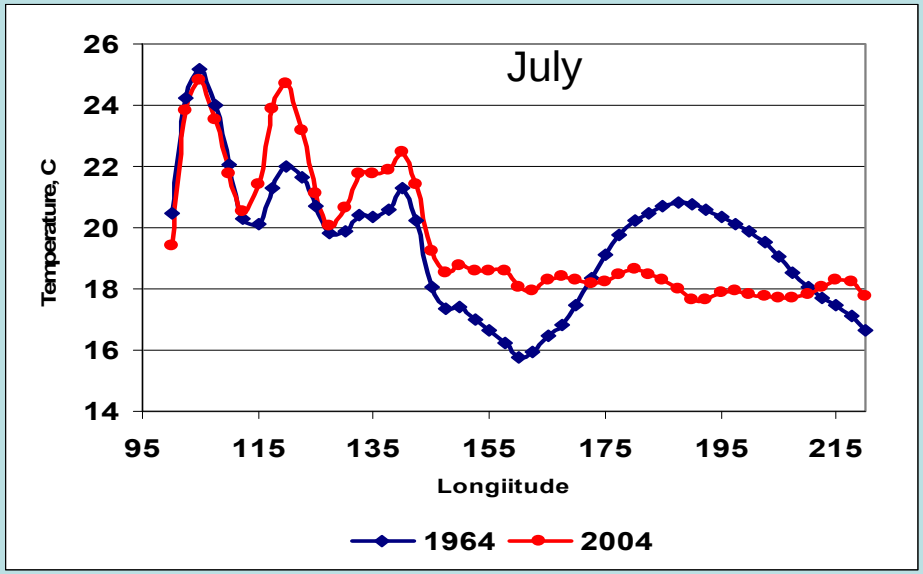


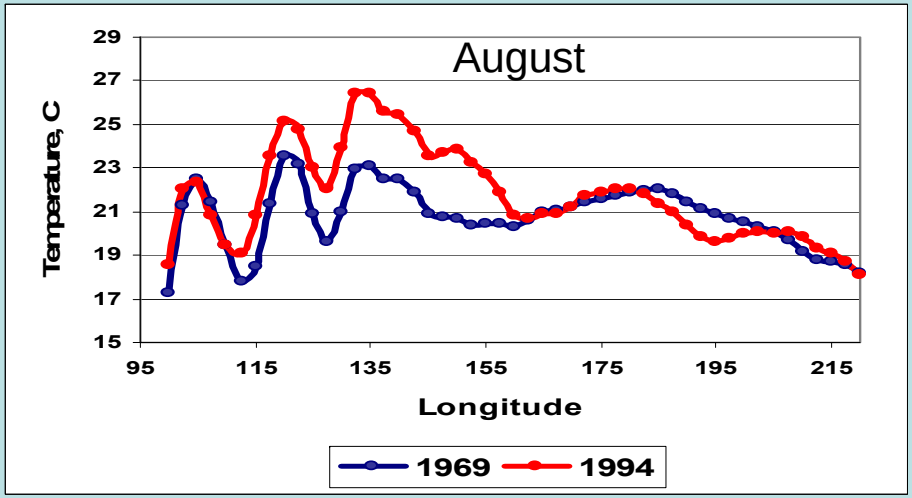


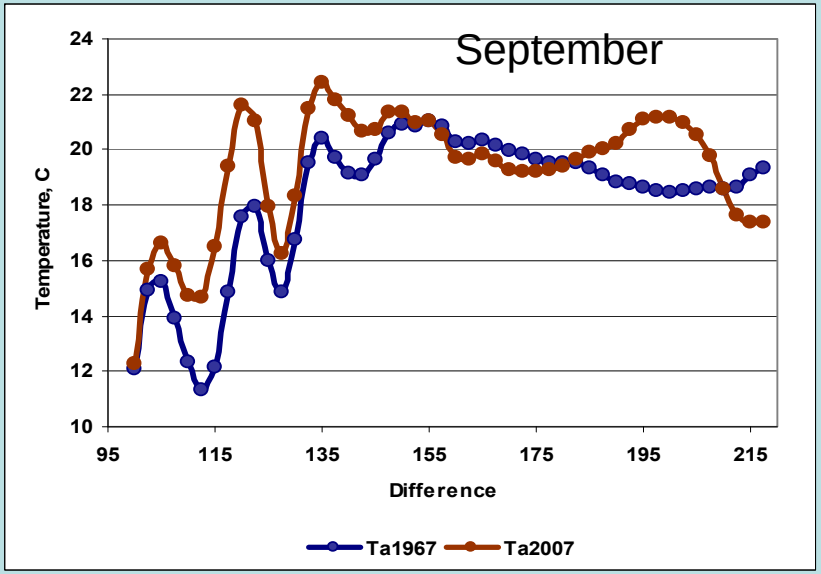


After 1976 baric gradient reduction is observed, and it can mean circulation regime shift.

Fig. 10 Air temperature motion by 40°N in July, August and September

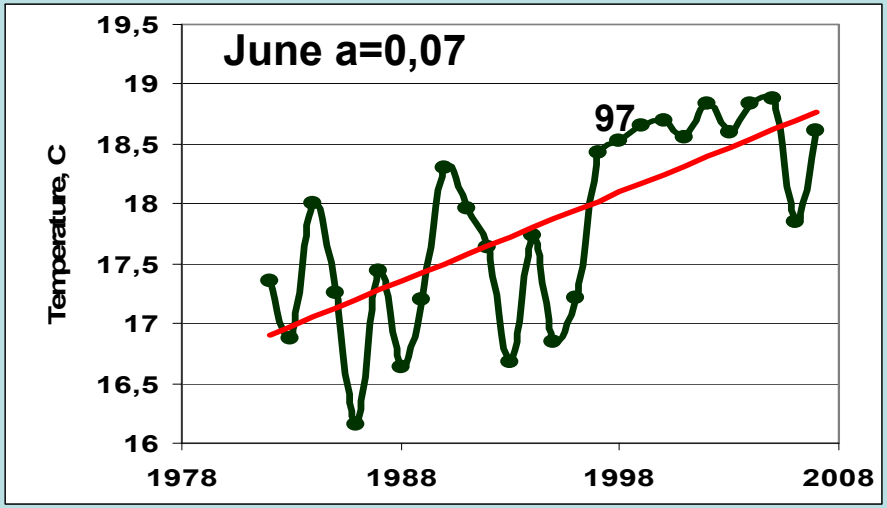


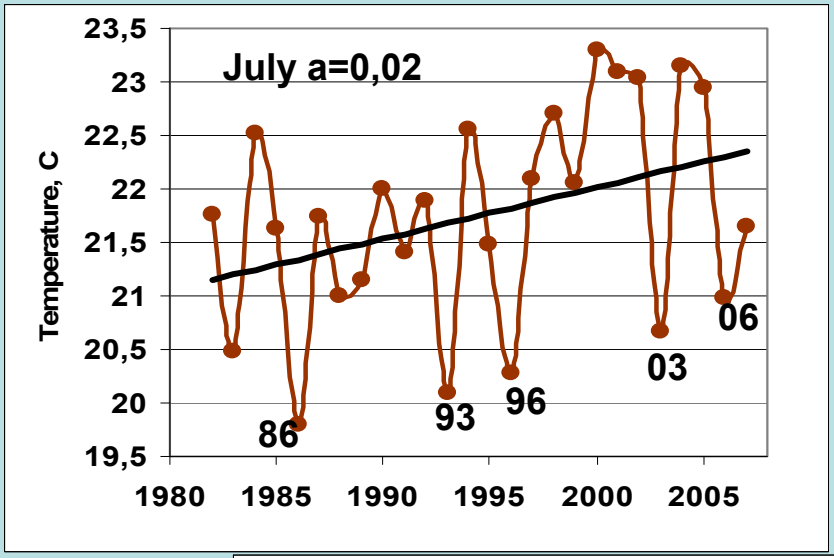




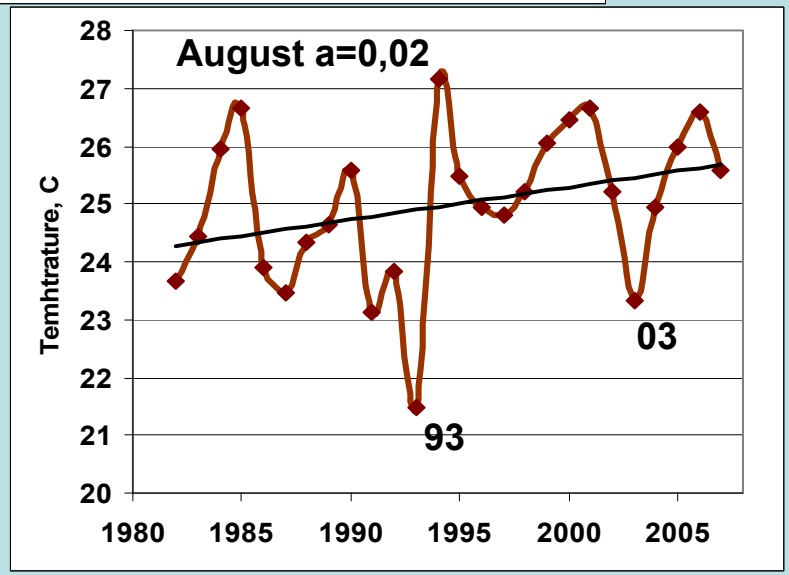
Circulation regime shift was characterized with growth air temperature at the Eastern Asia coast

Fig. 11. Water temperature changes in the Japan sea in June, July and August of 1982-2007





The maximum changes were observed in June, while line trend (a) factor value reaching 0,07. It corresponds to the first stage of summer monsoon weakening. Line trend factors diminish up to 0,02 in July and August as a result interannuall water temperature changes increase. It is coordinated with the second monsoon stage weakening.



Conclusion

- **Intensive pressure growth in Asian atmospheric action centers (AD and SFD), which has been observed since the middle of 70-s, and it continues at present. Circulational regime change in atmosphere in the Eastern Asia is well exposed on average maps, summarized by decades. If SFD was expressed with one center in 1967-1976, last decade was exposed by two centers in limits of our borders, one of which was shifted to the East.**

- **Regimes FSD change caused summer monsoon weakening. Consequence was air temperature growth on the Primorye Region coast and the Jsushima current intensity change in summer.**