

# Reporte mensual del recurso eólico y variables atmosféricas en el CEANA, julio 2021

**Autores: Gustavo Richmond Navarro y Luis Enrique Castro Rodríguez**

El Complejo Educativo Ambiental Naciente Arriaz (CEANA) es el foco de educación ambiental en busca de la conservación del recurso hídrico del cantón central de Cartago<sup>1</sup>, cuyas coordenadas son: 9°89'04.9" Norte y 83°93'42.0" Oeste. En sus instalaciones, el Laboratorio de Investigación en Energía Eólica (LIENE) ha instrumentado la torre que soporta el pararrayos, como se muestra en la Figura 1, provista de 8 anemómetros con veleta a alturas (en metros) de 2, 9.85, 12.2, 12.7, 15, 18, 19.4 y 21. Además, se ha colocado a 2 metros de altura una estación meteorológica para la medición de lluvia, humedad y temperatura. La instalación se desarrolló durante octubre de 2020. Los datos se registran cada 1 minuto.

En <https://www.youtube.com/watch?v=rmiAS7g96e4> se puede apreciar la instrumentación de la torre: en la descripción del vídeo están los enlaces al resto de vídeos de la instrumentación de la torre. Se pueden consultar los datos en tiempo real de las mediciones en <https://www.weatherlink.com/embeddablePage/show/516ded9137a945219fde1195703d7dad/summary>.

Para más información o para consultar los datos históricos registrados, se puede comunicar al correo [grichmond@tec.ac.cr](mailto:grichmond@tec.ac.cr).

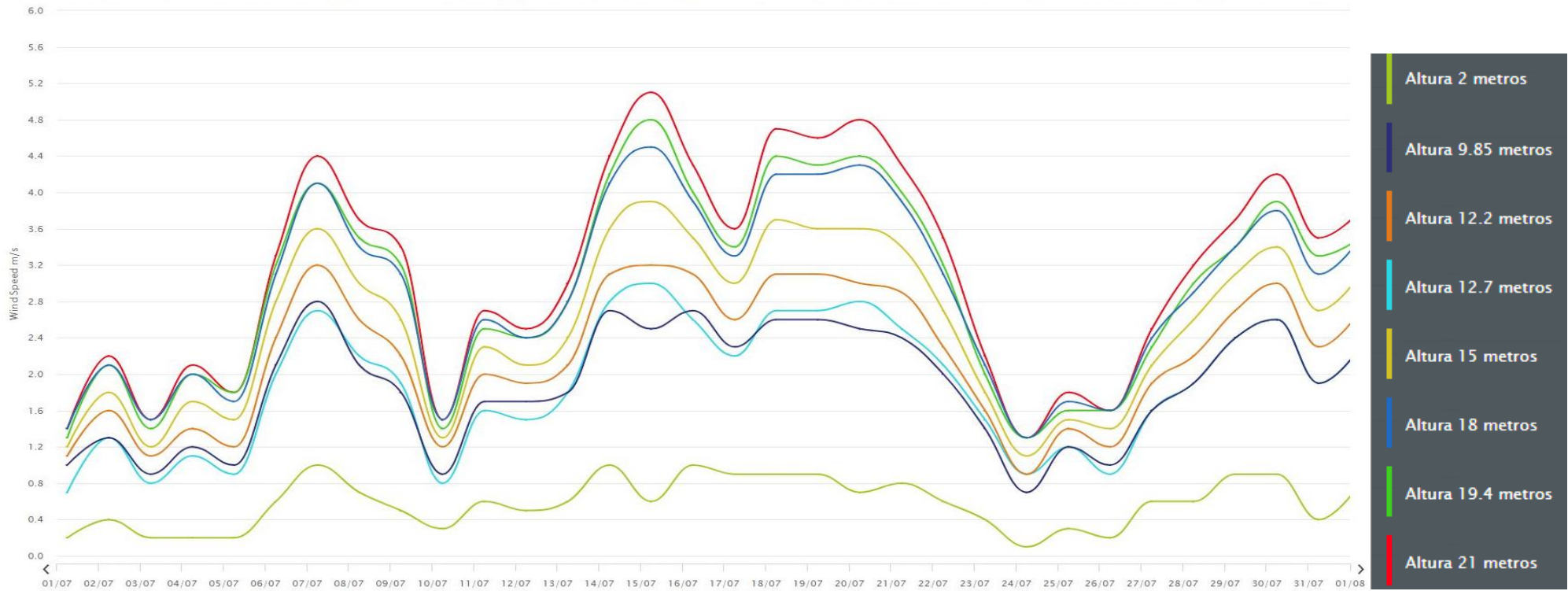


*Ilustración 1. Torre de pararrayos instrumentada con anemómetros y veletas.*

---

<sup>1</sup> Sitio web del CEANA: <http://ceana.muni-carta.go.cr/web/>

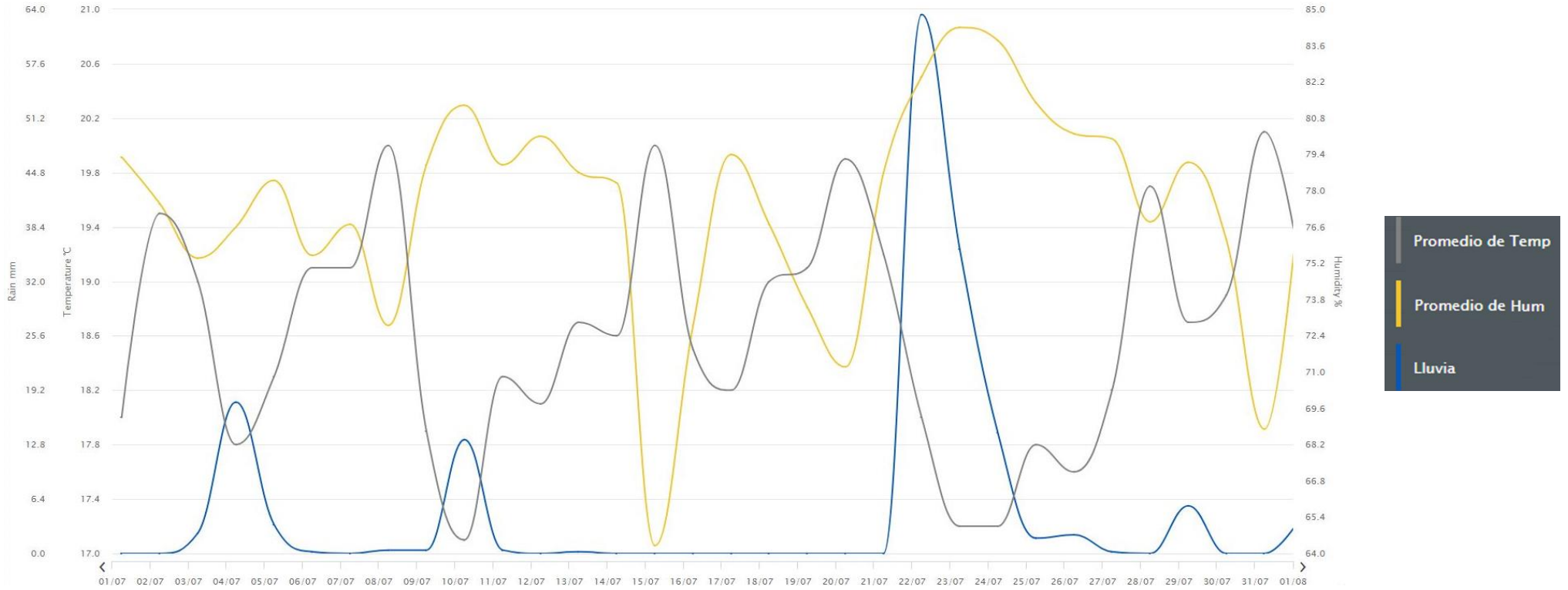
# Velocidad del viento en función de la altura



# Dirección del viento a 21 metros de altura



# Temperatura, humedad y lluvia



JULY 2021

LOCAL CLIMATOLOGICAL DATA

DAVIS INSTRUMENTS, WEATHERLINK NETWORK

Cartago, Provincia de Cartago CRI  
CEANA



Lat: 9.8897 Long: -83.9341 Elev (ground): 1506 meters Time Zone: America/Costa\_Rica

| TEMPERATURE °C         |         |                        |         |                   |                     | DEG DAYS<br>BASE 18.3°  |         | PRECIP.<br>(mm)            | PRESSURE<br>(mb)   |                      | WIND SPEED = m/s<br>DIR = DEGREES                |                 |                  |               |     |                 |     |         | Date |     |
|------------------------|---------|------------------------|---------|-------------------|---------------------|-------------------------|---------|----------------------------|--------------------|----------------------|--|-----------------|------------------|---------------|-----|-----------------|-----|---------|------|-----|
| Date                   | MAXIMUM | MINIMUM                | AVERAGE | AVERAGE<br>DEW PT | AVERAGE<br>WET BULB | HEATING                 | COOLING | WATER<br>EQUIV             | AVERAGE<br>STATION | AVERAGE<br>SEA LEVEL | RESULTANT<br>SPEED                               | RES DIR         | AVERAGE<br>SPEED | WIND MAX      |     |                 |     |         |      |     |
|                        |         |                        |         |                   |                     |                         |         |                            |                    |                      |  |                 |                  | INSTANT       |     | 2 - MIN         |     | ARCHIVE |      |     |
|                        |         |                        |         |                   |                     |                         |         |                            |                    |                      |  |                 |                  | SPEED         | DIR | SPEED           | DIR | SPEED   |      | DIR |
| 01                     | 23.0    | 14.2                   | 18.0    | 14.3              | 15.3                | 1.146                   | 0.786   | 0.0                        | 851.0              | 1020.3               | 0.2  | 188             | 0.2              | 5.4           | 170 | 2.6             | 187 | 3.0     | 191  | 01  |
| 02                     | 25.6    | 15.8                   | 19.5    | 15.4              | 16.4                | 0.591                   | 1.714   | 0.0                        | 851.5              | 1020.8               | 0.4  | 190             | 0.4              | 6.7           | 140 | 2.7             | 186 | 3.2     | 190  | 02  |
| 03                     | 25.2    | 14.2                   | 19.0    | 14.4              | 15.6                | 0.943                   | 1.615   | 2.4                        | 851.6              | 1020.9               | 0.1  | 194             | 0.2              | 5.4           | 272 | 1.6             | 193 | 2.3     | 191  | 03  |
| 04                     | 23.9    | 12.3                   | 17.8    | 13.6              | 14.8                | 1.864                   | 1.380   | 17.8                       | 851.4              | 1020.7               | 0.1  | 196             | 0.2              | 5.8           | 165 | 2.6             | 178 | 3.0     | 173  | 04  |
| 05                     | 25.5    | 13.4                   | 18.3    | 14.4              | 15.5                | 1.536                   | 1.474   | 3.4                        | 852.0              | 1021.4               | 0.1  | 189             | 0.2              | 5.4           | 181 | 2.0             | 182 | 3.0     | 183  | 05  |
| 06                     | 26.3    | 14.4                   | 19.1    | 14.5              | 15.8                | 1.009                   | 1.781   | 0.2                        | 851.2              | 1020.5               | 0.6  | 187             | 0.6              | 6.3           | 166 | 3.1             | 183 | 3.7     | 183  | 06  |
| 07                     | 25.4    | 16.1                   | 19.1    | 14.8              | 15.9                | 0.744                   | 1.465   | 0.0                        | 850.0              | 1019.1               | 1.0  | 187             | 1.0              | 7.2           | 168 | 3.2             | 188 | 3.4     | 197  | 07  |
| 08                     | 26.9    | 16.3                   | 20.0    | 14.7              | 16.1                | 0.568                   | 2.269   | 0.4                        | 849.9              | 1018.9               | 0.7  | 188             | 0.7              | 8.5           | 170 | 3.2             | 179 | 3.4     | 172  | 08  |
| 09                     | 22.3    | 15.8                   | 17.9    | 14.2              | 15.3                | 0.887                   | 0.503   | 0.4                        | 850.4              | 1019.6               | 0.4  | 190             | 0.5              | 4.9           | 135 | 2.0             | 186 | 2.4     | 182  | 09  |
| 10                     | 21.3    | 14.9                   | 17.1    | 13.9              | 14.9                | 1.545                   | 0.354   | 13.4                       | 850.2              | 1019.3               | 0.2  | 189             | 0.3              | 5.4           | 175 | 2.6             | 178 | 3.4     | 169  | 10  |
| 11                     | 24.1    | 14.7                   | 18.3    | 14.6              | 15.6                | 1.163                   | 1.170   | 0.4                        | 850.0              | 1019.1               | 0.5  | 190             | 0.6              | 7.2           | 167 | 3.0             | 193 | 3.3     | 191  | 11  |
| 12                     | 20.6    | 15.8                   | 18.1    | 14.6              | 15.6                | 0.820                   | 0.575   | 0.0                        | 850.5              | 1019.7               | 0.5  | 188             | 0.5              | 6.7           | 217 | 3.0             | 178 | 3.5     | 187  | 12  |
| 13                     | 22.8    | 16.5                   | 18.7    | 14.9              | 15.9                | 0.627                   | 0.950   | 0.2                        | 851.0              | 1020.2               | 0.6  | 190             | 0.6              | 7.2           | 172 | 2.6             | 187 | 3.7     | 193  | 13  |
| 14                     | 23.1    | 16.1                   | 18.6    | 14.7              | 15.8                | 0.695                   | 0.983   | 0.0                        | 851.8              | 1021.1               | 0.9  | 190             | 1.0              | 6.3           | 173 | 3.2             | 185 | 3.7     | 177  | 14  |
| 15                     | 26.2    | 15.8                   | 20.0    | 12.7              | 14.6                | 0.631                   | 2.315   | 0.0                        | 851.5              | 1020.8               | 0.5  | 192             | 0.6              | 6.3           | 228 | 2.2             | 179 | 2.9     | 176  | 15  |
| 16                     | 24.0    | 14.2                   | 18.5    | 13.4              | 14.8                | 1.340                   | 1.521   | 0.0                        | 851.1              | 1020.4               | 1.0  | 187             | 1.0              | 7.6           | 168 | 3.8             | 183 | 4.8     | 178  | 16  |
| 17                     | 20.8    | 16.1                   | 18.2    | 14.6              | 15.6                | 0.631                   | 0.512   | 0.0                        | 851.3              | 1020.5               | 0.8  | 190             | 0.9              | 6.3           | 166 | 2.7             | 182 | 3.4     | 177  | 17  |
| 18                     | 23.7    | 16.3                   | 19.0    | 14.7              | 15.9                | 0.642                   | 1.289   | 0.0                        | 851.0              | 1020.3               | 0.8  | 190             | 0.9              | 6.7           | 168 | 2.9             | 192 | 3.2     | 175  | 18  |
| 19                     | 26.0    | 15.9                   | 19.1    | 14.1              | 15.5                | 0.768                   | 1.565   | 0.0                        | 850.6              | 1019.7               | 0.8  | 189             | 0.9              | 7.2           | 166 | 2.8             | 185 | 3.5     | 177  | 19  |
| 20                     | 27.3    | 15.6                   | 19.9    | 14.2              | 15.6                | 0.835                   | 2.352   | 0.0                        | 849.9              | 1019.0               | 0.7  | 190             | 0.7              | 6.7           | 172 | 3.0             | 186 | 3.9     | 189  | 20  |
| 21                     | 25.6    | 16.9                   | 19.2    | 15.3              | 16.4                | 0.479                   | 1.306   | 0.0                        | 850.0              | 1019.1               | 0.7  | 188             | 0.8              | 6.3           | 175 | 3.1             | 187 | 3.7     | 180  | 21  |
| 22                     | 22.9    | 16.4                   | 18.0    | 14.9              | 15.8                | 0.883                   | 0.539   | 63.4                       | 851.6              | 1020.9               | 0.5  | 190             | 0.6              | 5.8           | 89  | 2.5             | 190 | 3.2     | 186  | 22  |
| 23                     | 18.4    | 16.1                   | 17.2    | 14.5              | 15.3                | 1.178                   | 0.001   | 35.8                       | 851.8              | 1021.2               | 0.4  | 189             | 0.4              | 5.8           | 172 | 1.8             | 187 | 2.6     | 179  | 23  |
| 24                     | 19.1    | 15.8                   | 17.2    | 14.4              | 15.2                | 1.197                   | 0.032   | 14.2                       | 851.8              | 1021.2               | 0.1  | 192             | 0.1              | 4.0           | 166 | 1.4             | 196 | 1.7     | 188  | 24  |
| 25                     | 23.2    | 14.8                   | 17.8    | 14.5              | 15.5                | 1.205                   | 0.635   | 1.8                        | 851.5              | 1020.8               | 0.3  | 189             | 0.3              | 7.6           | 164 | 4.0             | 186 | 4.7     | 176  | 25  |
| 26                     | 22.2    | 13.5                   | 17.6    | 14.1              | 15.1                | 1.487                   | 0.744   | 2.2                        | 851.5              | 1020.9               | 0.2  | 192             | 0.2              | 4.0           | 169 | 2.1             | 176 | 2.5     | 191  | 26  |
| 27                     | 24.4    | 14.9                   | 18.2    | 14.6              | 15.6                | 1.155                   | 1.024   | 0.2                        | 851.3              | 1020.5               | 0.5  | 188             | 0.6              | 7.6           | 166 | 3.2             | 189 | 3.9     | 194  | 27  |
| 28                     | 26.7    | 15.6                   | 19.7    | 15.4              | 16.5                | 0.755                   | 2.149   | 0.0                        | 850.2              | 1019.3               | 0.6  | 187             | 0.6              | 7.2           | 166 | 2.9             | 185 | 3.7     | 184  | 28  |
| 29                     | 25.0    | 15.7                   | 18.7    | 14.9              | 15.9                | 1.009                   | 1.327   | 5.6                        | 850.2              | 1019.3               | 0.8  | 186             | 0.9              | 7.6           | 165 | 3.5             | 184 | 3.9     | 184  | 29  |
| 30                     | 25.0    | 15.1                   | 18.9    | 14.5              | 15.7                | 1.063                   | 1.662   | 0.0                        | 850.7              | 1019.9               | 0.9  | 187             | 0.9              | 8.0           | 212 | 3.1             | 186 | 3.8     | 179  | 30  |
| 31                     | 27.1    | 15.3                   | 20.1    | 14.0              | 15.5                | 0.828                   | 2.623   | 0.0                        | 851.0              | 1020.2               | 0.4  | 189             | 0.4              | 6.3           | 167 | 3.4             | 182 | 3.5     | 179  | 31  |
|                        |         |                        |         |                   |                     |                         |         |                            |                    |                      |  |                 |                  | < Monthly Avg |     |                 |     |         |      |     |
| NUMBER OF DAYS WITH: > |         | Maximum Temp ≥ 32.2: 0 |         |                   |                     | Minimum Temp ≤ 0: 0     |         | Precipitation ≥ 0.2 mm: 13 |                    |                      | Greatest 24 - hr precipitation: 93.4 Date: 22-23 |                 |                  |               |     |                 |     |         |      |     |
|                        |         | Maximum Temp ≤ 0: 0    |         |                   |                     | Minimum Temp ≤ -17.7: 0 |         | Precipitation ≥ 2.0 mm: 7  |                    |                      | Monthly Total Precipitation: 161.8               |                 |                  |               |     |                 |     |         |      |     |
| SEA LEVEL PRESSURE: >  |         | MAXIMUM: 1023.3        |         | DATE: 5           |                     | TIME: 20:02             |         | MONTHLY TOTAL              |                    | SEASON TO DATE TOTAL |  | HEATING: 54.403 |                  | 64.568        |     | COOLING: 69.512 |     | 501.050 |      |     |
|                        |         | MINIMUM: 1016.8        |         | DATE: 28          |                     | TIME: 15:00             |         | DEGREEE DAYS: >            |                    |                      |  |                 |                  |               |     |                 |     |         |      |     |

JULY 2021  
Cartago, Provincia de Cartago CRI