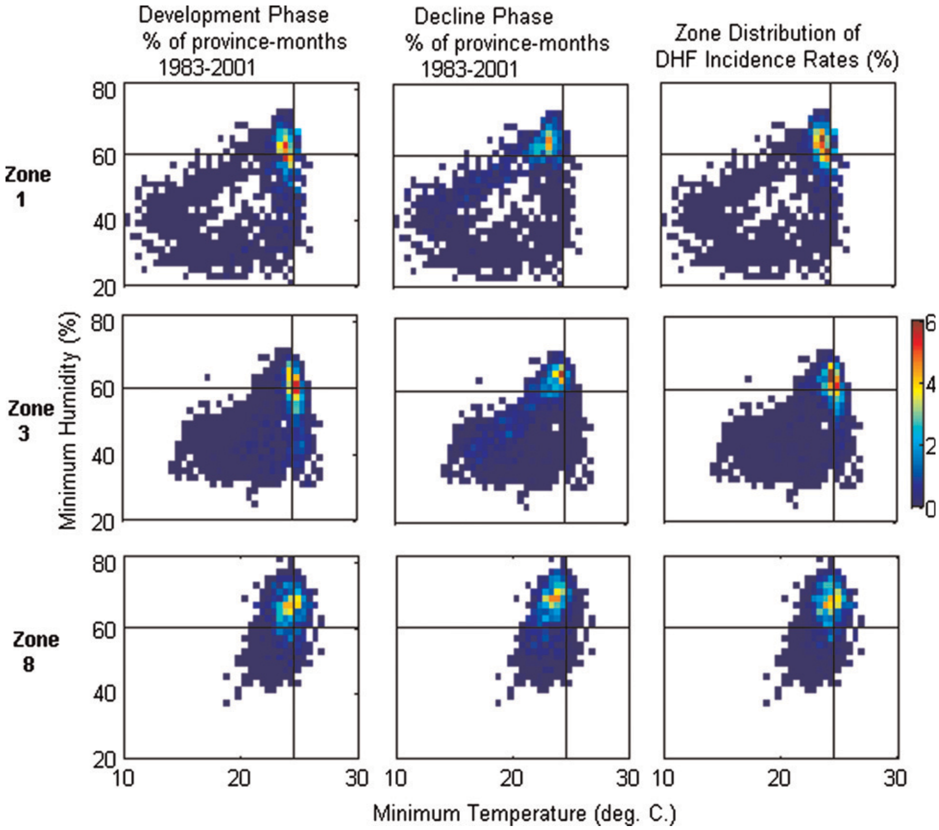

Figure S1. Development and Decline Phase in minimum humidity-temperature weather-space in Thailand. Frequency of occurrence of province-months in weather-space during Development Phase and Decline Phase is shown for three zones (zone 1: northwest, zone 3: central eastern, zone 8: south) of contrasting weather patterns for 1983–2001. Left column indicates distribution of occurrence of province-months during Development Phase. Center column indicates distribution of occurrence of province-months during Decline Phase. Right column indicates distribution of incidence rates per 100 K population per province-month (% of sum over all weather-space) for three zones. Grid resolution is 0.5°C min temperature, 2% min humidity. Reference lines at 24.5°C min temperature and 60% min humidity.

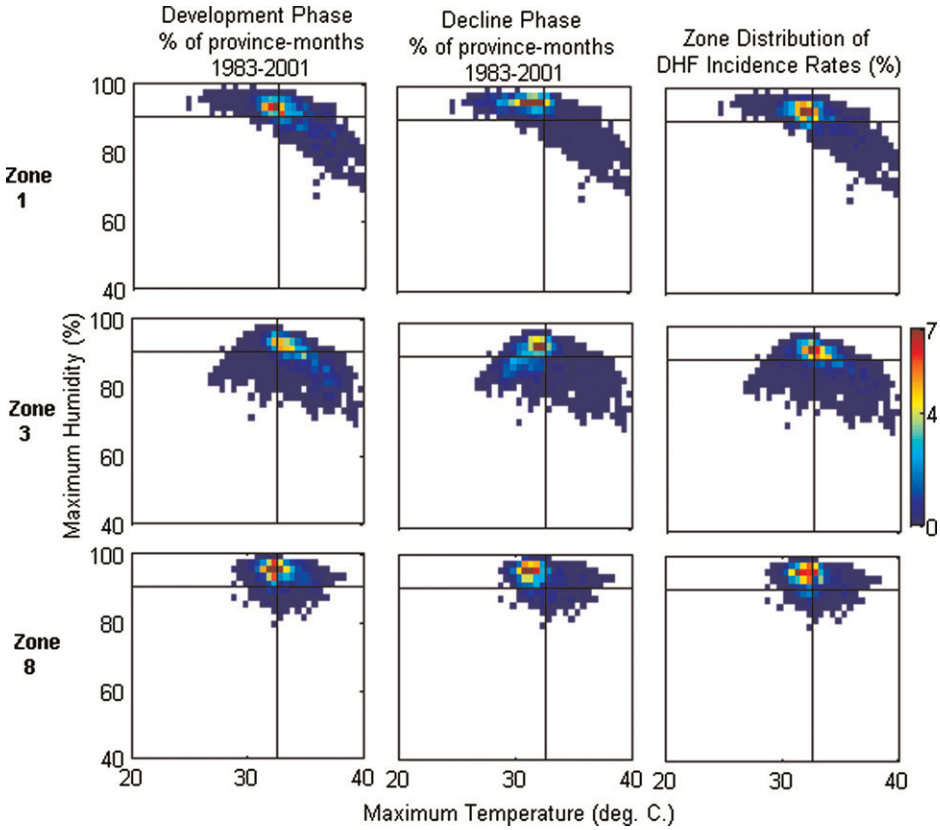

FIGURE S2. Development and Decline Phase in maximum humidity-temperature weather-space in Thailand. Frequency of occurrence of province-months in weather-space during Development Phase and Decline Phase is shown for three zones (zone 1: northwest, zone 3: central eastern, zone 8: south) of contrasting weather patterns for 1983–2001. Left column indicates distribution of occurrence of province-months during Development Phase. Center column indicates distribution of occurrence of province-months during Decline Phase. Right column indicates distribution of incidence rates per 100 K population per province-month (% of sum over all weather-space) for three zones. Grid resolution is 0.5°C max temperature, 2% max humidity. Reference lines at 32.5°C max temperature and 90% max humidity.

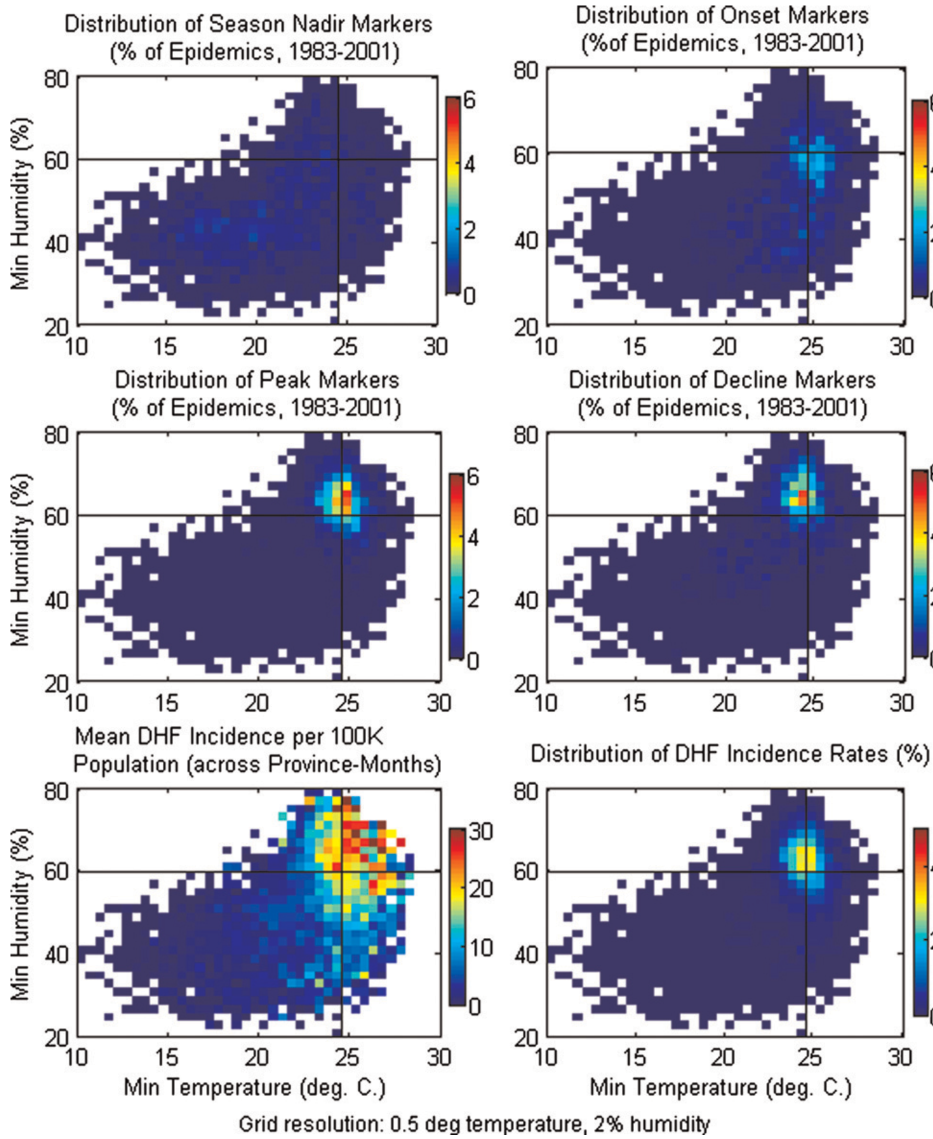

FIGURE S3. Distribution of seasonal transmission change-points in minimum humidity and temperature. Distribution of occurrence of change-point markers for all of Thailand in *minimum* humidity versus *minimum* temperature weather-space, 1983–2001: top left – Nadir, top right – Onset, center left – Peak, center right – Decline. Color indicates percent of total seasonal cycles. Mean dengue hemorrhagic fever (DHF) incidence rate per 100 K population per province-month for each grid interval across weather-space for all Thailand in bottom left panel. Distribution of incidence rates per 100 K population per province-month (% of sum over all weather-space) in bottom right panel. Reference lines at 24.5°C min temperature and 60% min humidity.

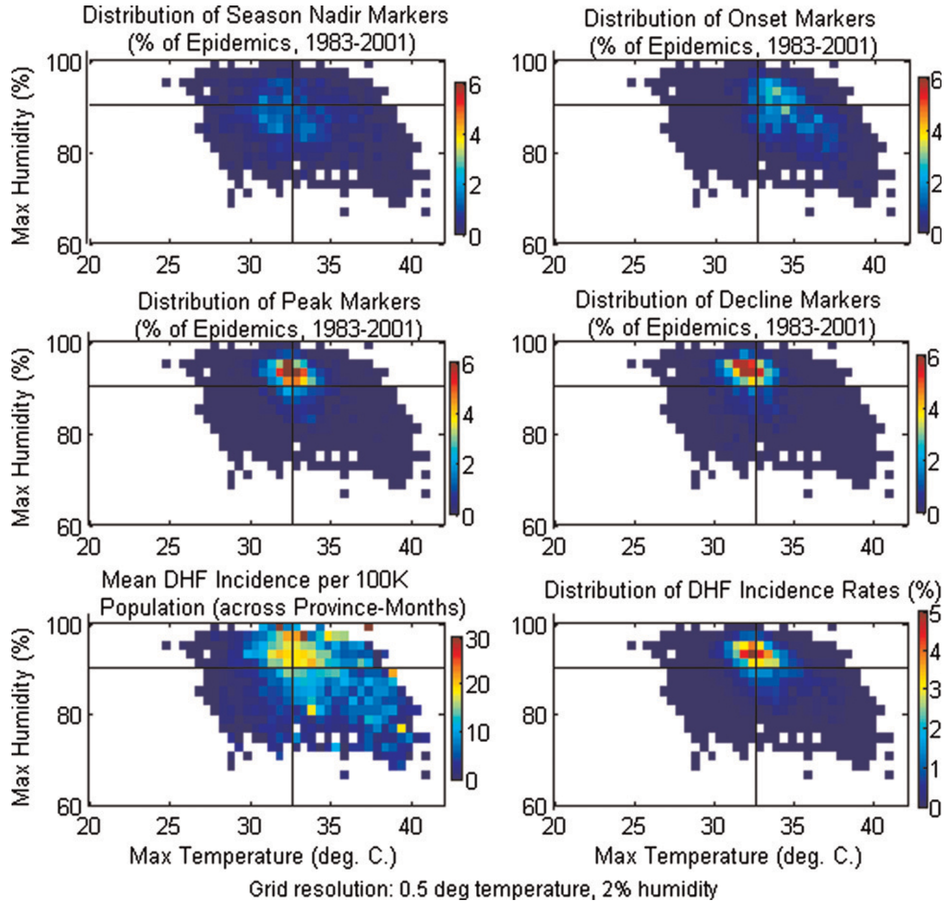

FIGURE S4. Distribution of seasonal transmission change-points in maximum humidity and temperature. Distribution of occurrence of change-point markers for all of Thailand in *maximum* humidity versus *maximum* temperature weather-space, 1983–2001: top left – Nadir, top right – Onset, center left – Peak, center right – Decline. Color indicates percent of total seasonal cycles. Mean dengue hemorrhagic fever (DHF) incidence rate per 100 K population per province-month for each grid interval across weather-space for all Thailand in bottom left panel. Distribution of incidence rates per 100 K population per province-month (% of sum over all weather-space) in bottom right panel. Reference lines at 32.5°C max temperature and 90% max humidity.

Supplemental Table 1

Comparison of weather conditions in same province-month between incidence quartiles

	Q4 vs. Q3		Q4 vs. Q2		Q4 vs. Q1		Q3 vs. Q2		Q3 vs. Q1		Q2 vs. Q1	
	Mean	95% CI	Mean	95% CI	Mean	95% CI	Mean	95% CI	Mean	95% CI	Mean	95% CI
Nadir												
Max Temp			58%	[0.52, 0.64]	61%	[0.53, 0.68]						
Mean Temp					63%	[0.55, 0.70]						
Min Temp					62%	[0.55, 0.69]						
Max Hum											41%	[0.34–0.48]
Mean Hum												
Min Hum												
Onset												
Max Temp					58%	[0.51, 0.65]			61%	[0.54, 0.69]		
Mean Temp					62%	[0.54, 0.69]			60%	[0.53, 0.68]		
Min Temp					61%	[0.54, 0.68]						
Max Hum					39%	[0.31, 0.47]			40%	[0.33, 0.48]		
Mean Hum									39%	[0.31, 0.46]	41%	[0.34, 0.49]
Min Hum									38%	[0.30, 0.45]	42%	[0.35, 0.49]
Mid-Devel.												
Max Temp	58%	[0.52, 0.64]	63%	[0.57, 0.70]	66%	[0.59, 0.73]			62%	[0.54, 0.69]		
Mean Temp	57%	[0.51, 0.63]	64%	[0.58, 0.70]	70%	[0.63, 0.76]			61%	[0.54, 0.68]		
Min Temp			59%	[0.52, 0.65]	66%	[0.60, 0.73]			59%	[0.51, 0.66]		
Max Hum			40%	[0.35, 0.4]	31%	[0.24, 0.38]			36%	[0.29, 0.43]	43%	[0.36, 0.49]
Mean Hum			41%	[0.35, 0.47]	33%	[0.27, 0.40]			34%	[0.27, 0.42]	42%	[0.35, 0.49]
Min Hum	43%	[0.37, 0.49]	40%	[0.34, 0.46]	34%	[0.27, 0.41]			36%	[0.29, 0.44]	43%	[0.35, 0.49]
Peak												
Max Temp	59%	[0.53, 0.65]	59%	[0.54, 0.65]	59%	[0.51, 0.66]					43%	[0.36, 0.49]
Mean Temp	58%	[0.52, 0.64]	58%	[0.52, 0.64]	62%	[0.55, 0.69]						
Min Temp	57%	[0.52, 0.63]	59%	[0.53, 0.65]	64%	[0.57, 0.71]			58%	[0.52, 0.66]		
Max Hum			43%	[0.37, 0.49]	37%	[0.30, 0.45]			42%	[0.34, 0.49]		
Mean Hum			44%	[0.37, 0.49]	39%	[0.32, 0.46]			40%	[0.33, 0.47]		
Min Hum	43%	[0.37, 0.49]	43%	[0.38, 0.49]	41%	[0.34, 0.49]						

Proportion of seasonal cycles in higher quartile that have higher weather measure at change-point marker than for same province-month in lower quartile cycles are listed by weather component. If no significant effect exists, an expected random occurrence would produce a proportion near 50%. Results are shown only for comparisons in which a significant difference in the weather pattern between quartiles was found ($P < 0.05$).

SUPPLEMENTAL INFORMATION

METHODS SUPPLEMENT

Definition of Change-Point Markers. *Onset change-point* was defined as the first month following Nadir in which evidence of potential epidemic development was observed. We assumed a Poisson flow of cases during the period of lowest virus transmission applying a Poisson distribution based on the mean of monthly case counts from the month preceding the first Nadir to the month following the last Nadir. This Poisson distribution reflects current local conditions of transmission during the quiet time of the transient cool dry season. Onset occurred in the first month when the province dengue hemorrhagic fever (DHF) case count indicated the Poisson distribution of the quiet season was no longer valid, defined as exceeding the 99th percentile of the Poisson cumulative distribution function (CDF). Given the large sample size, in defining Onset, we evaluated the 99th, 99.5th, and 99.9th percentile of the Poisson CDF as the point of termination of Quiet Phase of transmission. Equivalently, these options would allow a 1%, 0.5%, or 0.1% error, respectively, in choosing Onset when the case count was still consistent with the Poisson distribution of the Quiet Phase. It is helpful for prediction to pick Onset as early as possible, yet to be effective as a change-point marker a minimum error in identifying a change in transmission dynamics is necessary and is the risk if Onset is picked too early. All three percentiles provided similar results because case counts in the Quiet Phase are very low. Any of the three choices could be used effectively in this study and would provide the same interpretation of transmission dynamics. We report the result of statistical tests using the 99.9th percentile because Onset was slightly more effective in discriminating differences across incidence quartiles, with limited loss of predictive timing.

Decline change-point is the first month in which evidence of a significant drop in number of cases from Peak is observed. A Poisson distribution based on the number of cases at Peak describes the local flow of cases during conditions at Peak. Decline marker is defined as the first month in which the number of cases falls below the 1st percentile of the Poisson CDF defined at Peak. We tested the 1st and 0.5th percentile for definition of the Decline change-point marker and termination of the Peak Plateau Phase. This is a time when case counts are high. The 1st percentile provided the most consistent representation of the Peak Plateau Phase across cycles.

Design of statistical assessments. Statistical comparisons between seasonal transmission structure and weather parameters under different conditions were performed using three methods. Comparisons of the timing of change-point markers and transmission development parameters between incidence quartiles (Table 1) were performed using analysis of variance in a generalized randomized complete block (RCB) design.[1] Using this design, data were blocked by province with a province-year representing an experimental unit. Thus, data from years in quartile 3 for a province were compared with years in quartile 4 for the same province, etc. Because the distribution across quartiles is not exactly the same for all provinces, sample sizes across blocks were not identical. The method proposed by Keppel[2] for adjusting unequal sample sizes using an unweighted means assessment was applied to the RCB design; this allowed each province to contribute equally and avoid introducing a bias because of smaller or larger samples per block. Levene's test and Ansari-Bradley nonparametric test and log transformations were applied to ensure equal variance across blocks. Q–Q plots were used to check for a normal distribution in observations. Family-wise Bonferroni corrections and an additional factor for the treatment of unequal sample sizes were used to adjust the *P* value threshold for determining significant effect. The applied threshold is noted in each results table. Comparison of weather conditions at change-point markers across quartiles (Table 2) also used the method described previously. The comparison of weather-change within a province at epidemic change-points (Table 4) was performed using paired *t* tests, applying family-wise Bonferroni corrections for multiple testing. The comparison of weather conditions at the same time in the same province of different quartile years (Supplemental Table 1) was performed using a Monte Carlo simulation. 100,000 samples were drawn from empirical data for each weather component and each change-point marker from which 95% confidence intervals were determined in each scenario. For each sample, 100 data pairs were randomly drawn from each of the nine zones. A data pair consisted of weather for a randomly selected province at the time of the change-point marker for a specific quartile and weather at the same month in the same province for a lower quartile year. The mean difference within a pair in each measure across zones and the mean proportion of data pairs exhibiting increased measures in higher quartile years formed one sample in the simulation. Simulation results were used to determine if there was a region-wide trend indicating specific weather differences in relation to incidence quartile. Statistical analyses and development of data visualization software tools were performed in MATLAB (The MathWorks, Natick, MA).

Grouping provinces into zones. Provinces were grouped according to nine geographical zones (Figure 4) based on weather dynamics to aid with interpretation and visualization of results. Formation of zones was based on grouping contiguous provinces that had the most similar phase relationship in temperature cycles and humidity cycles. Thus, beginning in the north the provinces were grouped based on correlation between province pairs such that $\rho > 0.65$ for each temperature and humidity component between all province pairs within the group. Correlations within a group were typically much higher than this cutoff, usually > 0.80, and correlations between provinces not grouped together dropped to as low as 0.01. This grouping also associated provinces with similar temperature and humidity ranges.

REFERENCES FOR SUPPORTING INFORMATION

1. Lentner M, Bishop T, 1986. *Experimental Design and Analysis*. Blacksburg, VA: Valley Book Company.
2. Keppel G, 1991. *Design and Analysis: A Researcher's Handbook*. Englewood Cliffs, NJ: Prentice Hall.