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RESEARCH ARTICLE OPEN ACCESS

ASSESSMENT OF METEOROLOGICAL DROUGHT BY USING STANDARDIZED PRECIPITATION INDEX FOR SOLAPUR DISTRICT, (M.S), INDIA

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ABSTRACT

This Solapur is one of the district in Maharashtra state falls under semiarid region. Now a day's changing climate becomes a global problem and disturbing livelihood of the peoples. Agriculture is one of the sector suffering a lot from changing temperature, precipitation pattern, flood, drought, unseasonal rainfall etc. Drought and flood are natural but due to changing climate it can be one of the indicator used to detect climatic condition in particular region. Evaluating drought frequency and its magnitude will be helpful for farmers for managing the water resources. That will be useful for integrating farm activities with changing climate. In the above context efforts are taken to assess drought condition in 11 tehsils of Solapur district to get clear ides about frequency of drought from January 1990 to December 2020.

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INTRODUCTION

Droughts are known to occur in almost all climatic zones of the world. Droughts are typically related to the decrease in the quantity of precipitation received over a prolonged period of time, for instance a season or a year (Pandey *et al*. 2019). The standardized precipitation index (SPI) is a probability-based indicator that depicts the degree to which the accumulative precipitation of a specific period departs from the average state. SPI is easy to calculate and convenient to apply (Kubade *et al*., 2023). To reduce the devastating effect of drought and minimize the losses, preparedness and early warning system can help decision and policy makers to implement policies timely (Alam *et al*., 2015). Meteorological drought is defined as a condition, where the annual precipitation is less than the normal over an area for prolonged period (month, season or year). Hydrological drought is drought connected with the effects of periods of precipitation shortages on water supply and Agricultural drought mostly effects food production. Agricultural drought and precipitation shortages carry soil water deficits (Bharadiya *et al*. 2015). Standardized Precipitation Index (SPI) expresses the actual rainfall as standardized departure from rainfall probability distribution function and, hence, this index has gained importance in recent years as a potential drought indicator permitting comparisons across space and time (Kumar *et al*. 2009).

MATERIAL AND METHODS

Data collection: The rainfall data of approximately 30 (1990-2020) years in the region of Solapur district, Maharashtra were collected from Indian Meteorological Department, Pune.

Meteorological Drought: The Standard Precipitation Index (SPI) was used to analyse the weather drought for 11 tehsils in the Solapur district. SPI analysis of the drought was done using MS Excel. The steps involved in calculating SPI are shown below. Inadequate rainfall is the cause of any drought, including meteorological and agricultural droughts. The SPI is frequently used to calculate the precipitation deficit. It might be calculated across a range of time periods, from less than a month to 48 months or more. Standardized precipitation index was calculated according to the following formula Edwards and McKee, (1997).

$$SPI = \frac{x_i - \bar{x}}{\sigma}$$

Where, Xi = Precipitation of the specified time scale for ith year.$\bar{x}$=Long-term average precipitation of the specified time scale, s = Standard deviation of the precipitation of the specified time scale.

Classification of Drought condition according to SPI Class

Index class	Description
+2	Extremely wet
1.5 to 1.99	Very wet
1.0 to 1.49	Moderately wet
(0.99) to (-0.99)	Near normal
(-1.0) to (-1.49)	Moderately dry
(-1.5) to (-1.99)	Severely dry
(-2.0) or less	Extremely dry

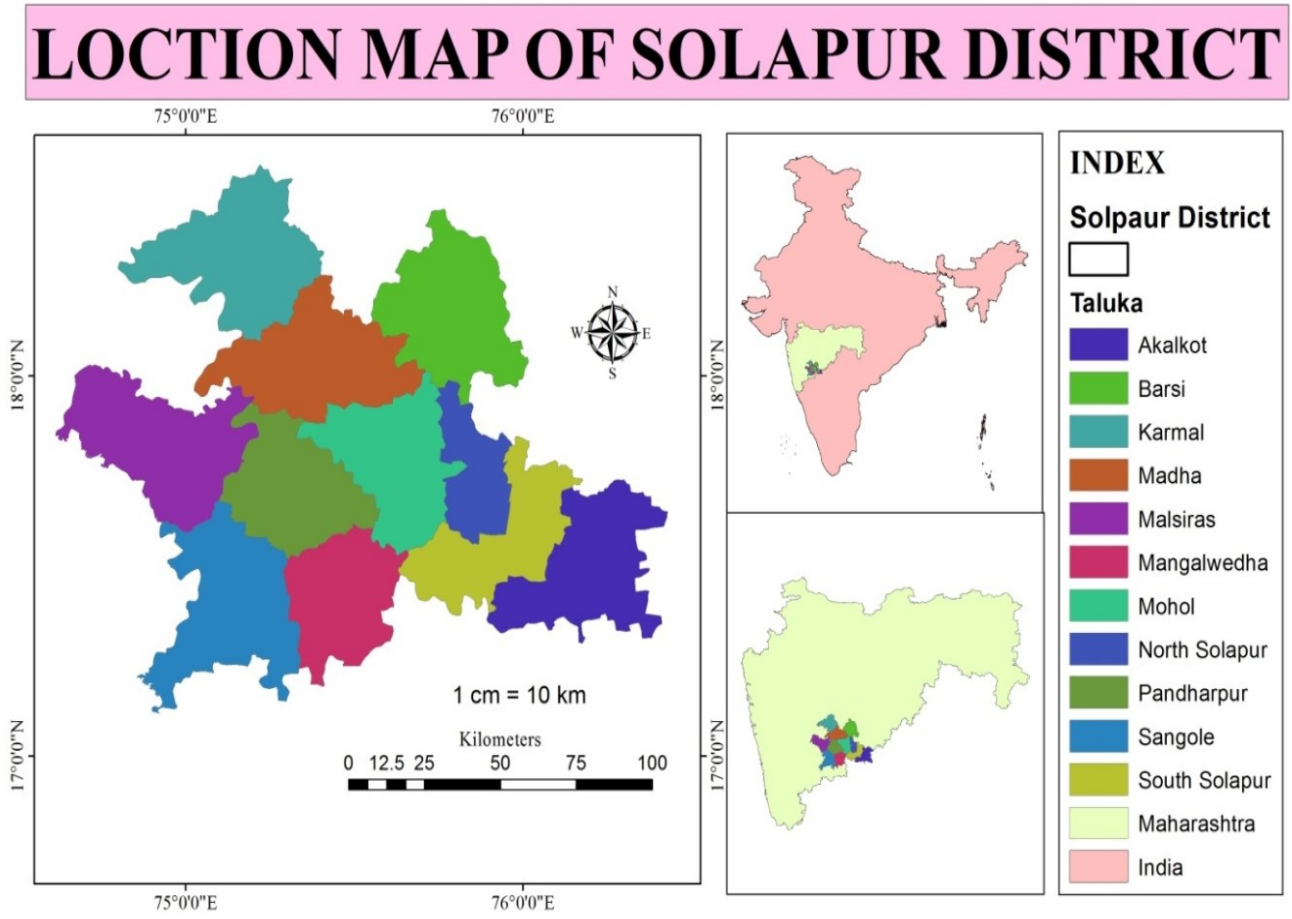

Figure 1. Location map of Solapur District

RESULT AND DISCUSSION

Annual SPI values (12 months basis) of different tehsils of Solapur district

Year	Akkalkoat	Barshi	Karmala	Madha	Malshiras	Mangalvedha	Mohol	North solapur	Pandharpur	Sangola	South solapur
1990	2.47	0.43	0.60	0.44	-0.77	0.00	-0.22	NA	-0.08	-0.23	NA
1991	1.36	-1.74	0.52	-0.51	0.68	-1.33	1.28	NA	1.05	-0.26	NA
1992	1.62	0.34	-0.21	2.13	-1.26	-0.79	-0.32	NA	0.37	-0.41	NA
1993	-0.66	0.42	0.29	1.63	1.23	0.45	-0.47	NA	-0.15	0.55	NA
1994	0.71	0.90	-1.32	0.36	1.92	-0.87	1.11	NA	-0.77	-1.02	NA
1995	1.17	0.48	-0.61	1.57	1.04	-0.02	0.17	NA	-0.56	-0.10	NA
1996	0.40	0.63	-0.92	0.28	2.12	-0.36	0.02	NA	-0.04	0.79	NA
1997	0.37	1.19	-0.96	0.58	0.68	-0.49	-1.41	NA	-0.07	1.95	NA
1998	0.09	-0.32	-0.02	0.23	2.37	-1.67	0.64	0.28	-0.80	-1.10	0.31
1999	0.16	-0.20	0.33	0.05	2.71	-0.04	-0.20	-1.57	-0.83	0.14	-0.55
2000	0.94	0.88	1.96	0.51	-1.72	-1.30	0.01	-0.22	-0.48	-0.56	-0.03
2001	0.21	1.52	-0.16	-0.61	-1.29	-0.35	0.38	-1.64	0.97	-0.57	1.53
2002	0.11	-0.04	-1.70	-0.14	-1.46	1.85	0.41	-0.84	0.13	1.17	0.51
2003	0.70	1.38	-0.98	0.24	-2.18	0.91	-0.85	0.10	-0.39	1.07	0.00
2004	-0.69	-0.34	0.97	-0.56	-1.00	2.10	-0.52	0.63	0.10	-1.54	0.85
2005	0.00	1.11	-0.29	0.21	-2.07	0.75	0.27	1.04	-0.52	-1.52	1.04
2006	0.73	1.62	-1.25	-1.19	-0.31	1.46	0.43	-0.22	-1.47	0.42	-0.22
2007	-0.29	1.81	-0.82	0.24	-0.32	1.21	0.37	NA	-0.19	0.61	-2.13
2008	-2.29	1.11	1.36	0.44	-0.06	-0.57	0.39	0.57	-1.04	-0.50	0.58
2009	-1.55	0.68	-0.69	-0.54	2.17	0.83	-1.30	-0.06	0.49	0.02	-0.06
2010	-0.79	1.20	0.73	1.93	-0.57	-1.01	1.01	-0.35	-0.43	-1.38	-0.35
2011	1.24	0.41	0.40	-0.74	-0.53	-1.50	0.25	1.31	-0.75	-1.41	1.31
2012	1.58	1.49	-1.59	0.30	-1.12	-0.12	-1.08	0.69	-0.58	-0.17	0.62
2013	1.34	0.17	-0.34	1.15	1.01	-2.21	-0.02	0.13	0.43	-1.18	-0.48
2014	1.53	0.45	-0.52	-0.37	-1.49	-0.95	-0.71	1.47	-0.66	1.35	-0.12
2015	1.04	-0.19	0.55	1.40	-1.17	-1.16	-1.06	0.51	1.00	0.57	-1.49
2016	-0.05	1.47	-0.43	0.84	-0.18	-1.52	-1.51	1.27	-0.95	0.17	0.90
2017	-0.74	1.93	0.20	1.05	-0.35	0.83	0.41	-1.48	-0.56	0.16	-1.45
2018	2.52	1.26	-1.04	-0.79	-0.58	-0.91	-0.22	0.01	-0.26	-0.19	NA
2019	0.89	0.50	-1.18	-0.64	0.38	0.15	0.08	1.19	-1.98	-0.81	1.41
2020	-1.18	1.02	-0.28	0.70	1.56	0.13	-0.12	-1.42	1.23	-0.22	NA

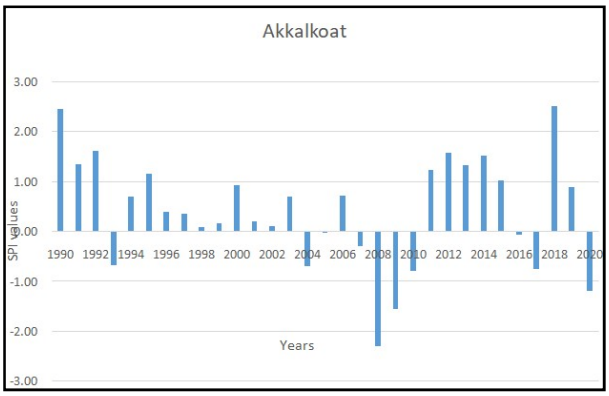

Fig. 2. SPI for Akkalkot Tehsil

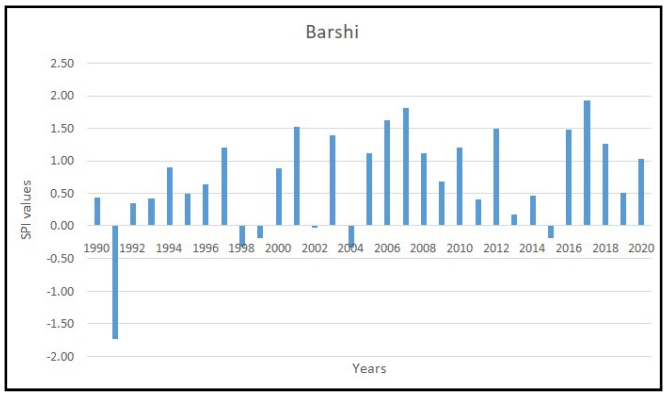

Fig. 3. SPI for Barshi Tehsil

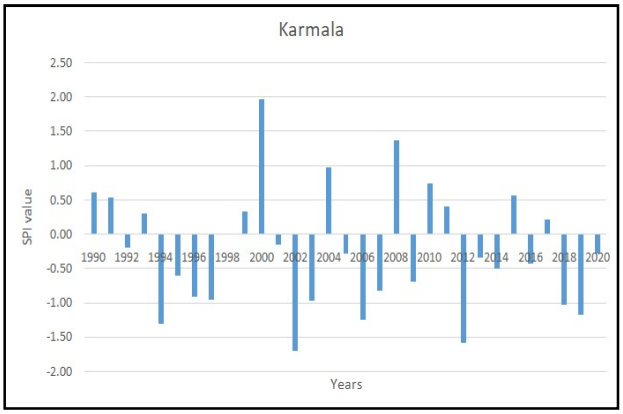

Fig. 4. SPI for Karmala Tehsil

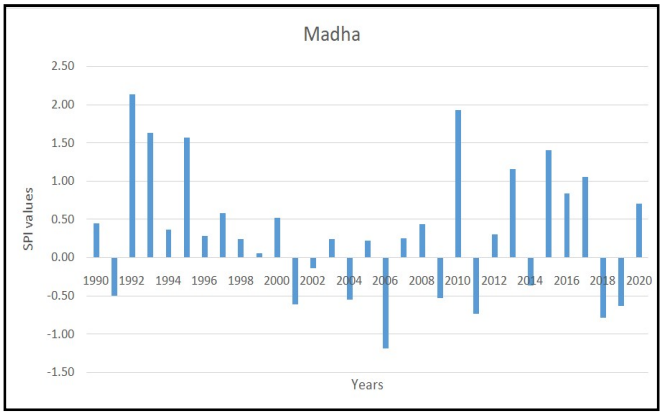

Fig. 5. SPI for Madha Tehsil

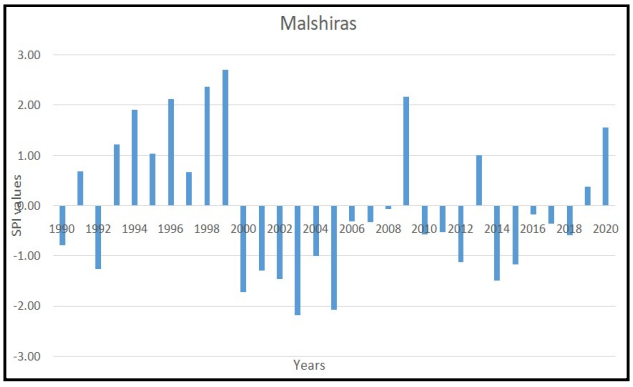

Fig. 6. SPI for Malshiras Tehsil

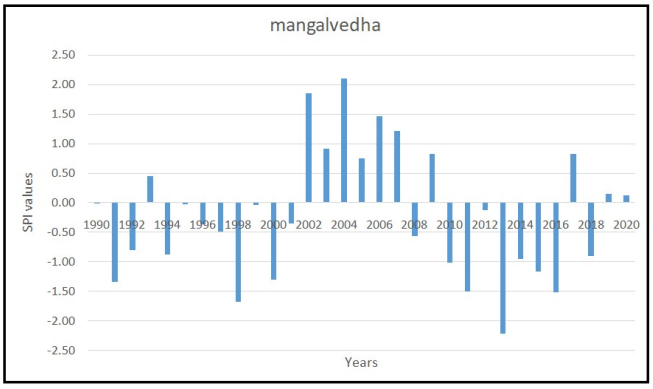

Fig. 7. SPI for Mangalvedha Tehsil

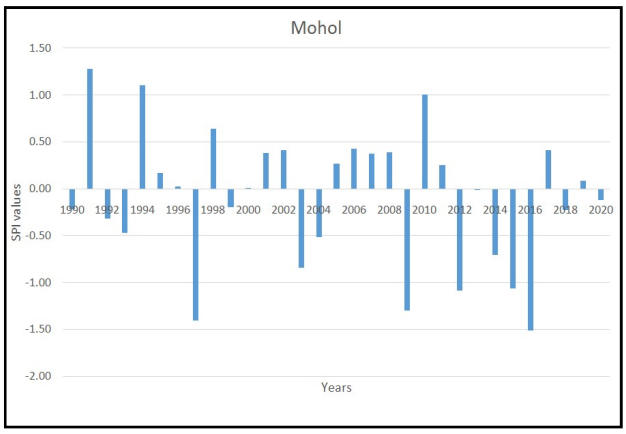

Fig. 8. SPI for Mohol Tehsil

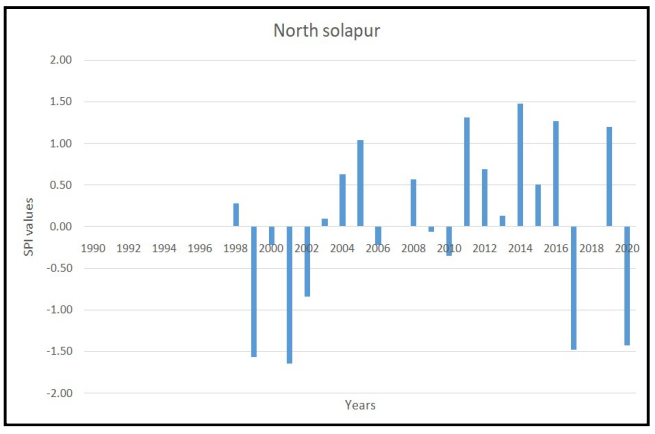

Fig.9. SPI for North Solapur Tehsil

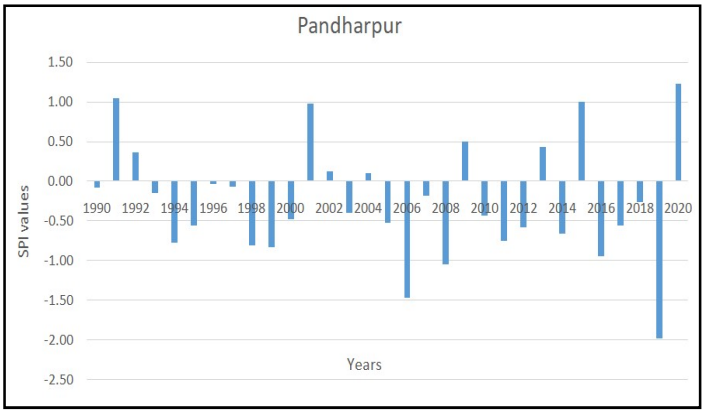

Fig. 10. SPI for Pandharpur Tehsil

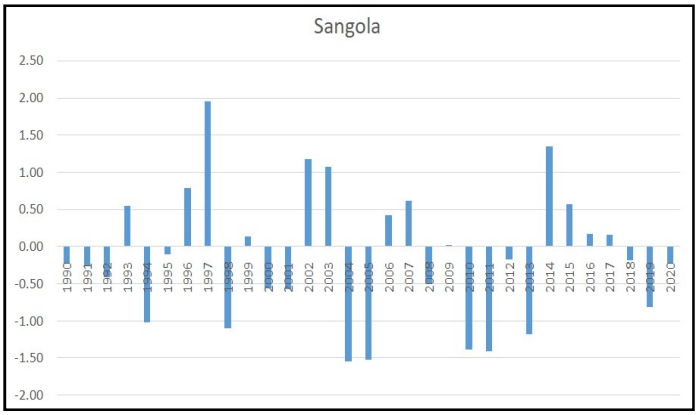

Fig. 11. SPI for Sangola Tehsil

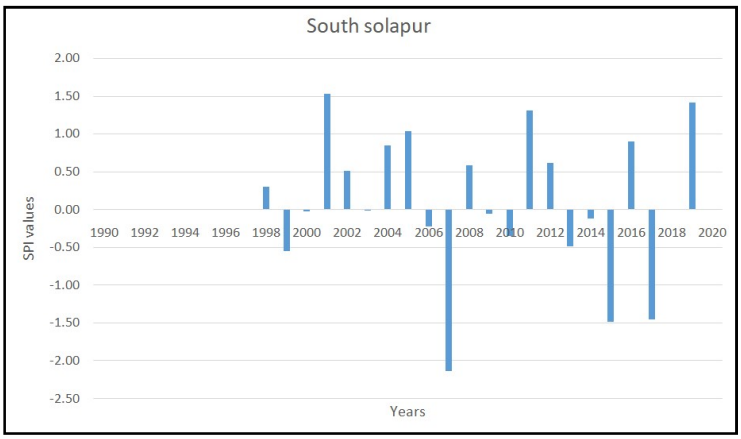

Fig. 12. SPI for South Solapur Tehsil

Meteorological drought is being examined for various tehsils in the Solapur districts during a12-month period (SPI 12). A negative SPI value suggested a drought (dry) situation, whereas a positive value indicated a wet condition. For Akkalkot Tehsil out of 30 years 1990, 2018 observed at extremely wet and 2009, 2008 observed at extremely dry. For Barshi tehsil 1991 observed at severely dry and 2007, 2017 observed at very wet. For Karmala Tehsil 2012 observed at very dry and 2000 observed at very wet. For Madha tehsil 1992, 1993 observed at extremely wet and very wet respectively. For Malshiras tehsil 1996, 1999, 2009 observed at extremely wet, 2020 observed at very wet and 2003, 2005 observed at extremely dry and 2000 observed at very dry. For Mangalvedha tehsil 2013 observed extremely dry, 2011 and 2016 observed at very dry and 2004 observed at extremely wet. For Mohol tehsil 2016 observed at very dry.For North Solapur 1991 and 2001 found at very dry. For Pandharpur tehsil 2019 observed at very dry. For Sangola tehsil 2004, 2005 observed at very dry. For South Solapur 2007 observed at extremely dry. For Malshiras tehsil it was observed that in 30 years condition of drought and flood are more as compare to other tehsils. After Malshiras same situation was Observed in Akkalkot tehsil. For Karmala, Mangalvedha, Mohol, Pandharpur, North Solapur, Sangola, and South Solapur observed with moderately dry and moderately wet years more frequently. Barshi tehsil observed with only one i.e.1991 year at extremely dry condition.

REFERENCES

Arti B Kubade, SV Bagade, VA Sthool, JD Jadhav, PB Pawar, SK Upadhye and SK Rahase, Analysis of rainfall for drought using standardized precipitation index (SPI) for various tehsils in Nandurbar district. (2023) *The Pharma Innovation Journal;* 12(3): 1962-1967.

Alam, N.M. G.C. Sharma, C. Jana, S. Patra, N.K. Sharma1, A. Raizada, Partha Pratim Adhikary and P.K. Mishra, PROBABILISTIC DROUGHT ANALYSIS OF WEEKLY RAINFALL DATA USING MARKOV CHAIN MODEL.(2015) *Journal of Reliability and Statistical Studies* Vol. 8, Issue 1: 105-114.

Bhagat, A. D. S. D. Gorantiwar and V. S. Malunjkar.(2022) Assessment of Meteorological Drought using Standard Precipitation Index (SPI) in Western Maharashtra, India, *J. Agric. Res. Technol., 47 (2) : 152-156.*

Ravi Shaha, Nitin Bharadiyab, Vivek Manekarc 2015. Drought Index Computation Using Standardized Precipitation Index (SPI) Method for Surat District, Gujarat. Aquatic Procedia 4 (2015) 1243 – 1249.

Yogesh Pandey, Ram Nath Jha, Sabah Parvaze, Latief Ahmad and Shahzad Faisal, 2019. Standardized Precipitation Index (SPI) for Drought Intensity Assessment in South Kashmir. *Int. J. Curr. Microbiol. App. Sci 8*(12): 2846-2856.

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