

*Supplementary Materials:*

**Intensifying Haze and Disappearing Dense Fog in Winter at Tribhuvan International Airport, Kathmandu:  
Impacts in Aviation**

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**Table S.1:** Seasonal average values of different meteorological parameters namely, visibility, temperature, dew-point temperature, relative humidity, and wind speed at Tribhuvan international airport (TIA) in Kathmandu from Nov 1976 to 2023. The bold-faced numeric values are the highest and lowest monthly averages

Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Visibility (km)	<b>5.83</b>	6.41	6.85	7.13	8.35	8.69	8.50	<b>8.70</b>	8.57	8.44	7.41	6.24
	±	±	±	±	±	±	±	±	±	±	±	±
	<b>0.06</b>	0.07	0.07	0.07	0.07	0.07	0.06	<b>0.06</b>	0.06	0.07	0.07	0.06
Temperature (°C)	<b>10.51</b>	13.39	17.29	20.81	22.38	24.10	23.82	<b>23.94</b>	22.93	20.23	15.47	11.59
	±	±	±	±	±	±	±	±	±	±	±	±
	<b>0.07</b>	0.08	0.08	0.008	0.06	0.05	0.04	<b>0.04</b>	0.04	0.06	0.07	0.07
Dew point Temperature (°C)	<b>5.00</b>	6.85	9.05	11.62	16.05	19.67	20.95	<b>20.93</b>	19.76	15.33	10.12	6.25
	±	±	±	±	±	±	±	±	±	±	±	±
	<b>0.03</b>	0.03	0.05	0.06	0.04	0.03	0.02	<b>0.02</b>	0.02	0.05	0.04	0.04
Relative Humidity (%)	73.6	70.1	64.1	<b>62.4</b>	72.0	79.1	<b>85.8</b>	84.9	84.1	76.8	74.9	74.4
	±	±	±	±	±	±	±	±	±	±	±	±
	0.3	0.3	0.3	<b>0.4</b>	0.3	0.2	<b>0.2</b>	0.2	0.2	0.3	0.3	0.3
Wind Speed (m/s)	<b>2.3</b>	2.8	3.6	<b>3.9</b>	2.9	2.7	2.7	3.0	2.4	2.7	2.5	2.5
	±	±	±	±	±	±	±	±	±	±	±	±
	<b>0.3</b>	0.3	0.5	<b>0.5</b>	0.2	0.3	0.4	0.4	0.2	0.4	0.4	0.5

**Table S.2:** Trend results of meteorological parameters: Relative Humidity (RH), temperature (T), and Wind Speed (WS) in winter (DJF) at Tribhuvan international airport (TIA) in Kathmandu from 1976 to 2022 using Mann-Kendall and Sen's slope estimator. CI denotes the confidence interval

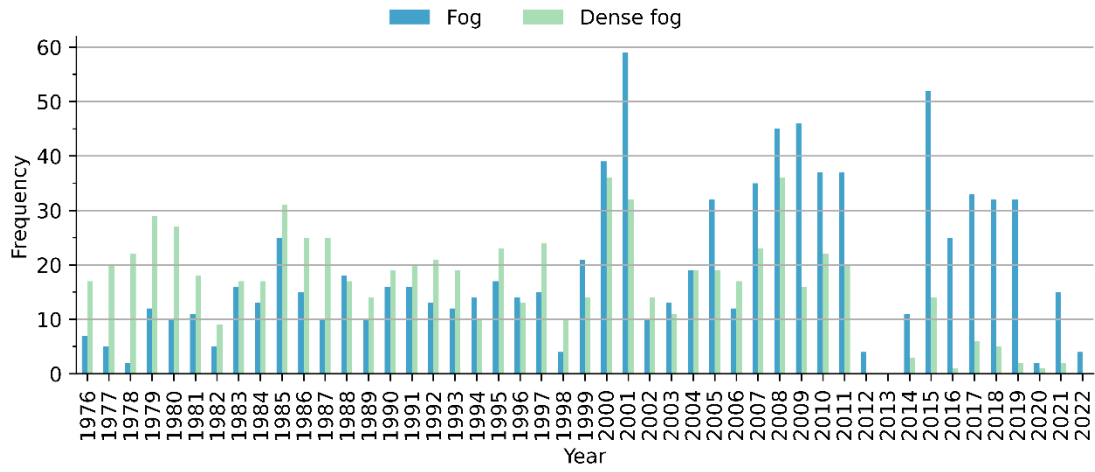
	Period	Mann-Kendall		Sen's slope	
		$Z_{MK}$	$p$ -value	Trend $Q$ ( $\%yr^{-1}$ )	CI %
(a) Relative Humidity (RH) (%)	1976–2000	2.55	0.011	0.28†	[−0.10, 0.65]
	2001–2022	−2.87	0.004	−0.46**	[−0.94, 0.64]
	1976–2022	−1.24	0.215	−0.06 <sup>ns</sup>	[−0.20, 0.18]
(b) Temperature (T) (°C)	1976–2000	0	1.0	0.00 <sup>ns</sup>	[−0.13, 0.13]
	2001–2022	−1.48	0.14	−0.06 <sup>ns</sup>	[−0.16, 0.12]
	1976–2022	3.06	0.002	0.04**	[0.01, 0.09]
(c) Wind Speed (WS) (m/s)	1976–2000	0.37	0.708	0.01 <sup>ns</sup>	[−0.06, 0.47]
	2001–2022	−1.96	0.049	−0.02†	[−0.03, 0.01]
	1976–2022	−3.37	<0.001	−0.02*	[−0.03, 0.00]*

\*- 0.001, \*\* - 0.01, and † - 0.05 level of significance ; ns – non significant

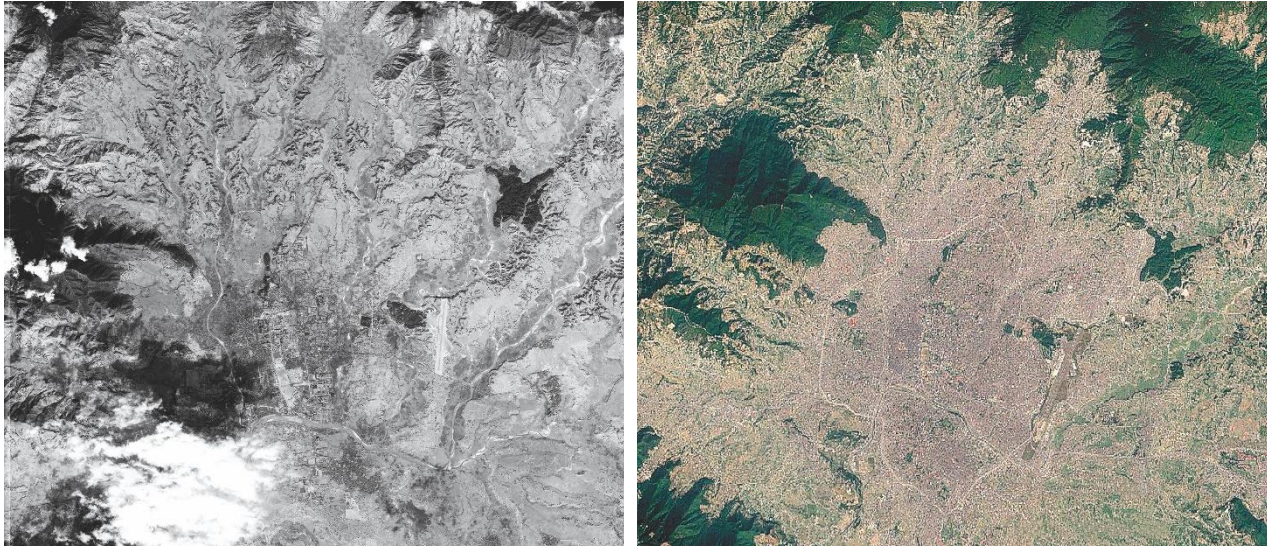
**Table S.3:** Trend results of winter season average values of nighttime meteorological parameters, namely, Relative Humidity (RH), Temperature (T), Dew-point Depression (T<sub>dep</sub>), and Wind Speed (WS) in winter (DJF) at Tribhuvan international airport (TIA) in Kathmandu from 1976 to 2022 using Mann-Kendall and Sen's slope estimator. CI denotes the confidence interval

	Period	Mann-Kendall		Sen's slope	
		$Z_{MK}$	$p$ -value	Trend $Q$ (% $yr^{-1}$ )	CI %
(a) Relative Humidity (RH) (%)	1976-2000	1.89	0.059	0.18 <sup>ns</sup>	[-0.17,0.43]
	2001-2022	-3.44	<0.001	-0.70*	[-1.13, 0.18]
	1976-2022	-1.93	0.05	-0.11 <sup>ns</sup>	[-0.29, 0.10]
(b) Temperature (T) (°C)	1976-2000	0.58	0.559	0.01 <sup>ns</sup>	[-0.05,0.10]
	2001-2022	2.68	0.007	0.14**	[0.06, 0.34]
	1976-2022	3.75	<0.001	0.07*	[0.01, 0.11]
(c) Dew point Depression (T <sub>dep</sub> ) (°C)	1976-2000	-2.19	0.028	-0.03†	[-0.05, 0.00]
	2001-2022	3.29	<0.001	0.13*	[0.03, 0.25]
	1976-2022	1.67	0.10	0.02 <sup>ns</sup>	[-0.01, 0.06]
(d) Wind Speed (WS) (m/s)	1976-2000	0.53	0.597	0.01 <sup>ns</sup>	[-0.03, 3.43]
	2001-2022	-1.43	0.153	-0.01 <sup>ns</sup>	[-0.09, 0.03]
	1976-2022	0.47	0.64	0.00 <sup>ns</sup>	[0.00,0.00]

\*- 0.001, \*\* - 0.01, and † - 0.05 level of significance ; ns - non significant



**Figure S.2:** Annual frequency of fog and dense fog days over TIA (1976–2022)



**Figure S.2:** Satellite image taken on 5 February 1967 (left) showing the broad floodplains of rivers flowing through the Valley floor and open areas and agricultural lands in and around TIA and Google Earth map taken on 20 April 2022 (right) showing urbanization of the Valley (Dixit, 2022)

## REFERENCE

Dixit, K. (2022). Kathmandu from space 60 years apart. Nepali Times. Retrieved November 27, 2022 from <https://www.nepalitimes.com/here-now/kathmandu-from-space-60-years-apart>