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LASER RADAR OBSERVATION OF THE FOG BY "YAMASE WIND" FROM THE OKHOTSK SEA

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1.Introduction

Okhotsk sea causes two remarkable phenomena-one is sea ice in winter and early spring, another is so-called "Yamase" wind in summer, which results in a cold temperature and dense fog.

We have observed the density distribution of the "Yamase" fog caused by this cold wind from Okhotsk sea by using laser radar during these several years, and revealed the inner structure of the "Yamase" fog.[1)]

2.Laser radar system

Fig.1 shows schematic diagram of the optical radar which have been developed in our laboratory. We employed a flashlamp-pumped dye laser as a transmitter with an output of 1J, and 1μsec pulse width.

The laser beam is horizontally shot against the "Yamase" fog or shot vertically using 45° angle mirror. The range resolution is 180m.

In addition to these methods, it is possible to observe the fog 3-dimensionally, by scanning the 50cm dia.Cassegrain telescope.

3.Laser radar observation of "Yamase" fog

Fig.2 and Fig.3 are the typical density distributions of the Yamase fog. The height of Yamase fog is very low and the fog invades to the land as if it creeps.

Fig.4 shows the typical thickness of the Yamase fog layer. The thickness is less than 1km or so, and the change of the upper border is rather large compared with that of the lower.

The speed of the Yamase fog is as large as 5～6m/sec when it invades to the land, but after the invasion the speed will be very low as shown Fig.5(a). The fog seems to move upward and downward periodically, and the speed is less than 1 or 2m/sec during a night. Fig.5(b) shows the Fourier transformation of the same graph(a). The dominant periods of the change of the fog speed are 100, 25, 16 and 12 minutes. The same result is obtained for the speed of horizontal movement of the Yamase fog.

Fig.6 shows the comparison of the density distribution of a sea fog and a land fog. The land fog profile is very much complicated, while the sea being simple.

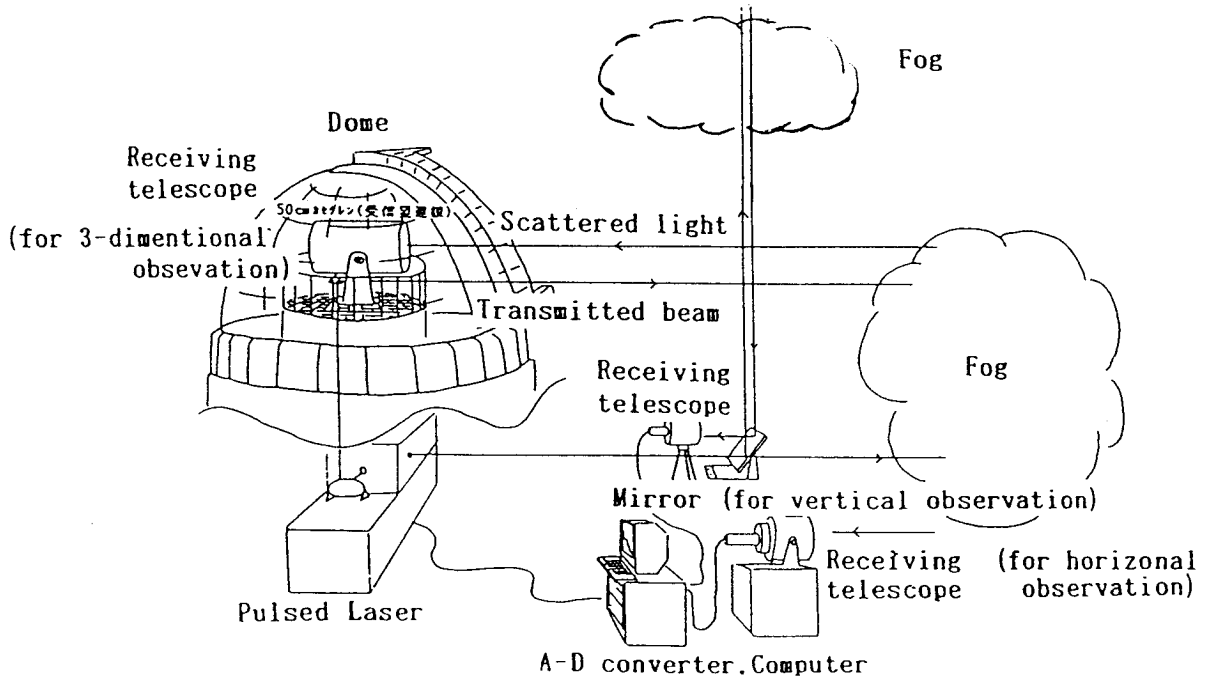


Fig.1 Schematic diagram of optical radar

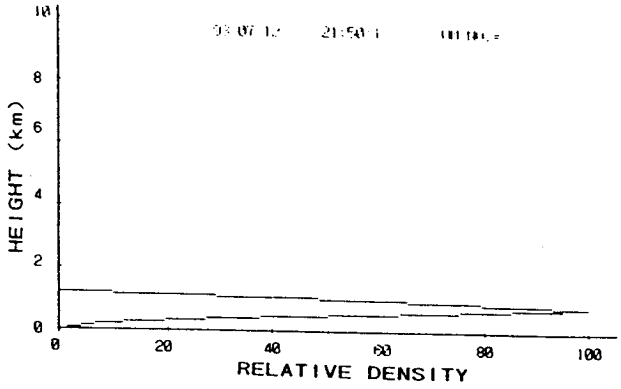


Fig.2 A tyipical vertical density distribution

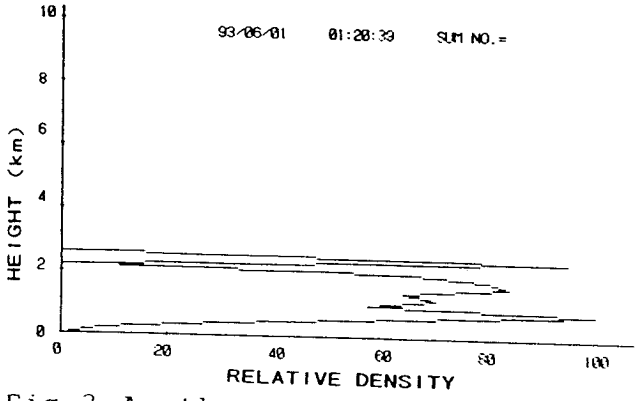


Fig.3 Another example of vertical density distribution

4.Conclusion

The results obtained are as follows.

1) The density distributions of Yamase fog are obtained for the first time.
2) The height of Yamase fog is less than 1km or so.
3) The speed of Yamase fog is below 1～2m/sec after invasion.
4) The vertical profile is usually a simple peak, but sometimes double or triple peaks are seen.

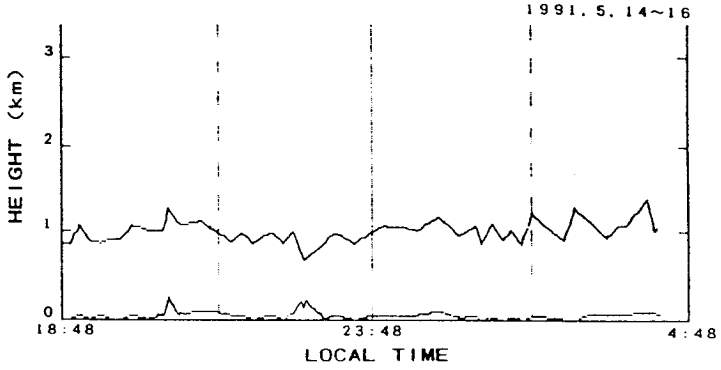
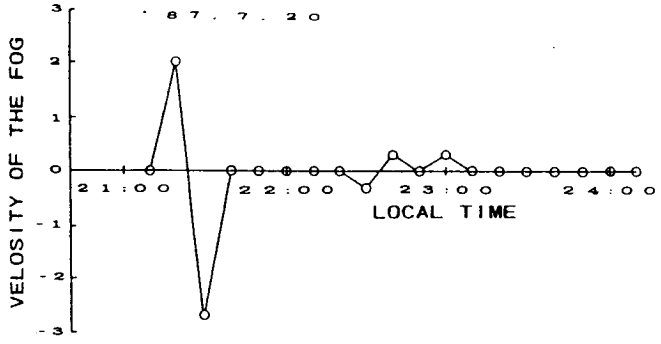


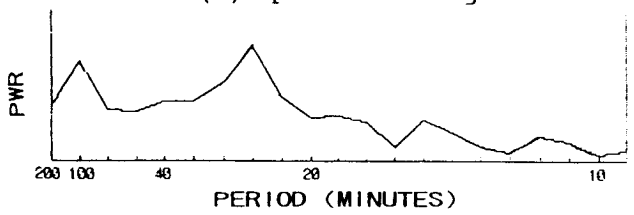
Fig.4 Time development of the thickness of Yamase fog layer

Reference

1)M.Jyumonji and H.Uchiyama: Proc. of the Symp. on Okhotsk Sea and Sea Ice (1994.2)



(a) speed of fog



(b) Fourier Transformation of the upper data

Fig.5 Speed of Yamase fog

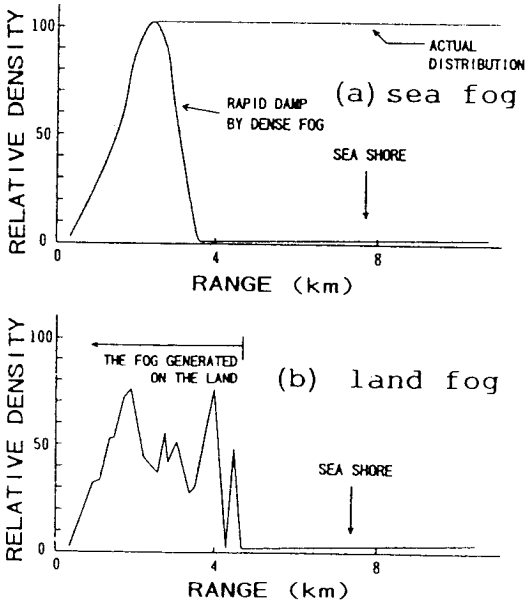


Fig.6 Comparison of sea fog and land fog