

“HURACANES” MEDITERRÁNEOS EN EL CLIMA PRESENTE Y FUTURO

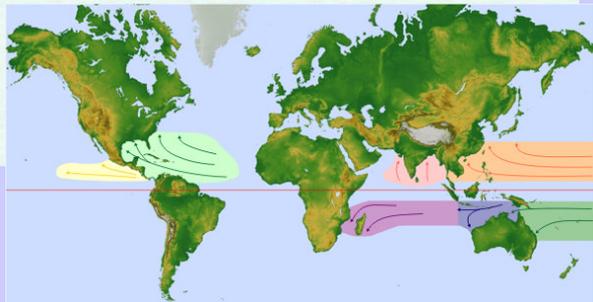
**Jornadas sobre
OBSERVACIÓN DE LA TIERRA Y CAMBIO GLOBAL**
(Escola d'Hoteleria i Turisme, campus UIB, 8 y 9 de Mayo de 2007)

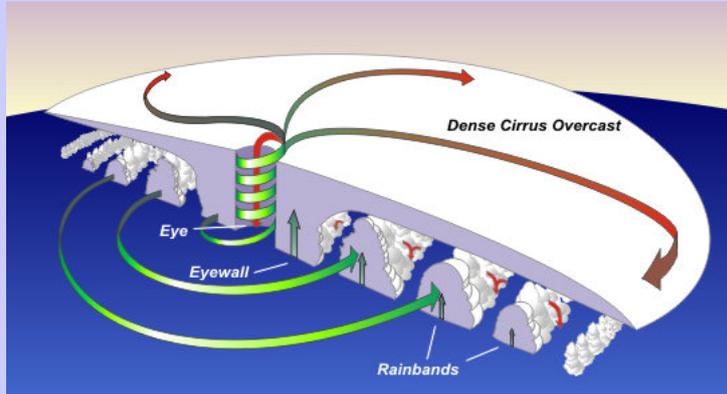
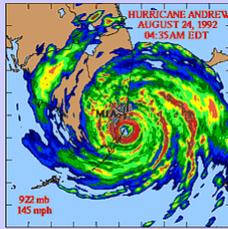
Romualdo Romero March

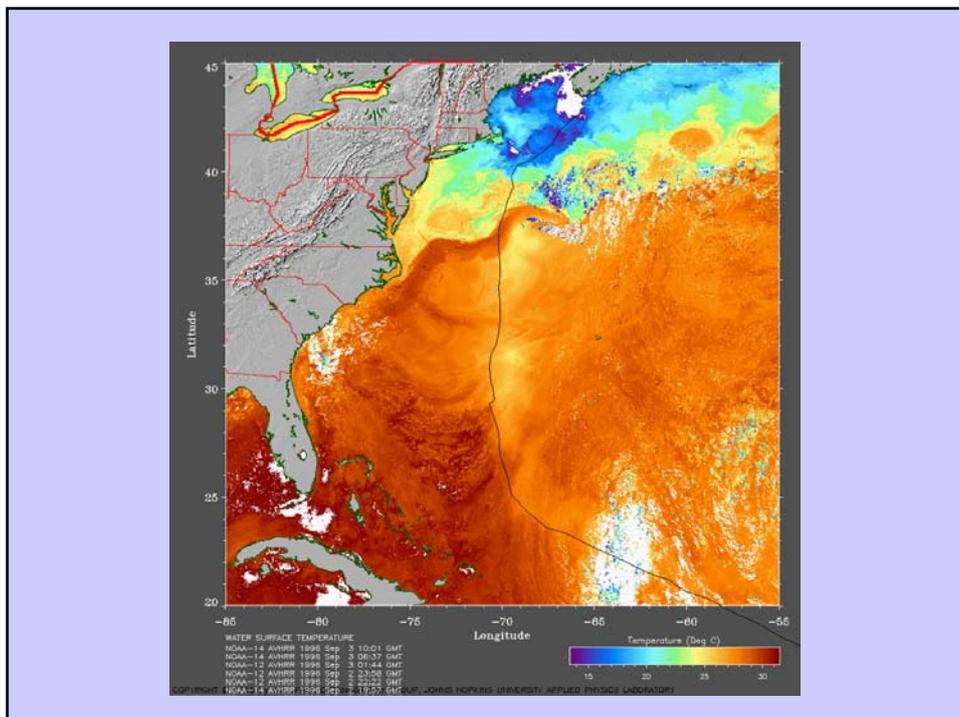
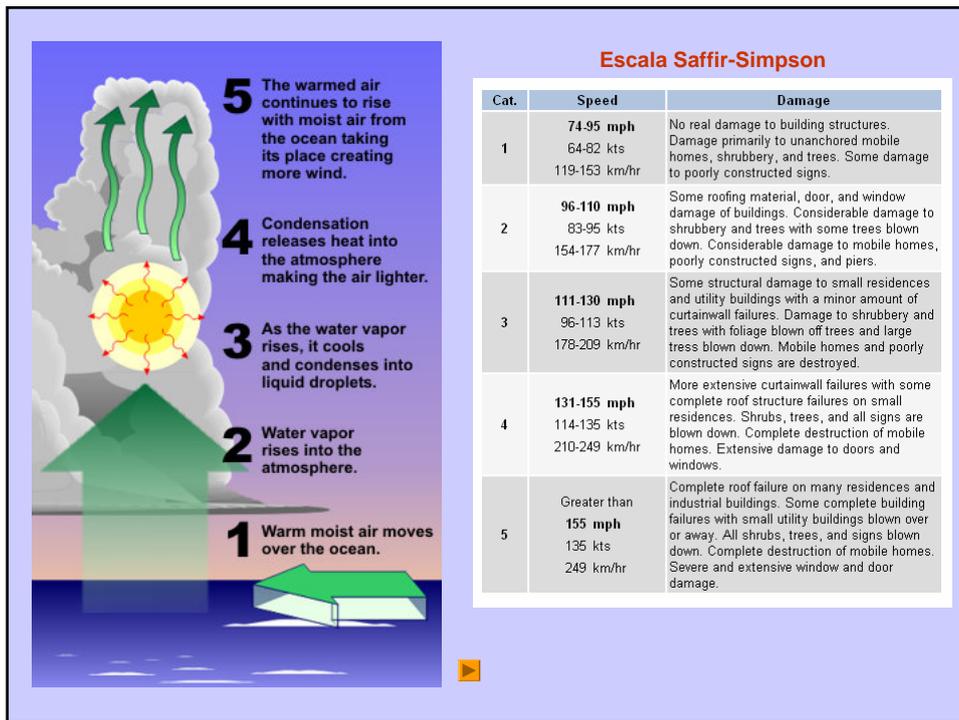


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Agustí Jansà (CMT del INM en Illes Balears)
Kerry A. Emanuel (MIT, Boston, USA)*

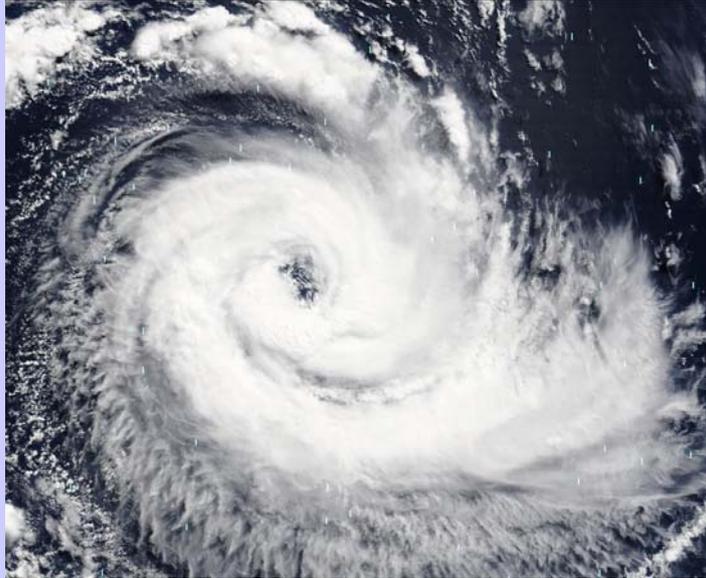
Tropical Cyclones



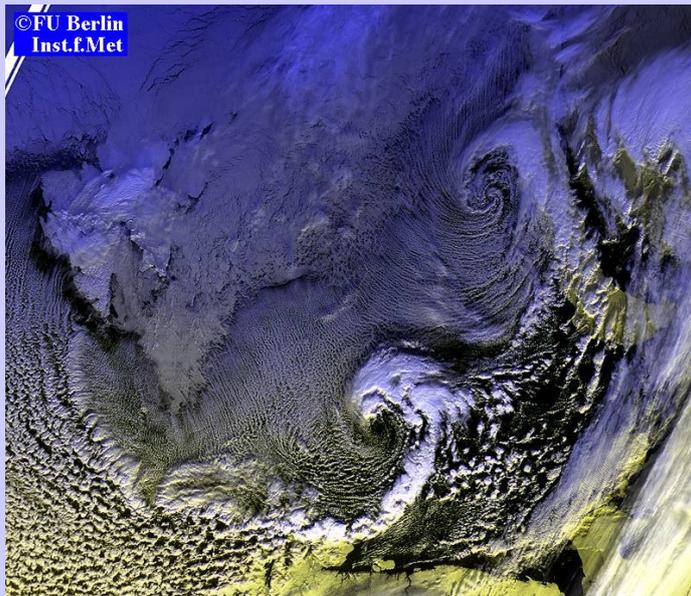




**Huracán Catalina (Brasil, marzo 2004),
formado a partir de una depresión fría en altura**



Bajas Polares

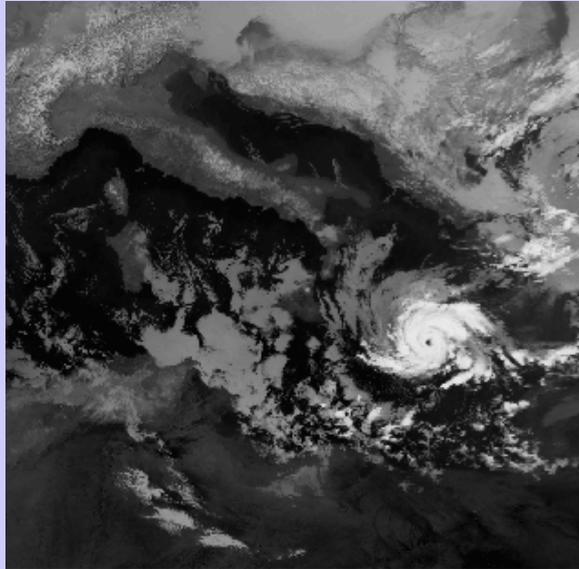




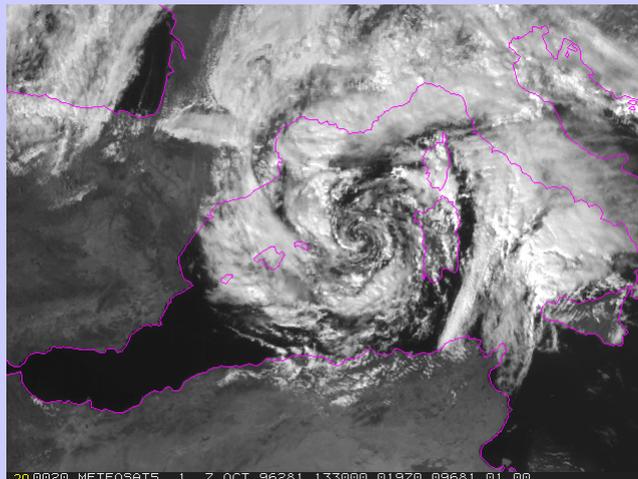
MEDICANES

- Varios por año en el conjunto de la cuenca mediterránea, rara vez alcanzando la categoría de huracán (120 km/h).
- Típicamente, se forman bajo el efecto de una depresión fría y aislada en los niveles medio-altos de la troposfera.
- Se sustentan en el elevado desequilibrio termodinámico aire-mar propiciado por la perturbación primaria. Son más frecuentes en otoño.

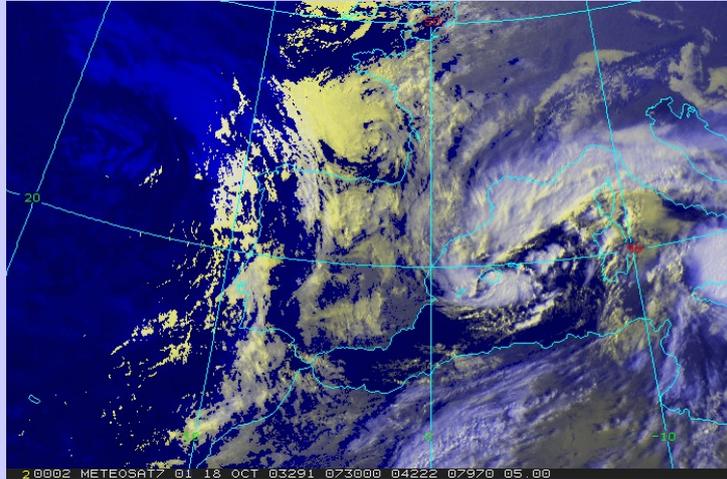
Medicane del 15-17 Enero 1995

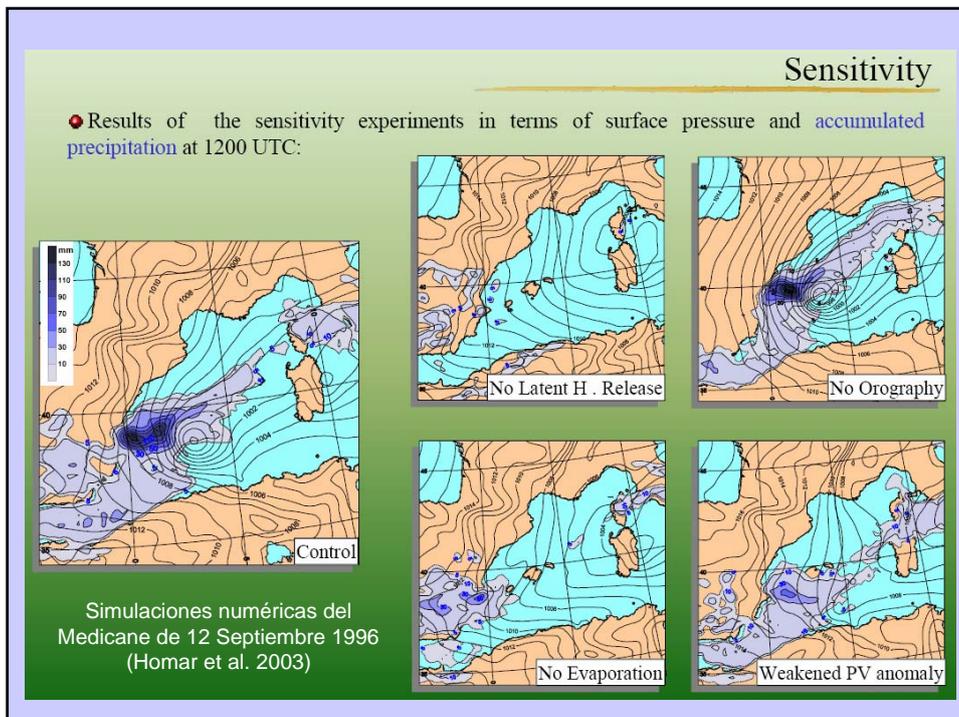
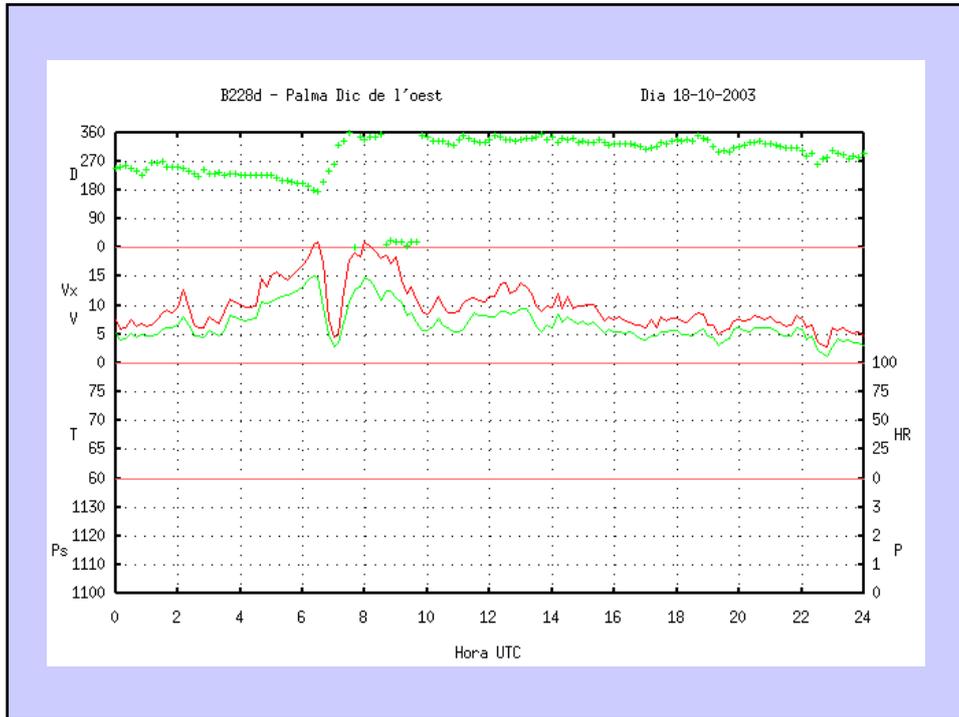


Medicane del 7-10 Octubre 1996



Medicane del 18 Octubre 1996





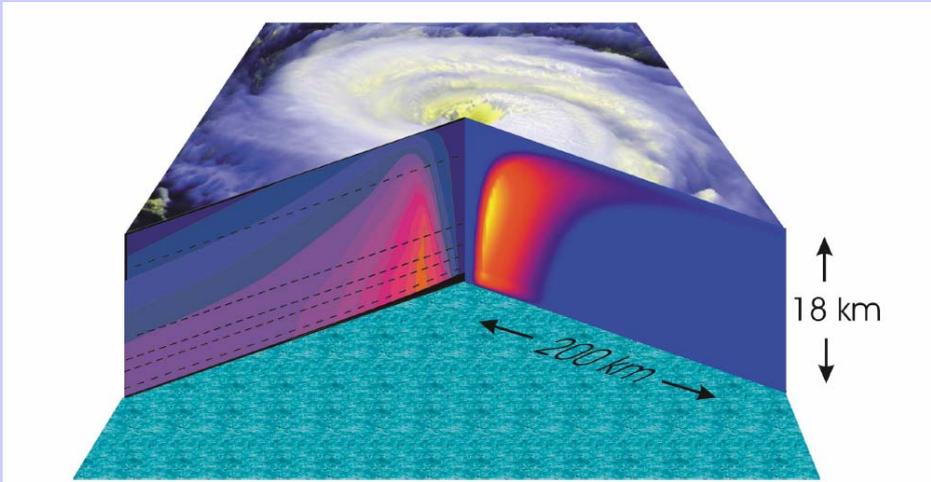
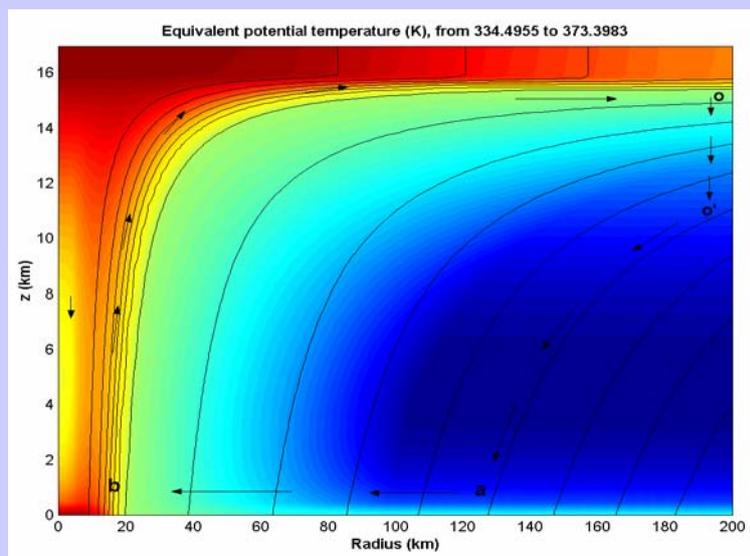


Figure 3 Cutaway view of the structure of a tropical cyclone. The top of the storm is based on a satellite photograph of the cloud structure of Hurricane Fran of 1996. The right-hand cut shows the vertical component of velocity, from a numerical simulation of a hurricane using the model of Emanuel (1995a); maximum values (yellow) are approximately 8 ms^{-1} . The left-hand cut shows the magnitude of the tangential wind component measured in Hurricane Inez of 1966 by aircraft flying at levels indicated by the black dashed lines; from Hawkins & Imbembo (1976). Maximum values are approximately 50 ms^{-1} .

Energía del Huracán (ciclo de Carnot)

a-b: Expansión isotérmica b-o: Expansión adiabática o-o': Compresión isotérmica o'-a: Compresión adiabática



Balance Energético (Estado Estacionario)

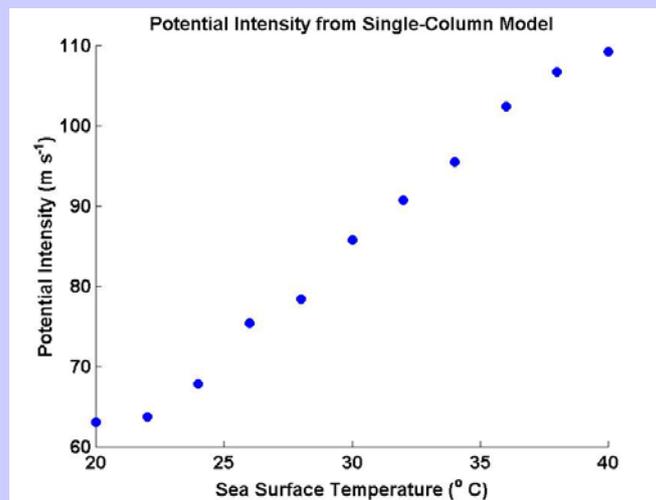
$$P = 2\pi \frac{T_s - T_o}{T_s} \int_a^b \left[C_k \rho |V| (k_0^* - k) + C_D \rho |V|^3 \right] r dr$$

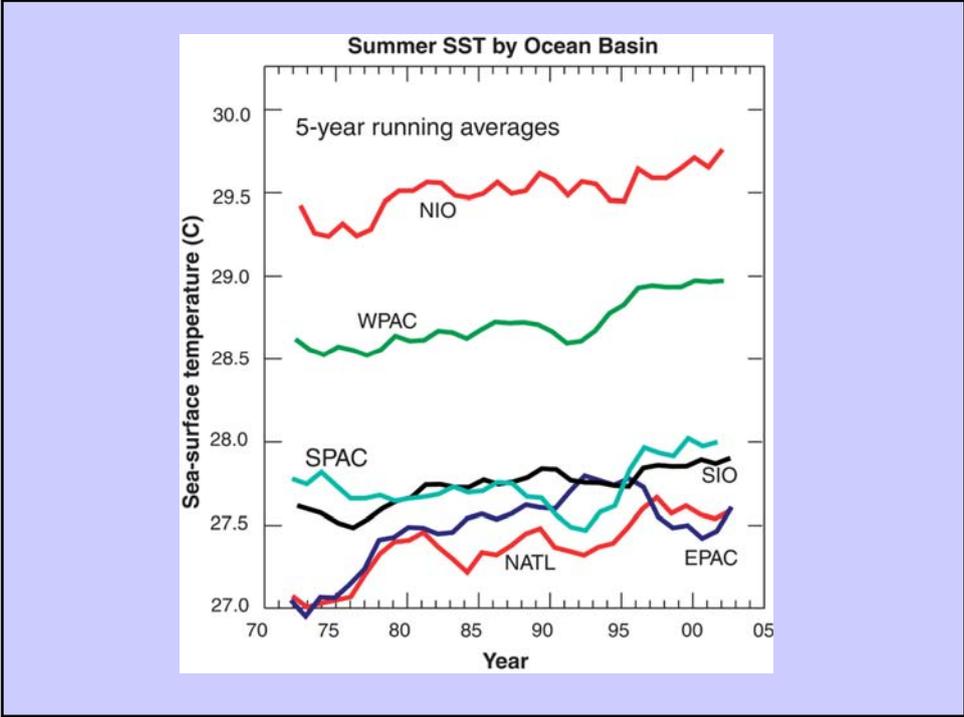
$$D = 2\pi \int_a^b C_D \rho |V|^3 r dr$$

$$\rightarrow |V_{\max}|^2 \cong \frac{C_k}{C_D} \frac{T_s - T_o}{T_o} (k_0^* - k)$$

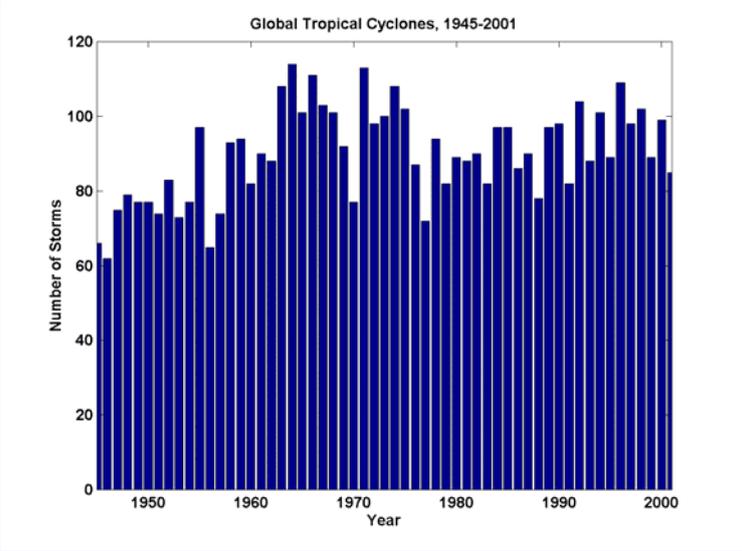
> P_{\min} using the gradient-wind relationship

TEORÍA: La Intensidad Potencial Aumenta con la SST (Emanuel, 1987)

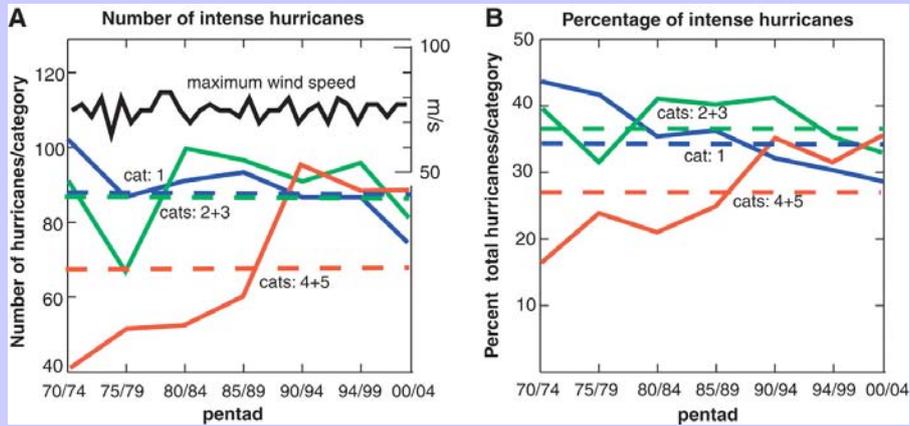




La frecuencia no ha cambiado significativamente



Webster et al. (Science, 2005)



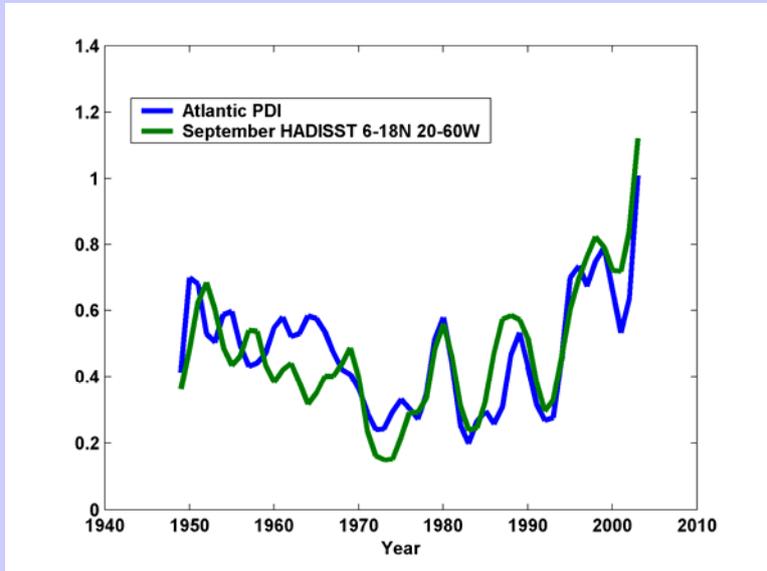
Medida de la actividad del ciclón tropical

$$Power\ dissipation = 2\pi \int_0^\tau \int_0^{r_0} C_D \rho |\mathbf{V}|^3 r dr dt.$$

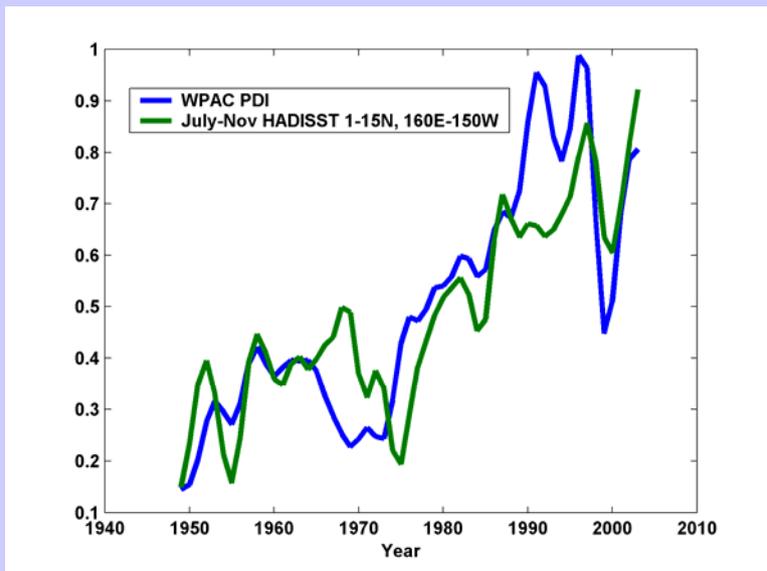
Simplified “Power Dissipation Index”:

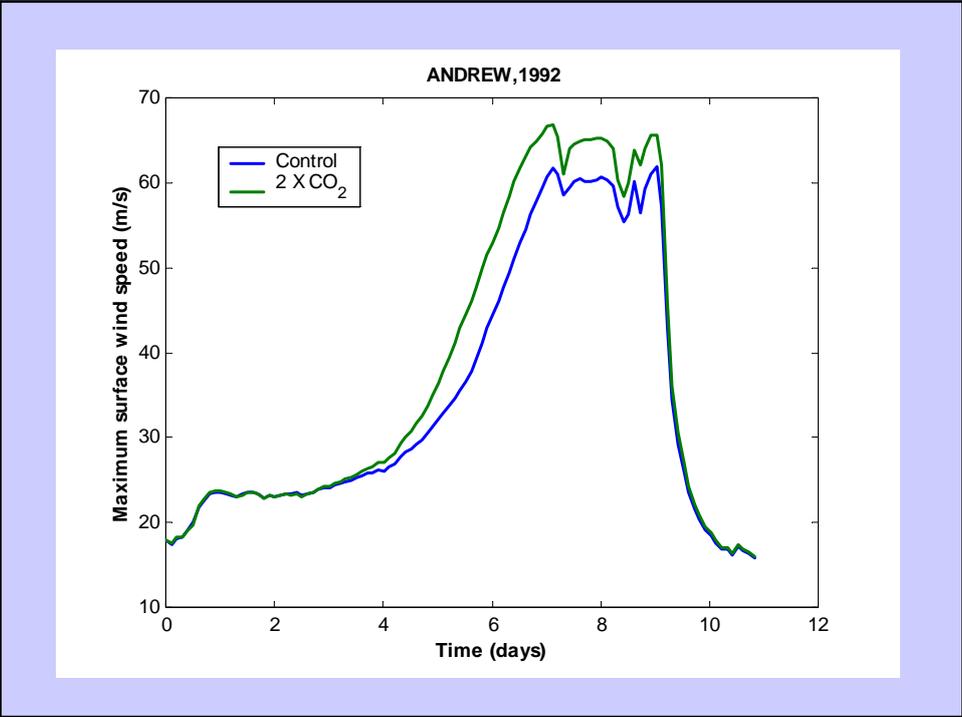
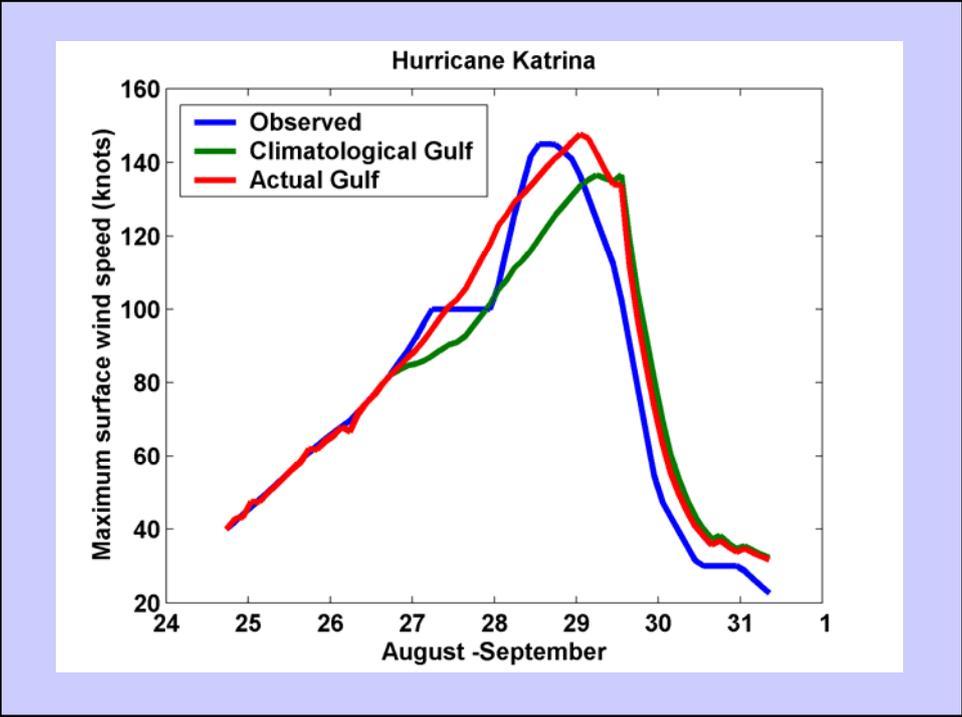
$$PDI \equiv \int_0^\tau V_{max}^3 dt$$

Atlántico

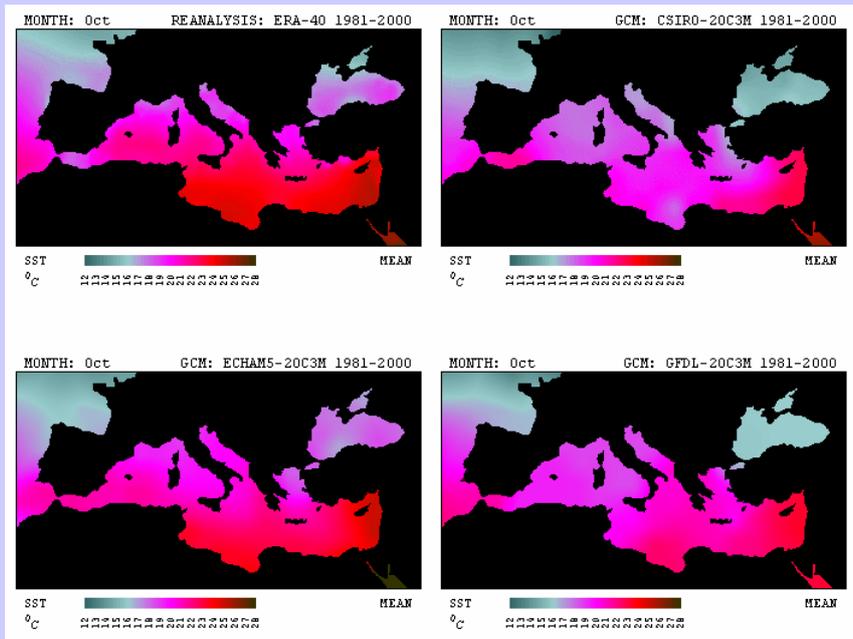
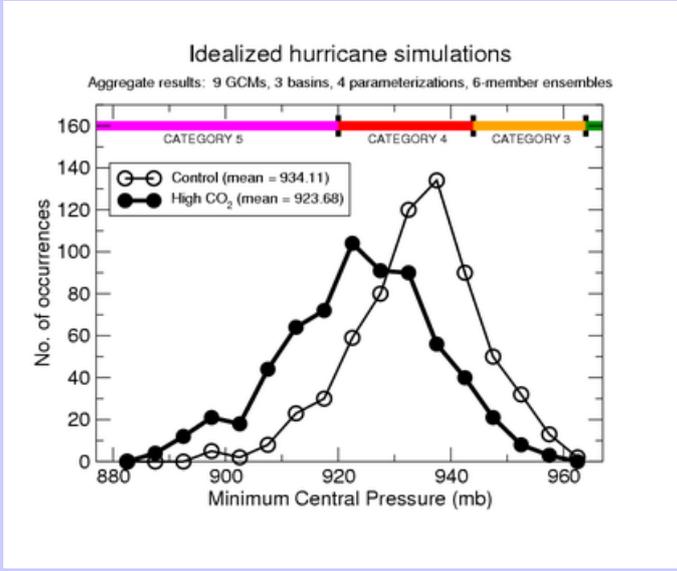


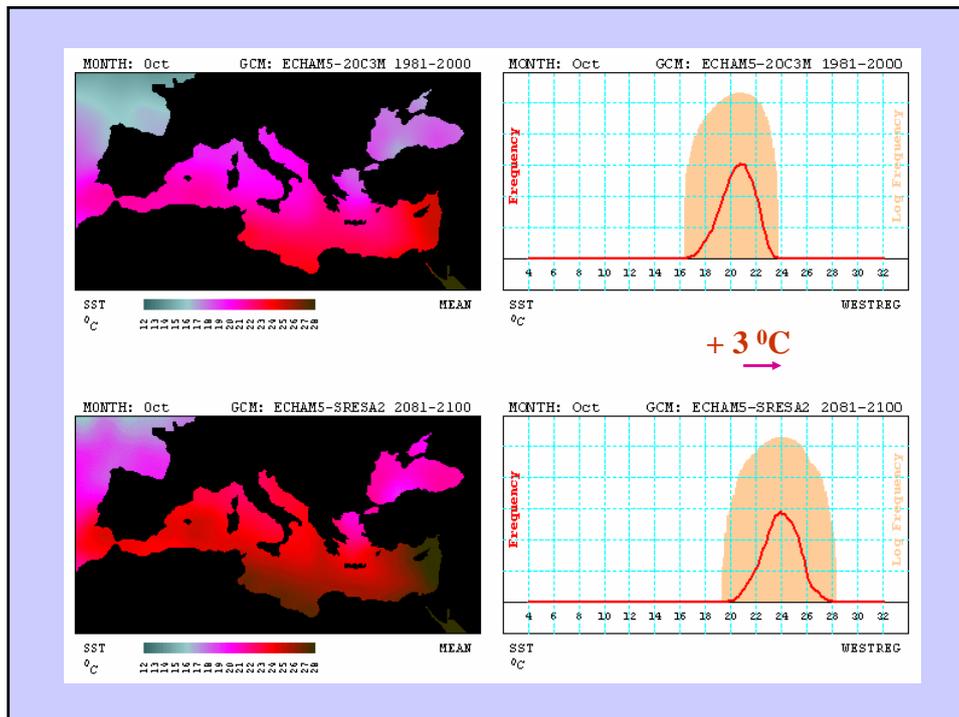
Pacífico NW





Knutson and Toleya (J. Climate, 2004)





Índice Empírico de Génesis

$$I = 10^5 \eta^{3/2} \left(\frac{H}{50} \right)^3 \left(\frac{V_{pot}}{70} \right)^3 \left(1 + 0.1 V_{shear} \right)^{-2},$$

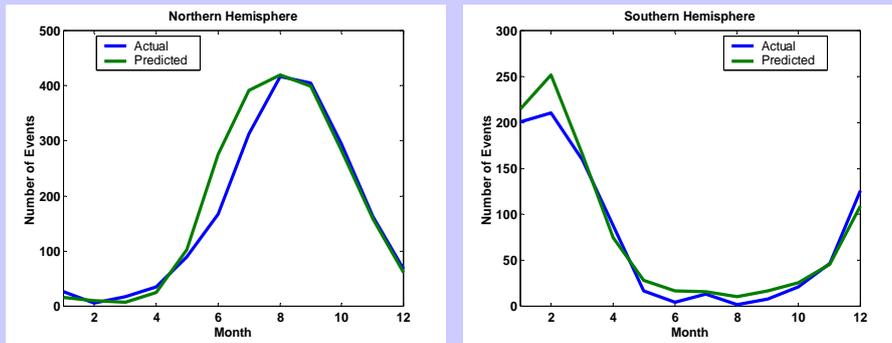
$\eta \equiv 850 \text{ hPa absolute vorticity } (s^{-1}),$

$V_{pot} \equiv \text{Potential wind speed } (ms^{-1}),$

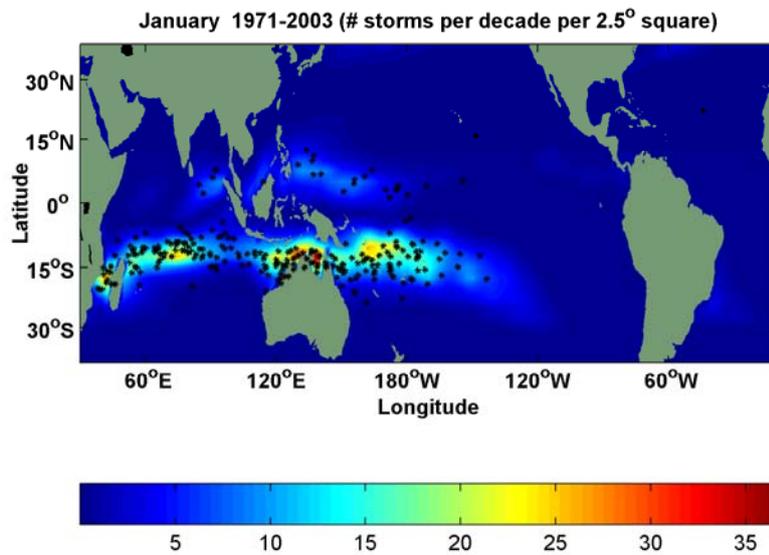
$H \equiv 600 \text{ mb relative humidity } (\%),$

$V_{shear} \equiv \left| \mathbf{V}_{850} - \mathbf{V}_{250} \right| (ms^{-1}).$

Variabilidad Estacional



Variabilidad Espacial (H.S)



Variabilidad Espacial (H.N)

August 1971-2003 (# storms per decade per 2.5° square)

