

Secondary Eyewalls

Observations and Modeling

Sergio F. Abarca

Julio 10, 2015

College Park, MD

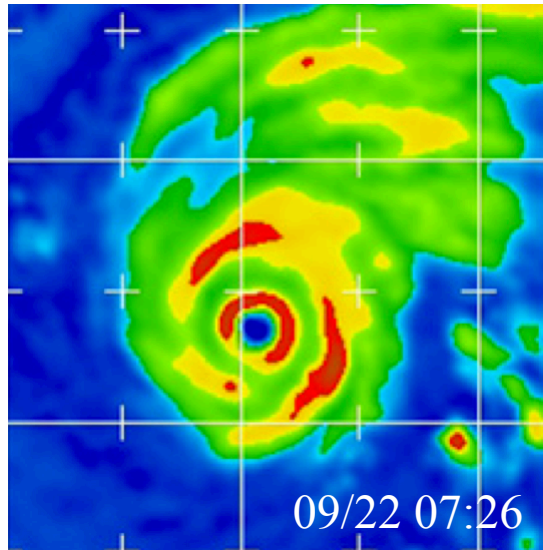
- **What are Secondary eyewall (SE)?**
- **How SEs differ from:**
 - **Secondary eyewall formation?**
 - **Eyewall replacement cycle?**
 - **Moat?**
- **Why SEs are important?**
- **How we identify them in**
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 - **Models?**
- **How to use SEs as guiding agents for:**
 - **Model evaluation?**
 - **SEs are rare in mesoscale models**
 - **Are the storm wide processes of SEF commonly occurring in HWRF?**
 - **Are the BL processes of SEF commonly occurring in HWRF?**
 - **Are HWRF SEs alike those in nature?**
 - **Edouard (2014)**
 - **Model improvement?**
 - **Tune HWRF physics (microphysics, convection, PBL) to:**
 - **Get SE**
 - **Get SEF**
- **Generate HWRF based forecasting tools for SEs**

Keqin Wu

Federico Di Catarina
Weiguo Wang
Hyun-Sook Kim

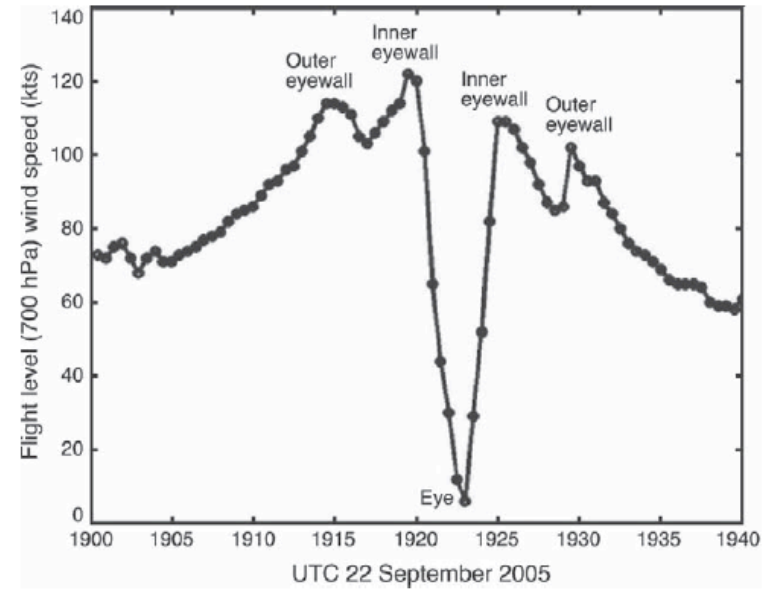
Lin Zhu

What is a Secondary Eyewall (SE)?



Brightness temperature, from
Aqua/AMSR-E (at 89 GHz)

Rita (2005)



Houze et al. (2006)

Secondary eyewall:

A structure approximately concentric to the primary eyewall characterized by a maxima in:

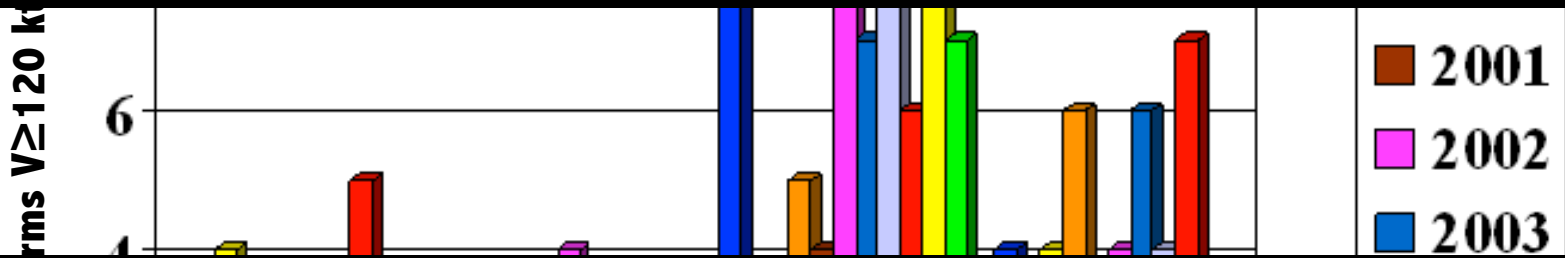
- Convective activity
- Tangential winds

Different from
Secondary eyewall formation
Eyewall replacement cycle
Moat

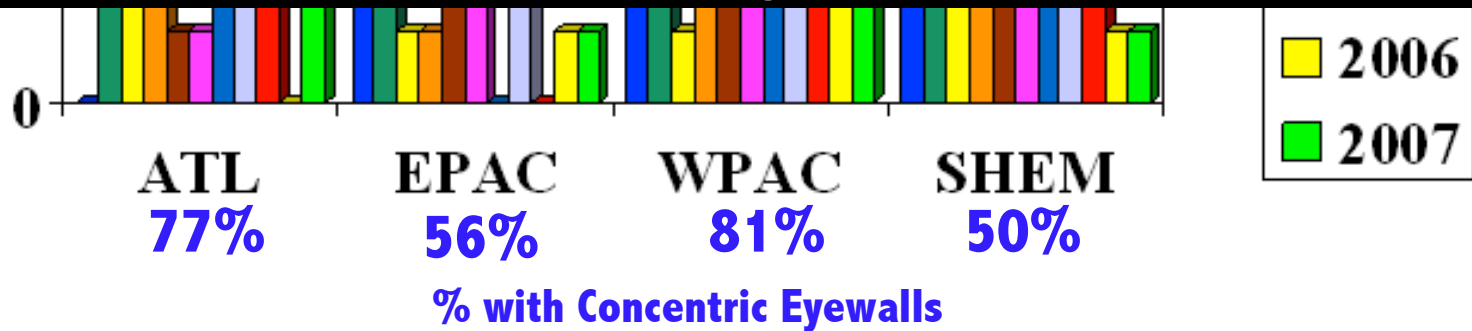
SEs are a common feature of intense storms

Not in mesoscale simulations!

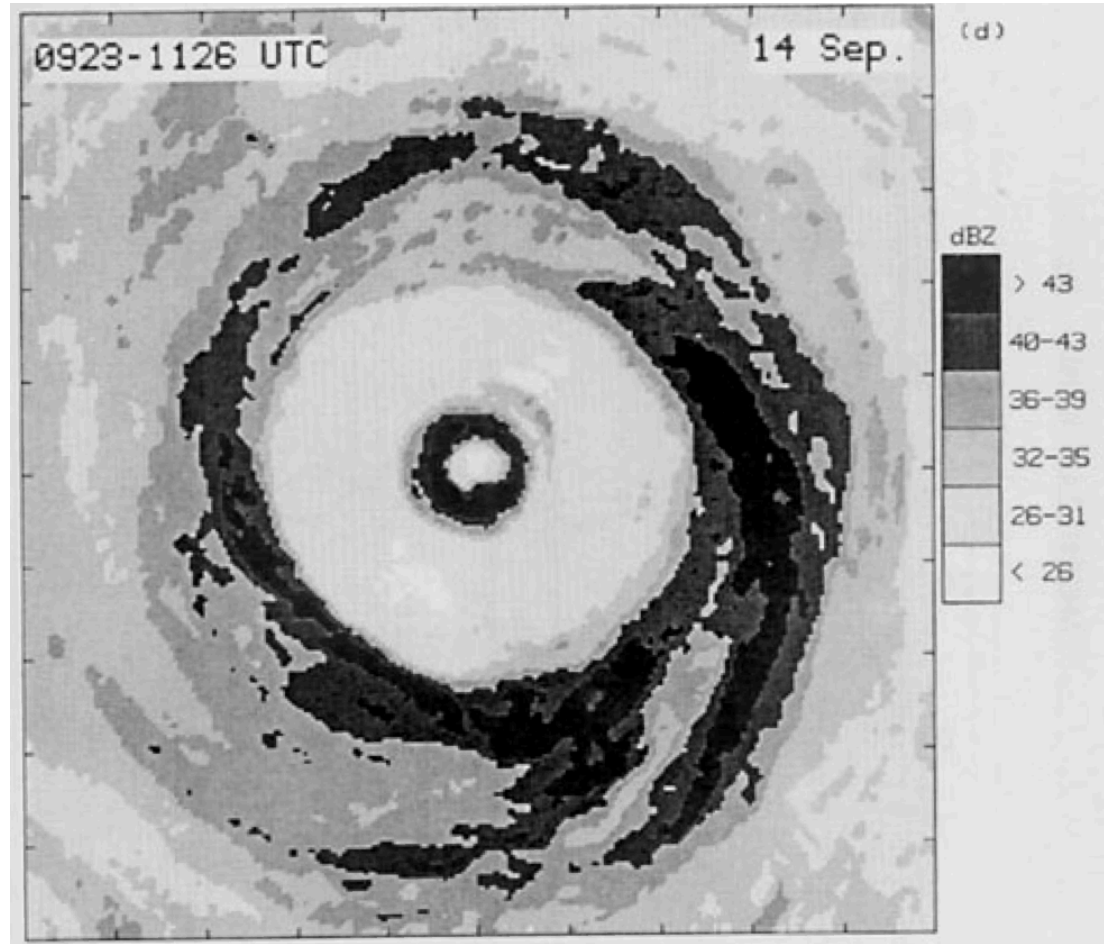
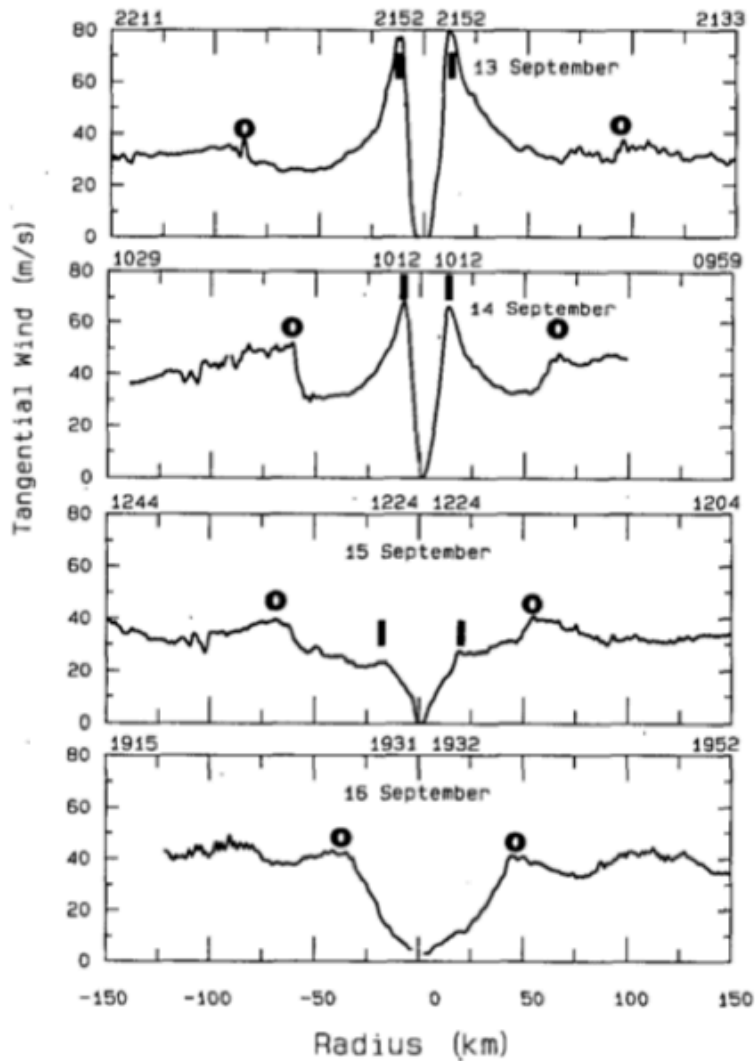
~6% in AHW



Why?

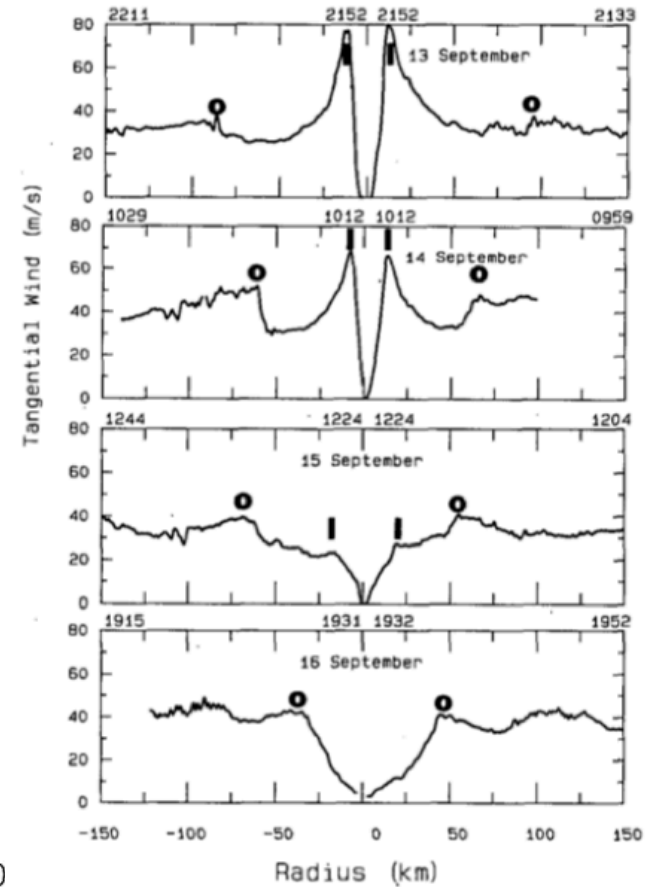
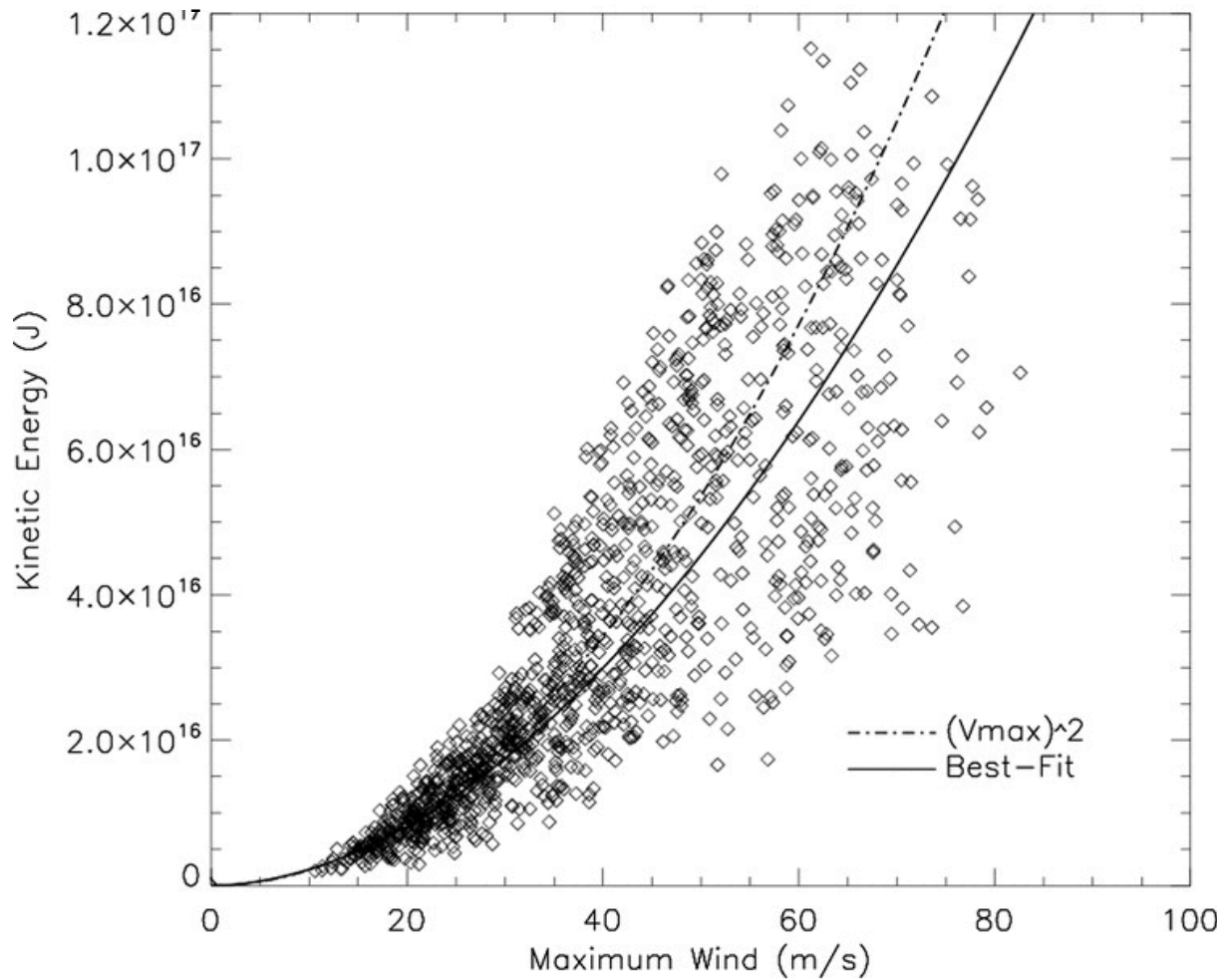


Gilbert (1988)



Eyewall Replacement Cycle (ERC)

Black and Willoughby (1992)



Black and Willoughby (1992)

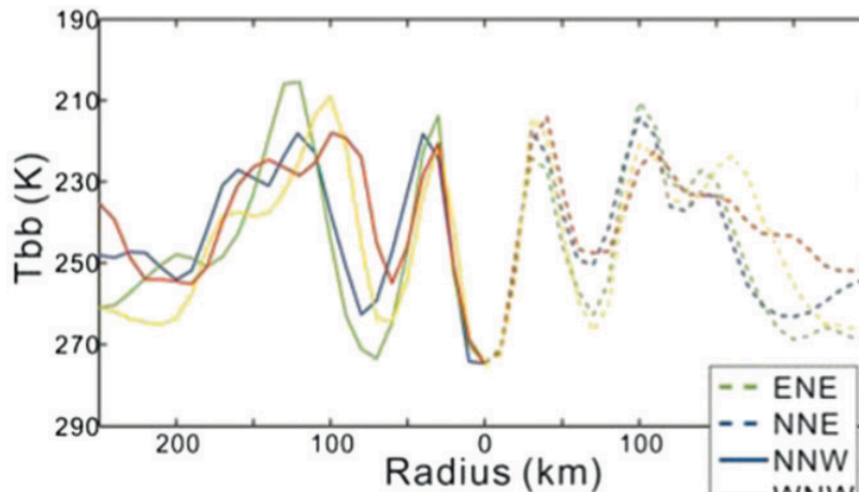
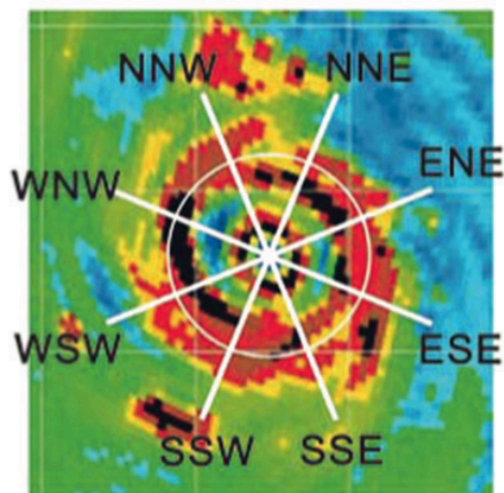
r=0-200 km

1244 wind field analyses

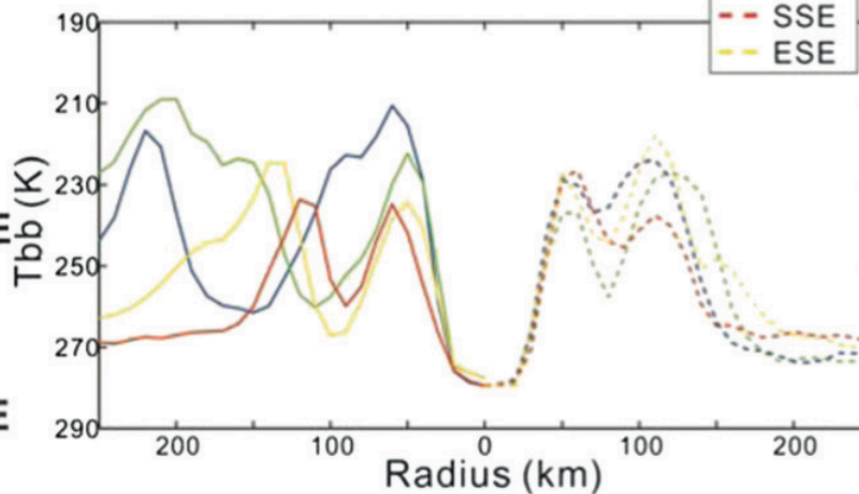
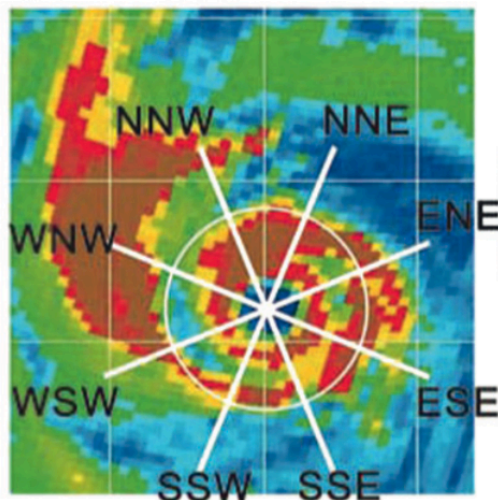
Secondary eyewall formation (SEF) is one of the main processes of storm growth

How we identify SEs in Observations?

(a) 1997 02C Oliwa
0912-0051Z

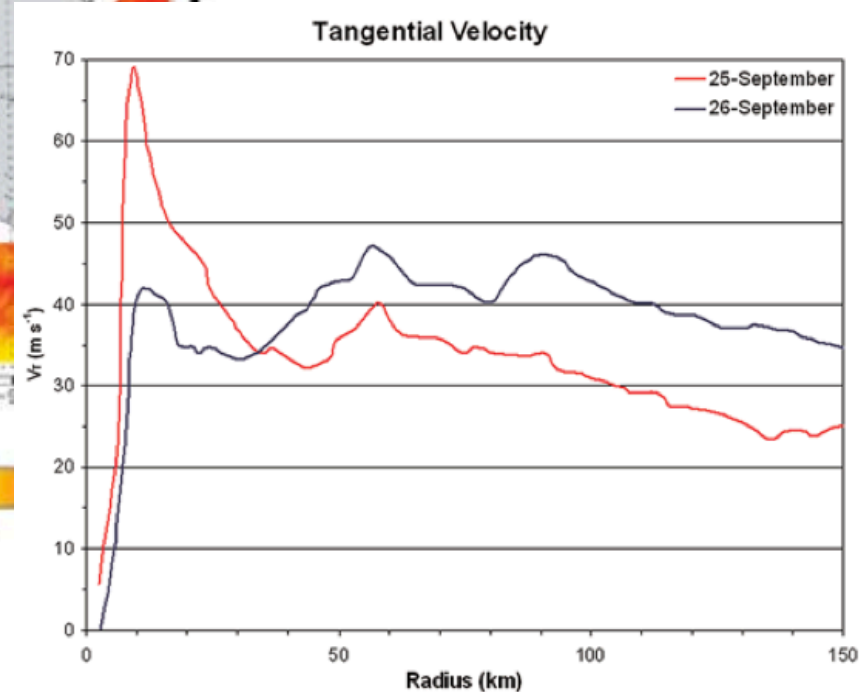
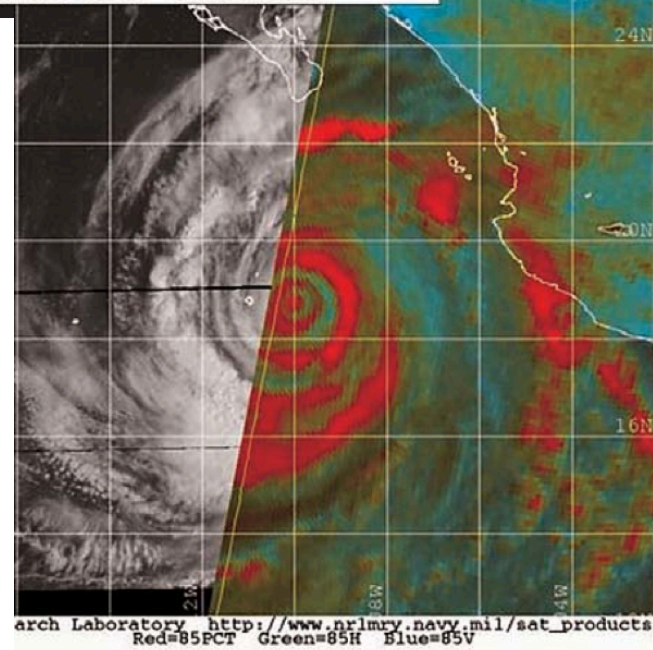
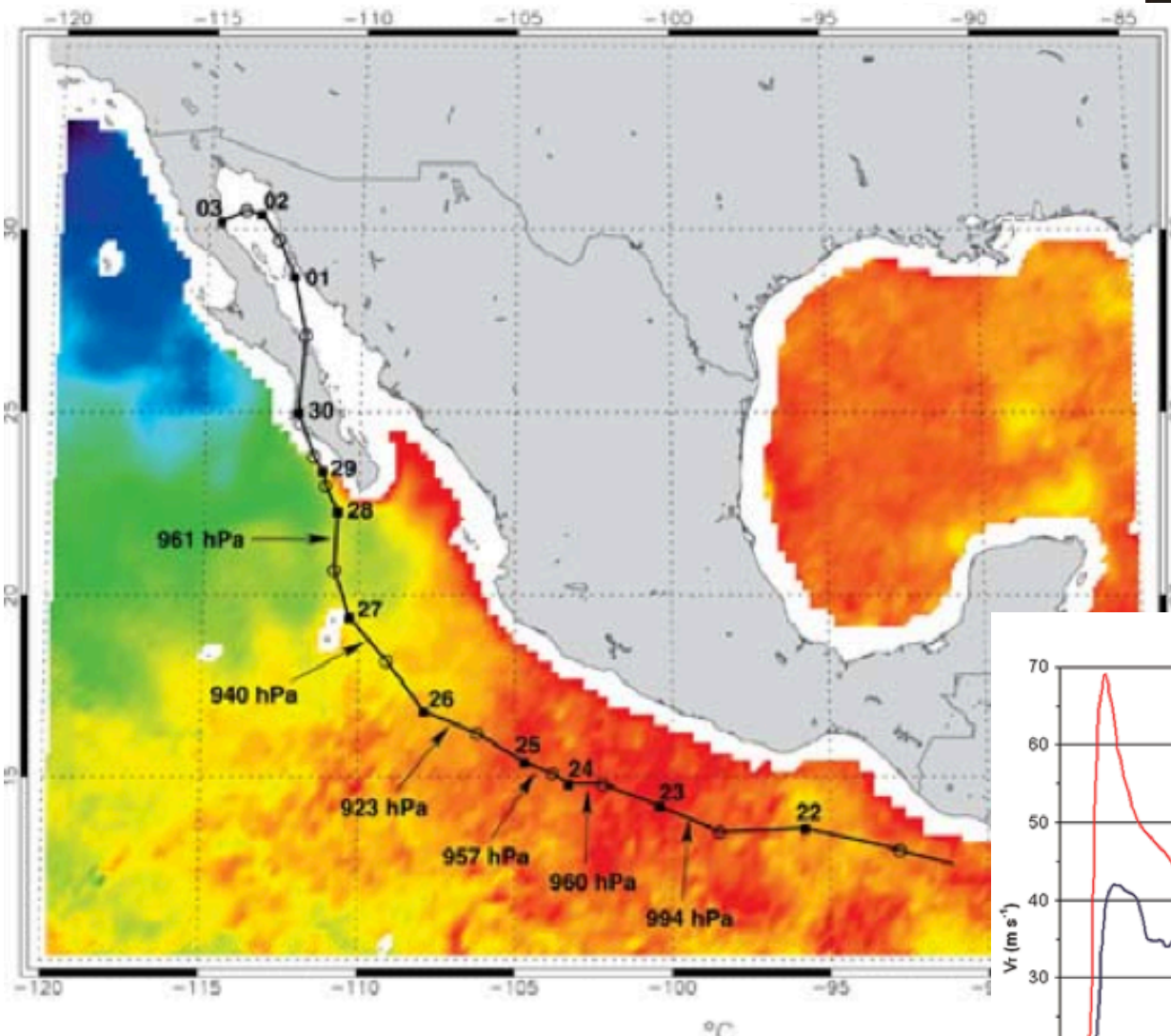


(b) 2009 11W Vamco
0824-2000Z



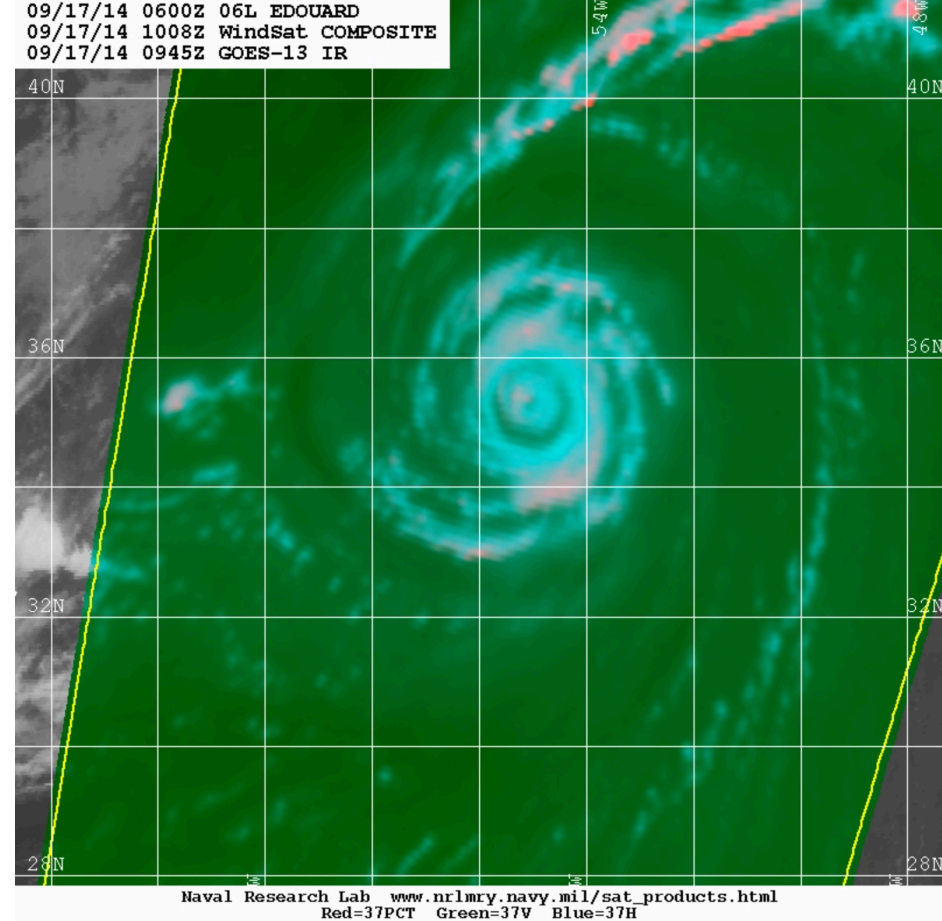
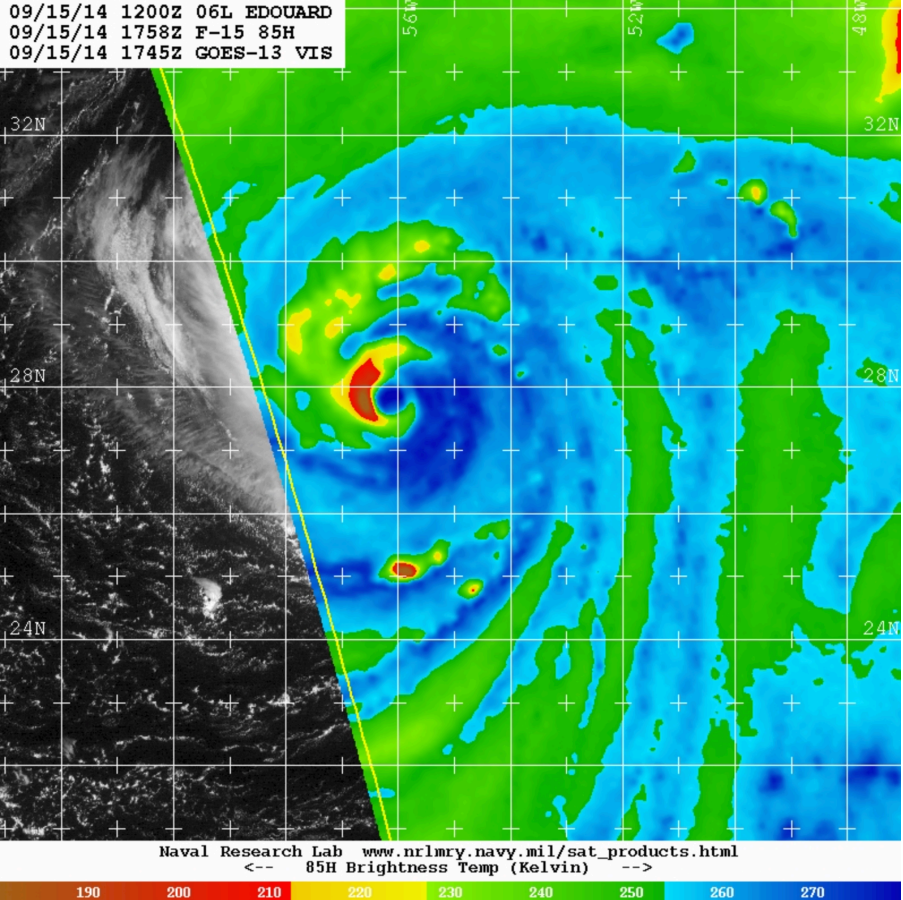
Juliette (2001)

Research Laboratory http://www.nrlmry.navy.mil/sat_products
 09/26/01 1800Z 11E JULIETTE
 09/26/01 1638Z SSMI F-15 COMPOSITE
 09/26/01 1615Z GOES-10 VIS



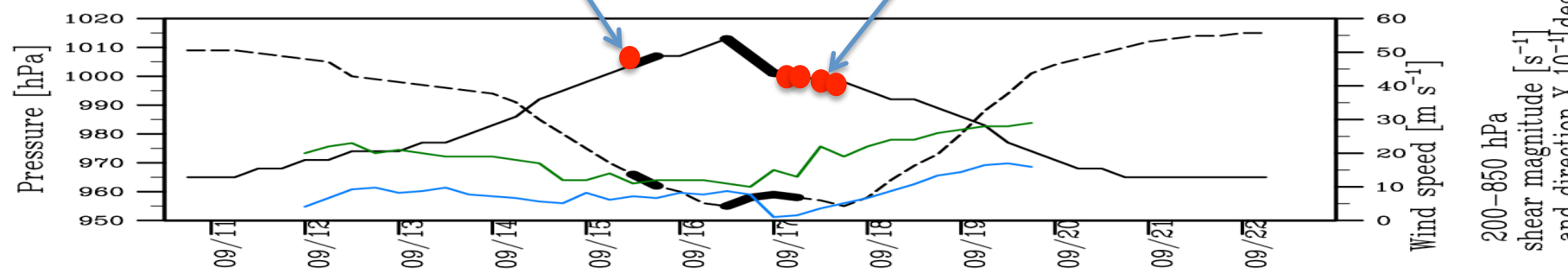
Tertiary eyewalls!

McNoldy (2004), Abarca et al. (2015)



0915, 1758UTC

0917, 1008UTC

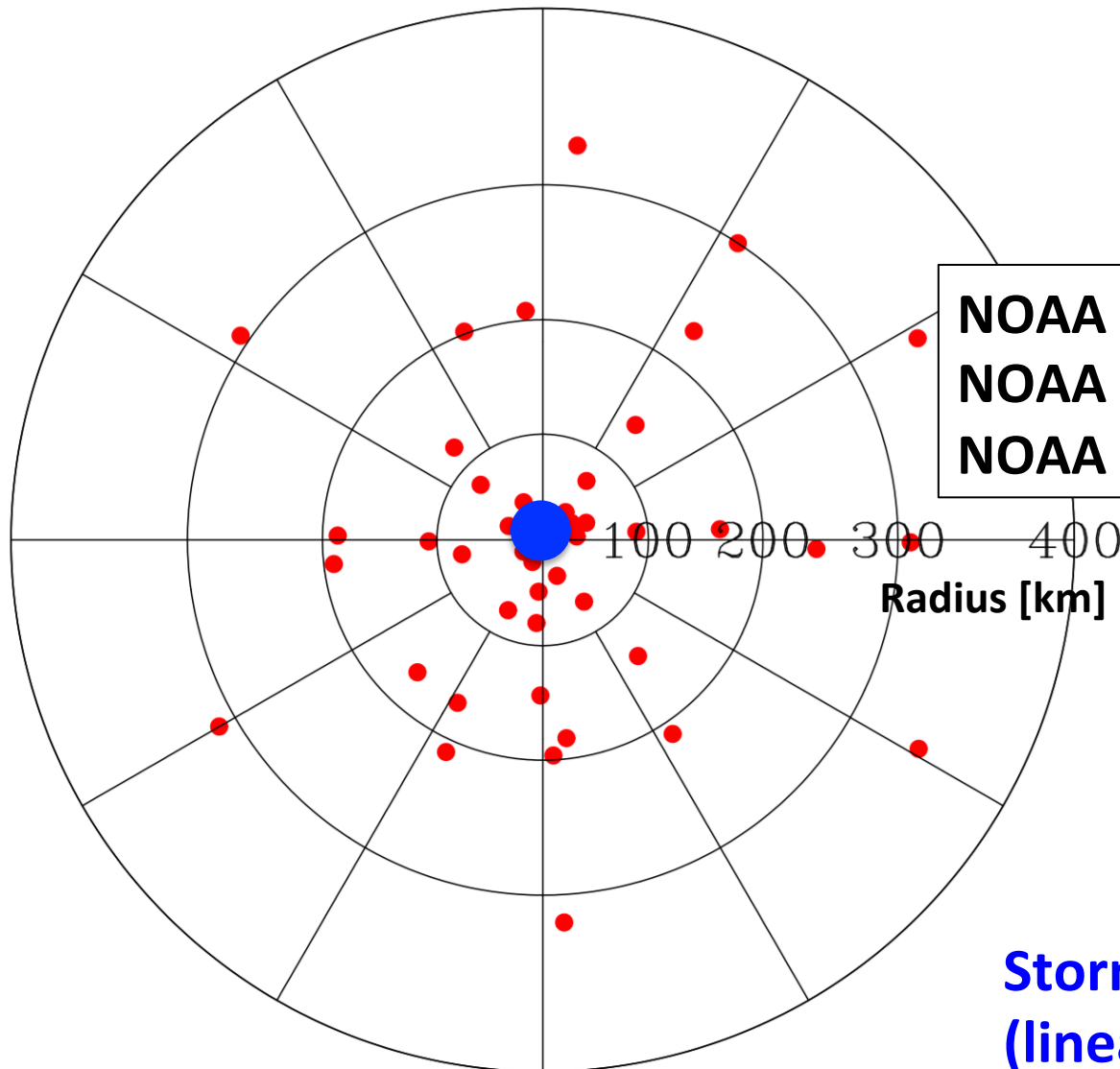


Secondary eyewall formation

9/15 4:13-19:20 UTC

~5 hours

49 dropsondes



NOAA P-3 Orion -5-12 kf, 19 drops
NOAA P-3 Orion- 5-12 kf, 14 drops
NOAA G-IV Jet- 45 kf feet, 16 drops

Storm center from Best tracks
(linear interpolation to 10 min)

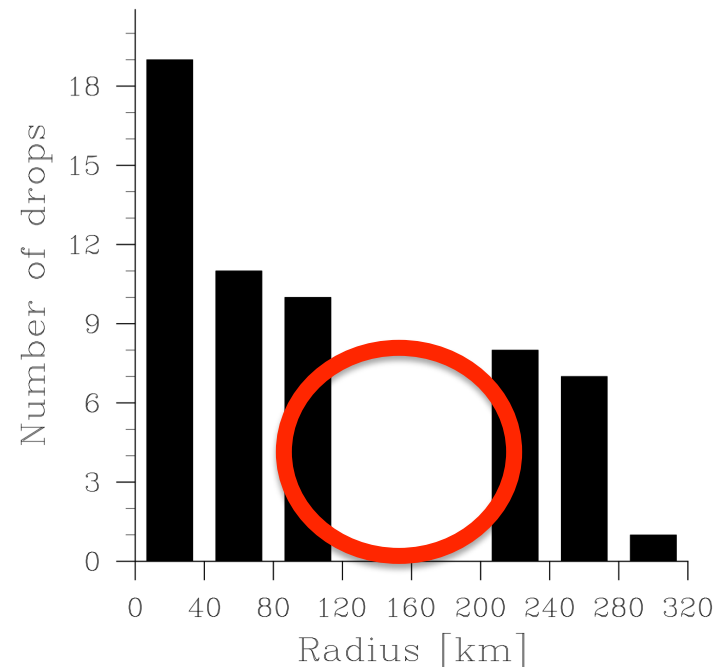
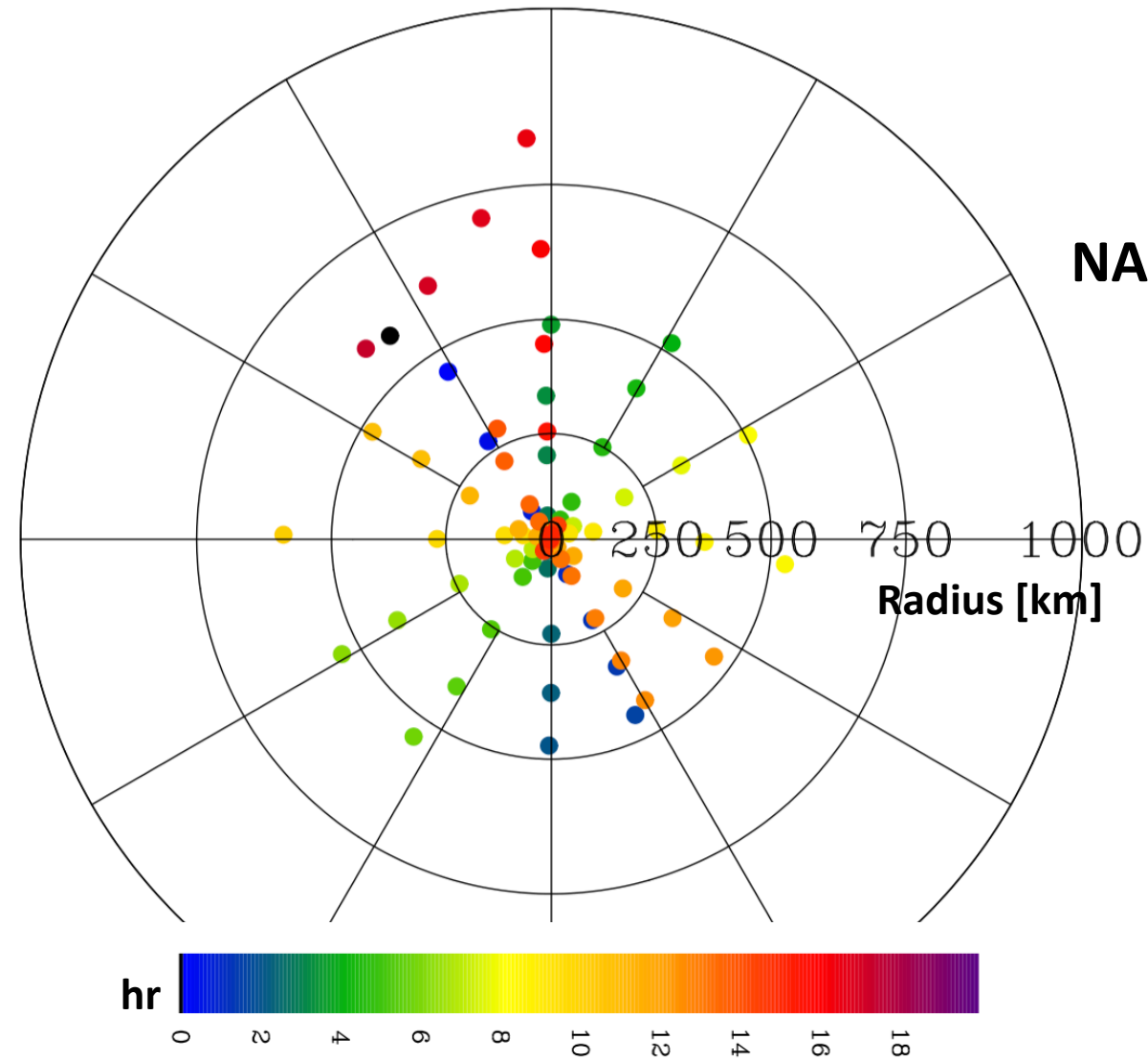
Decaying double-eyewalled storm

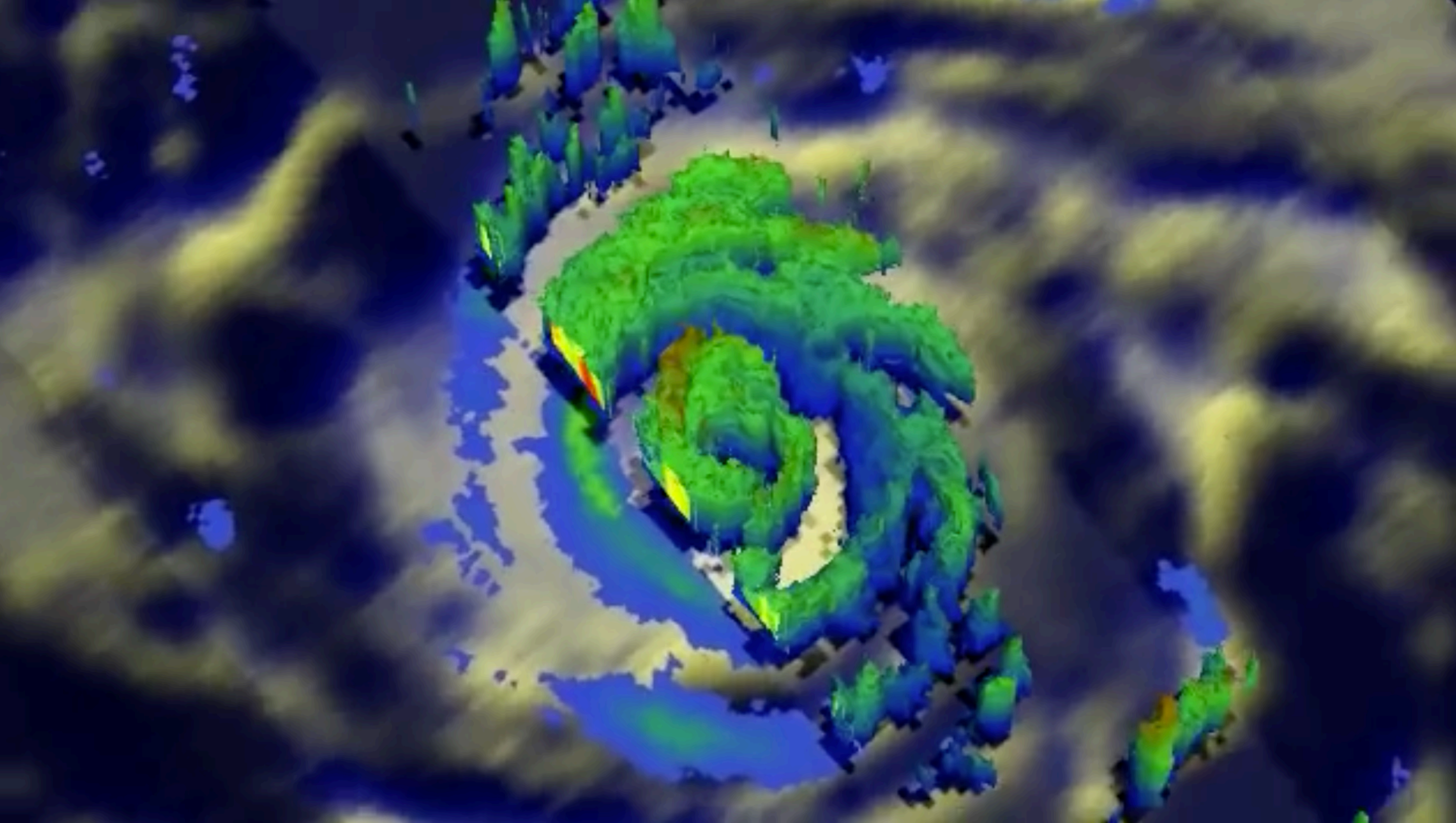
9/16 15:06 UTC – 9/17 08:28 UTC

~18 hours

87 dropsondes

NASA Global Hawk– 55k feet





Sept 17 03:39 UTC, TRMM

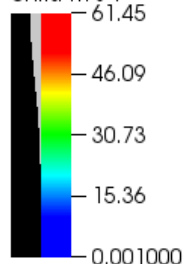
<https://www.youtube.com/watch?v=KXOvVWzMREQ>

“...outer eyewall forming around Edouard's original eyewall”

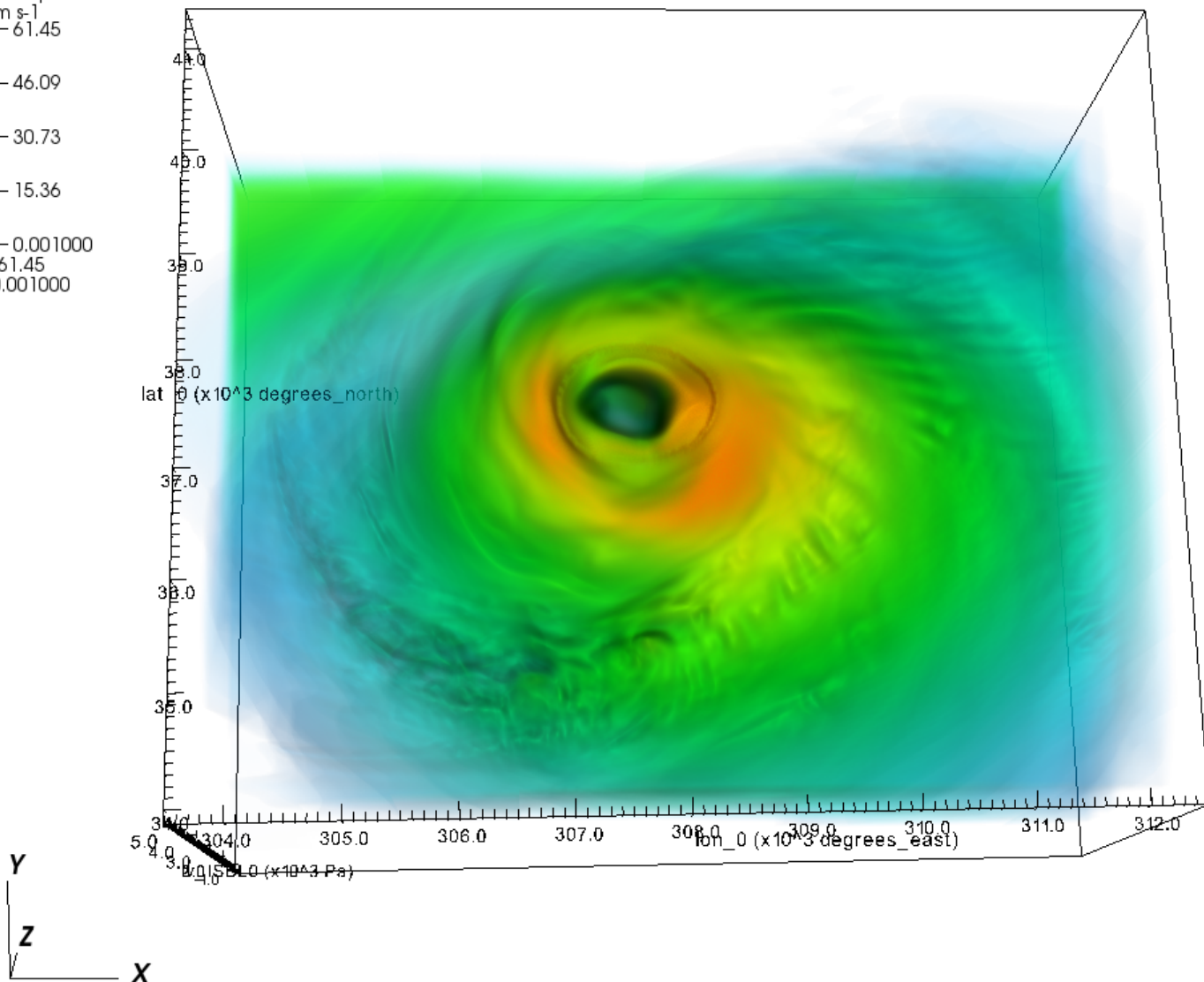
DB: edouard06l.2014091706.hwrfrprs_nf012.nc

Cycle: 0

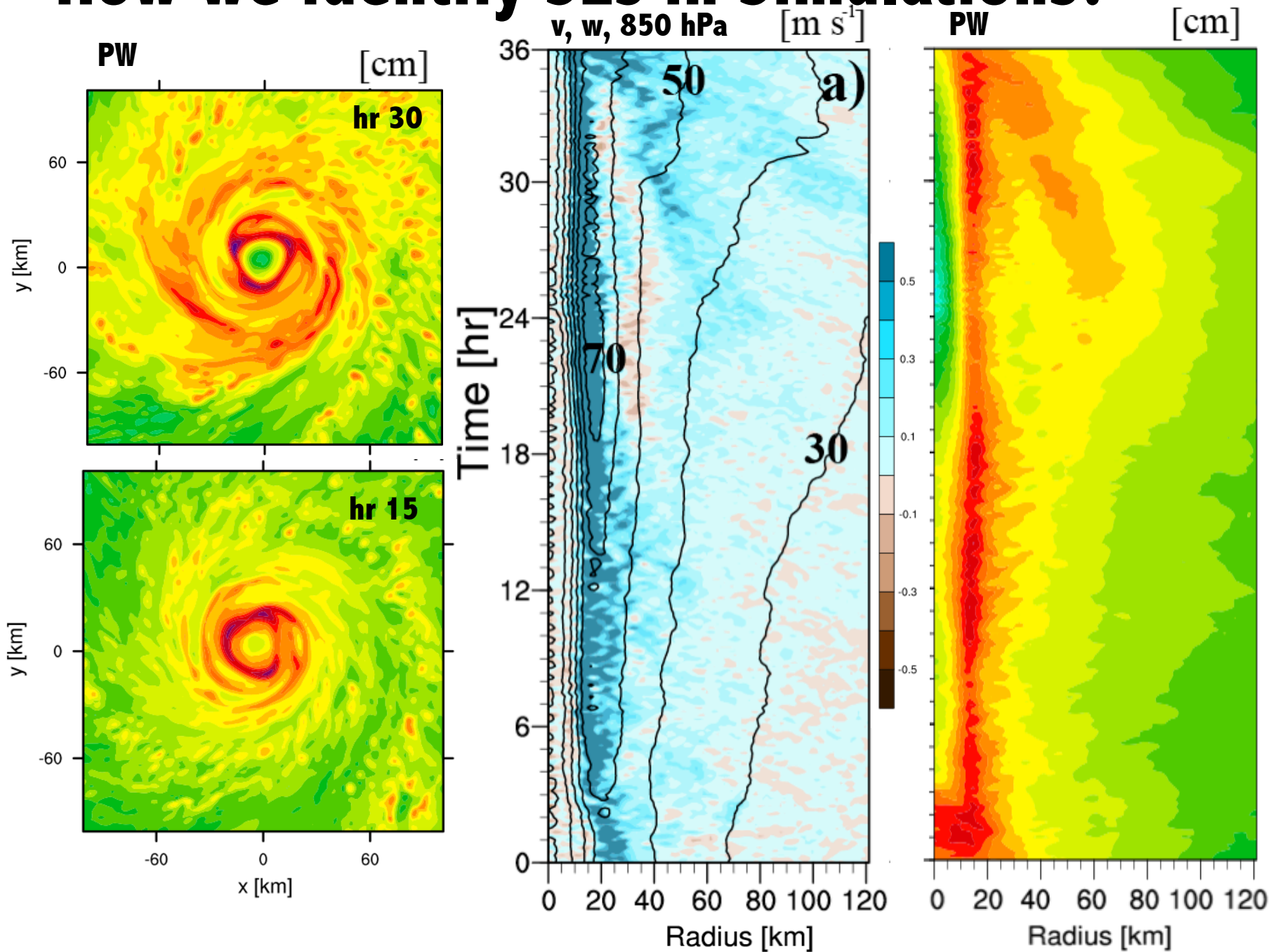
Volume
Var: windSpeed
Units: m s⁻¹

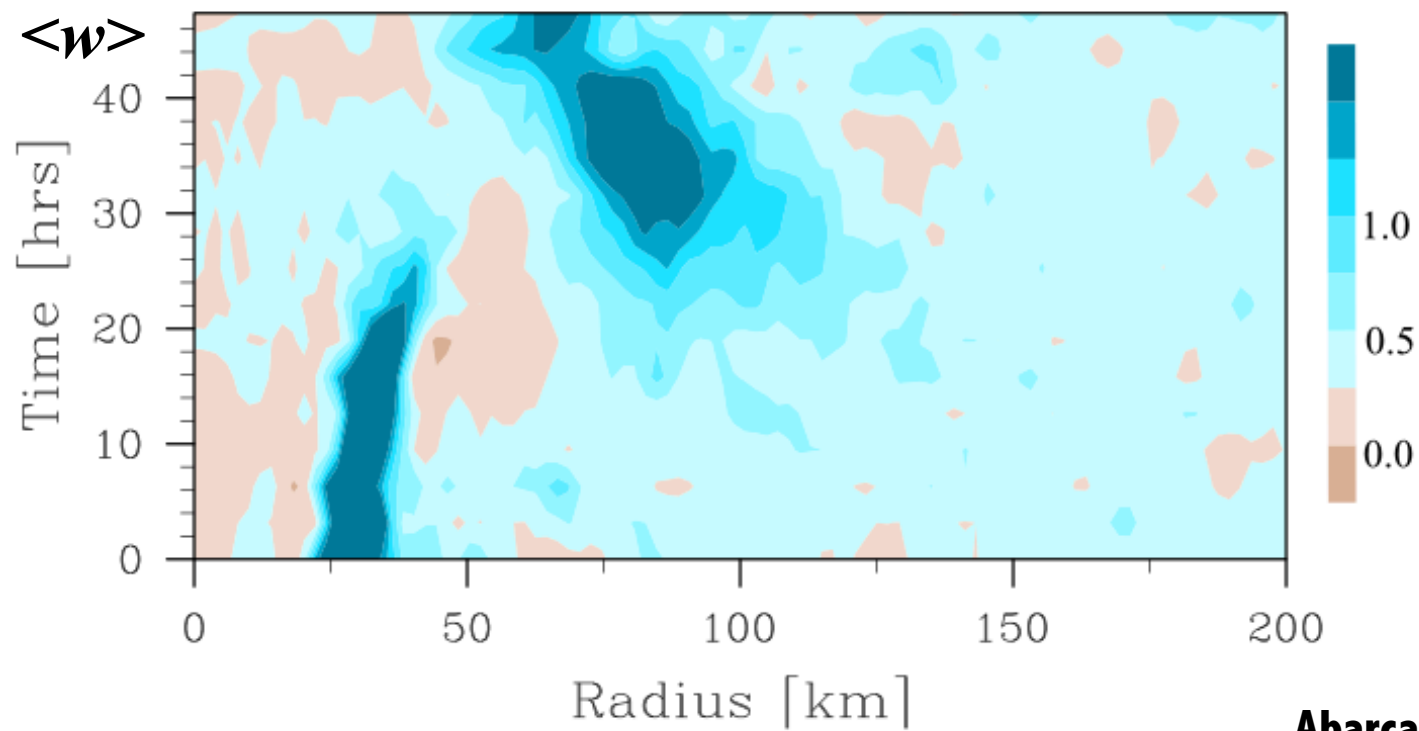
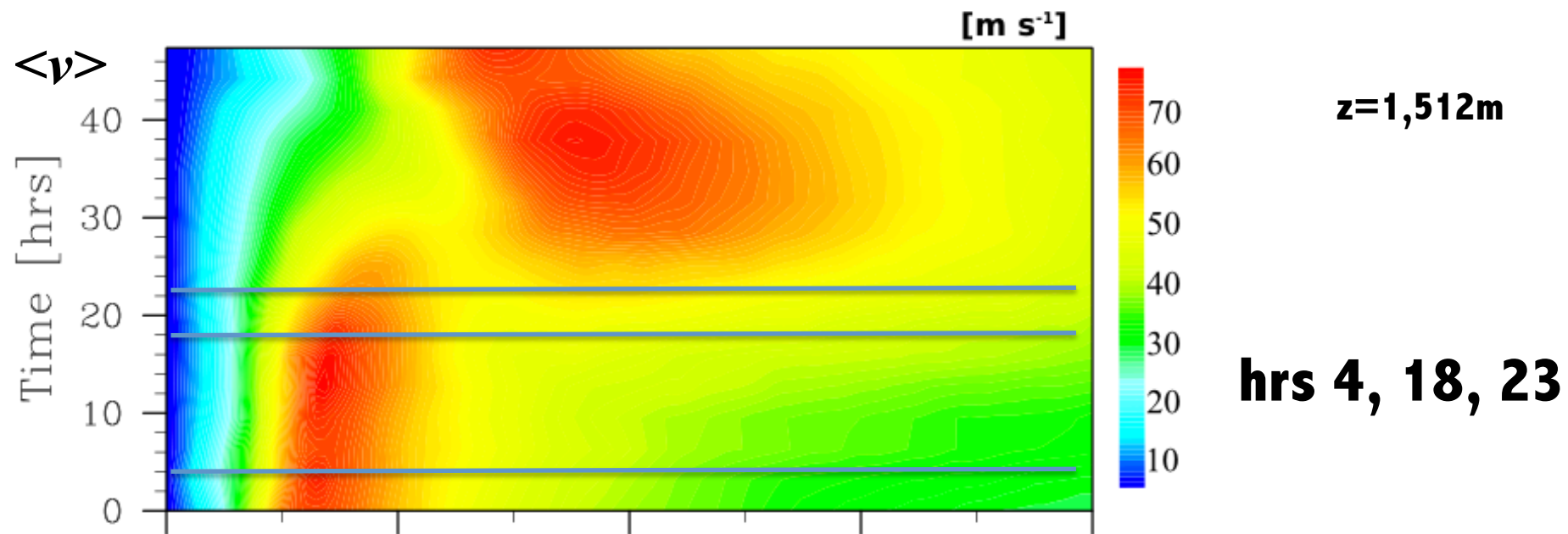


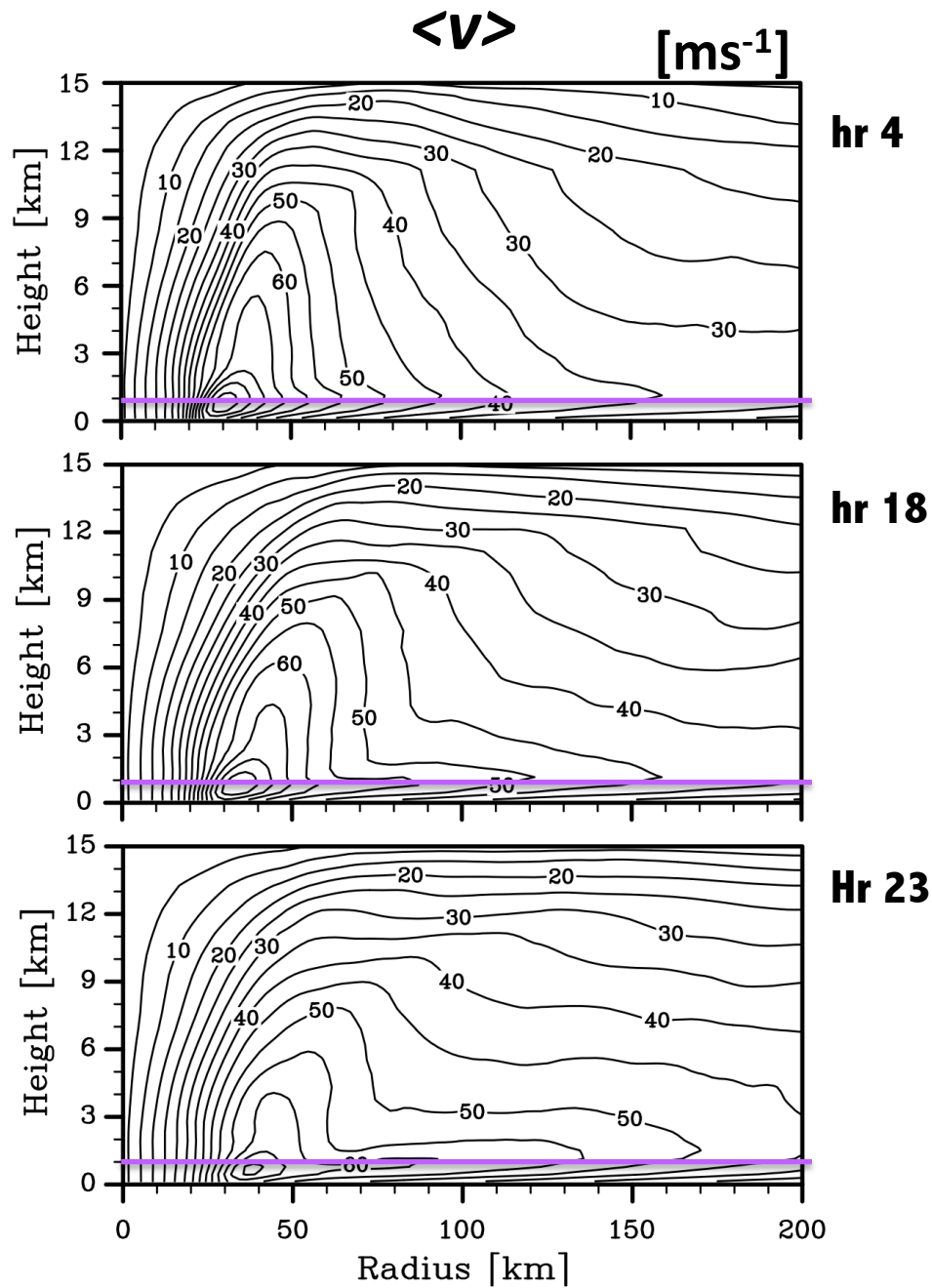
Max: 61.45
Min: 0.001000



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