Atlantic basin TC scenarios

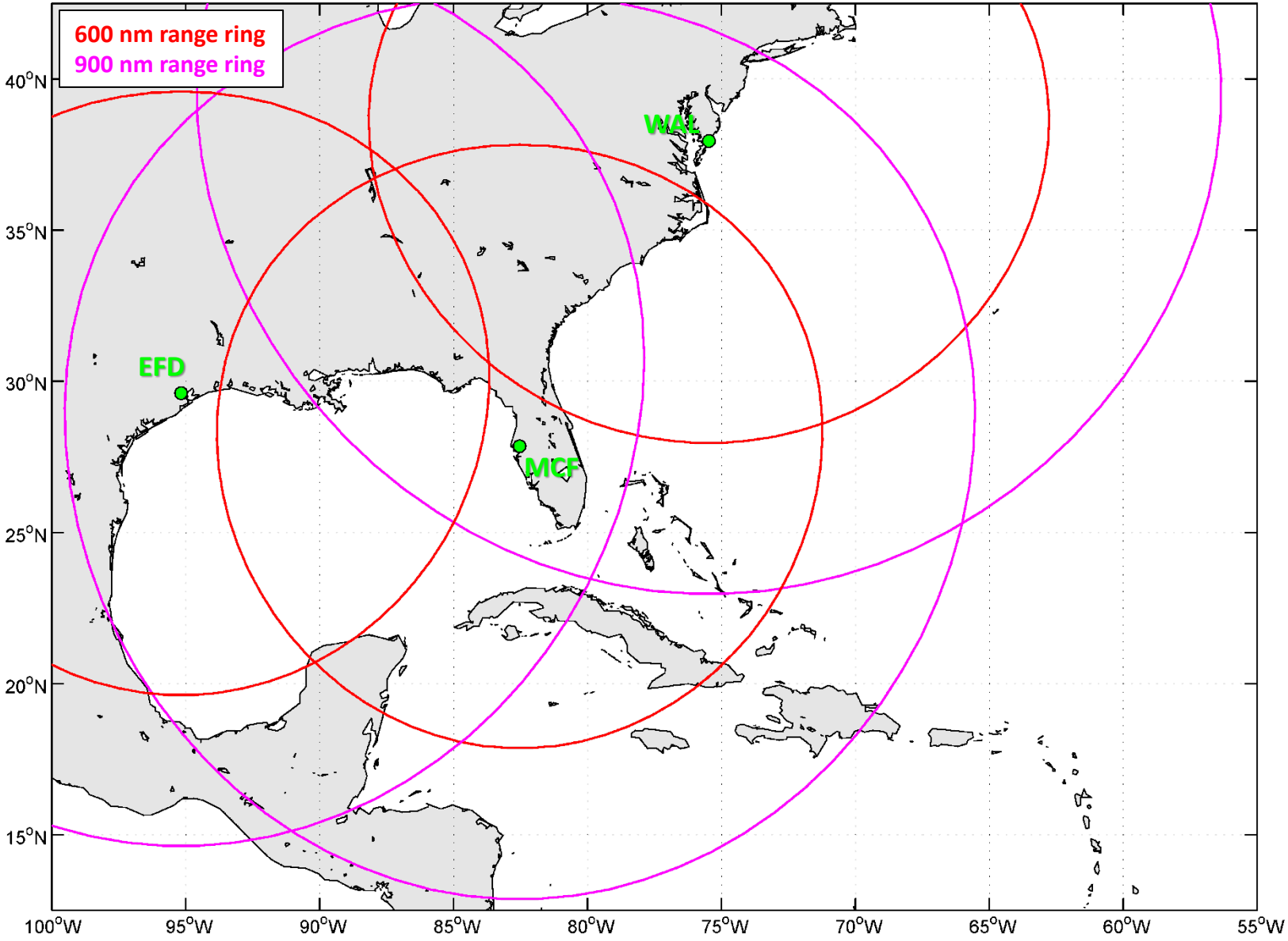
- Here, we use historical TCs (2007-2014) to examine 6 prototypical scenarios for which a WB-57 flight from Elllington (EFD), MacDill (MCF), or Wallops (WAL) would feasibly reach a feature of potential interest.

- This exercise utilizes observations and model analyses, but we should keep in mind that we will be using imperfect forecast information to make decisions in the field

- Things to think about

  - Is the TC worth flying or not? Potential science benefits vs. practicalities
  - Aircraft deployment strategy: Stay at EFD? Forward deploy?
  - What specific aspect(s) of the TC and its outflow should we sample?

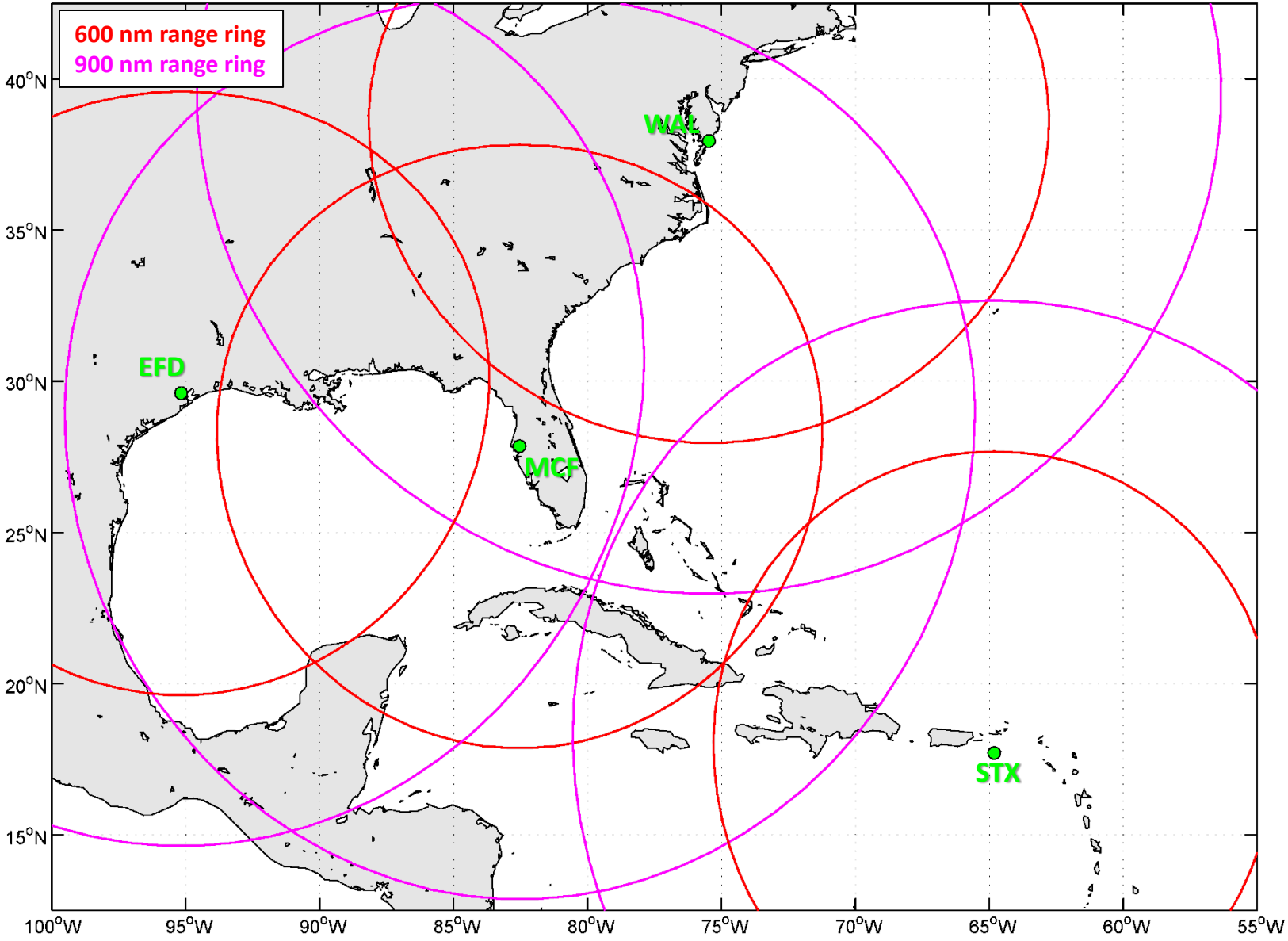
600 and 900 nm range rings



600 nm: A couple hours on-station time at feature of interest

900 nm: Out-and-back to feature of interest

600 and 900 nm range rings



600 nm: A couple hours on-station time at feature of interest

900 nm: Out-and-back to feature of interest

Scenario #1: TC enters Gulf of Mexico after passing through Bahamas or NW Caribbean region

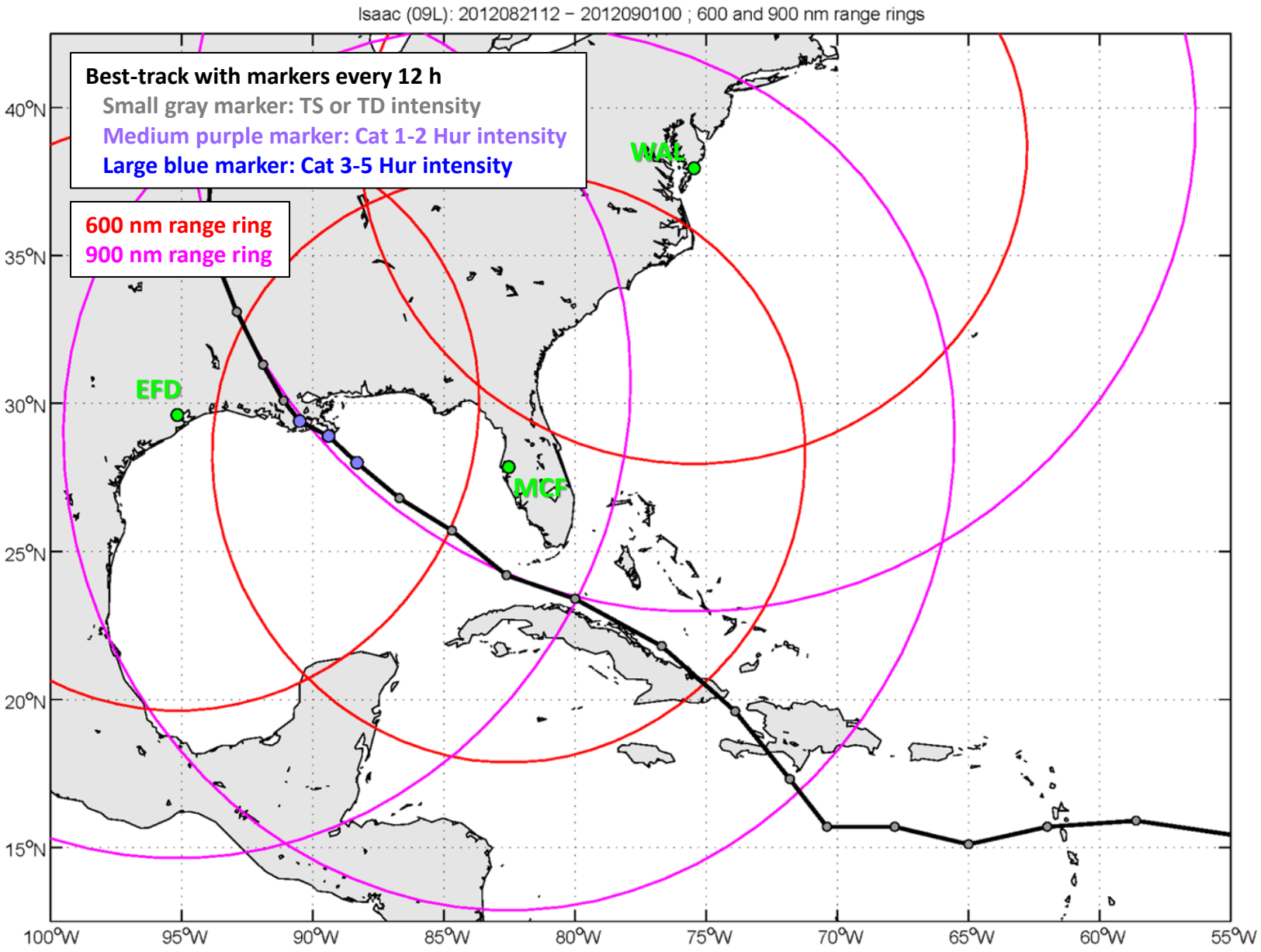
Case Study:

- Isaac (09L, 2012)

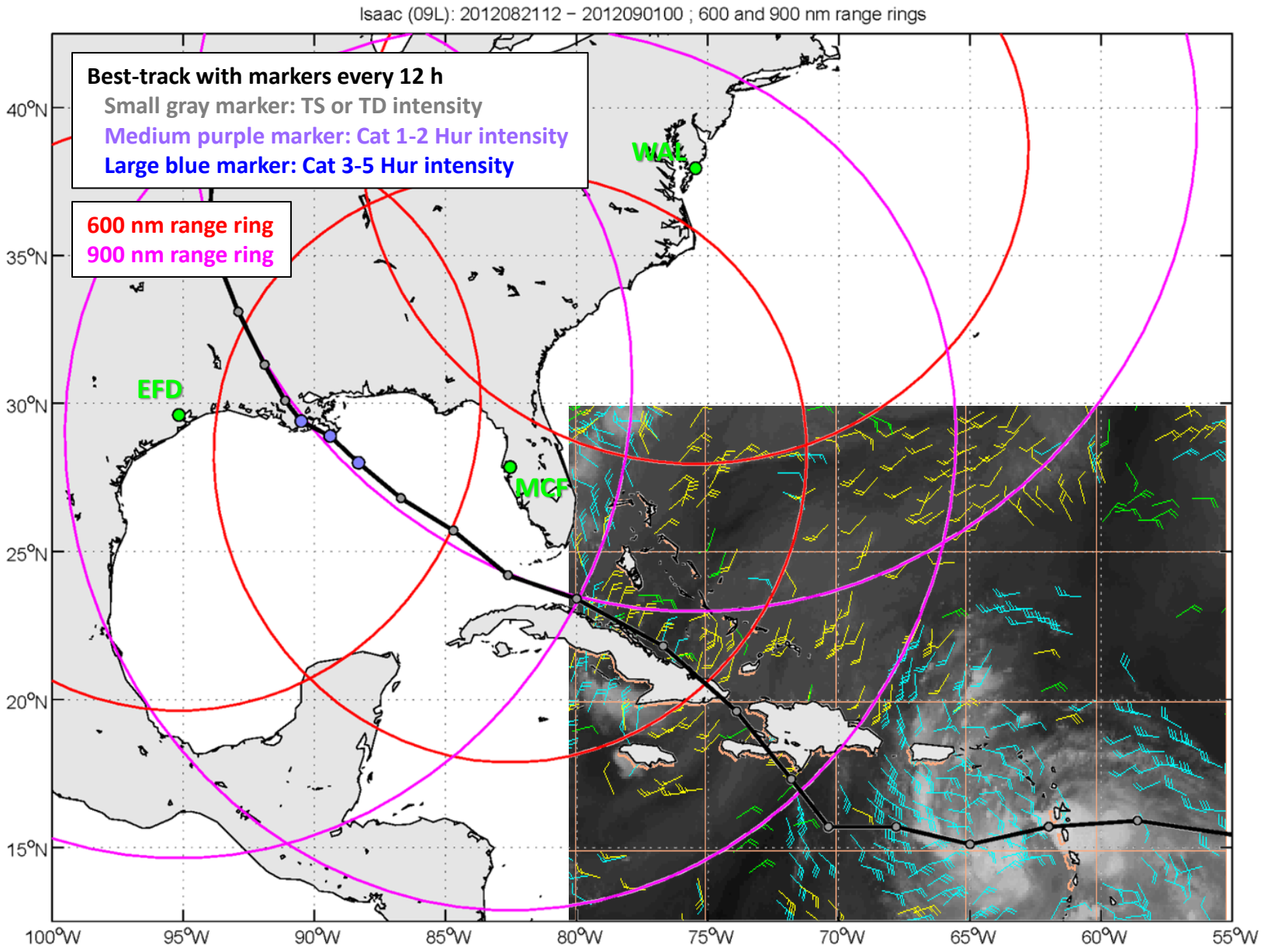
Other examples:

- Ida (11L, 2009)
- Dolly (04L, 2008)
- Gustav (07L, 2008)
- Ike* (09L, 2008)

* AMV/range ring plots available, but not included in presentation



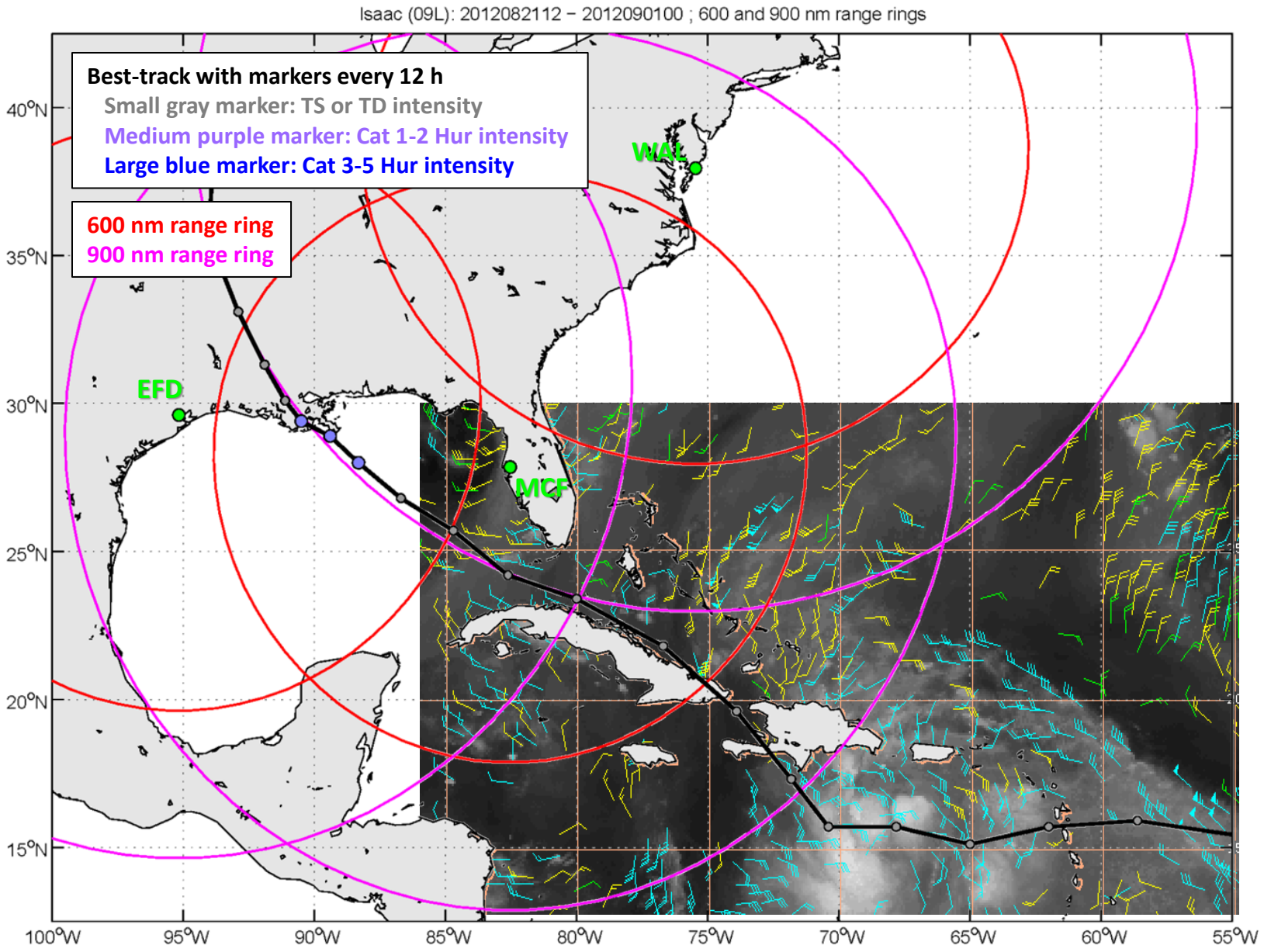
Isaac (09L): 2012082112-2012090100



Isaac (09L): 2012082112-2012090100

CIMSS Upper-level AMVs: 2012082300

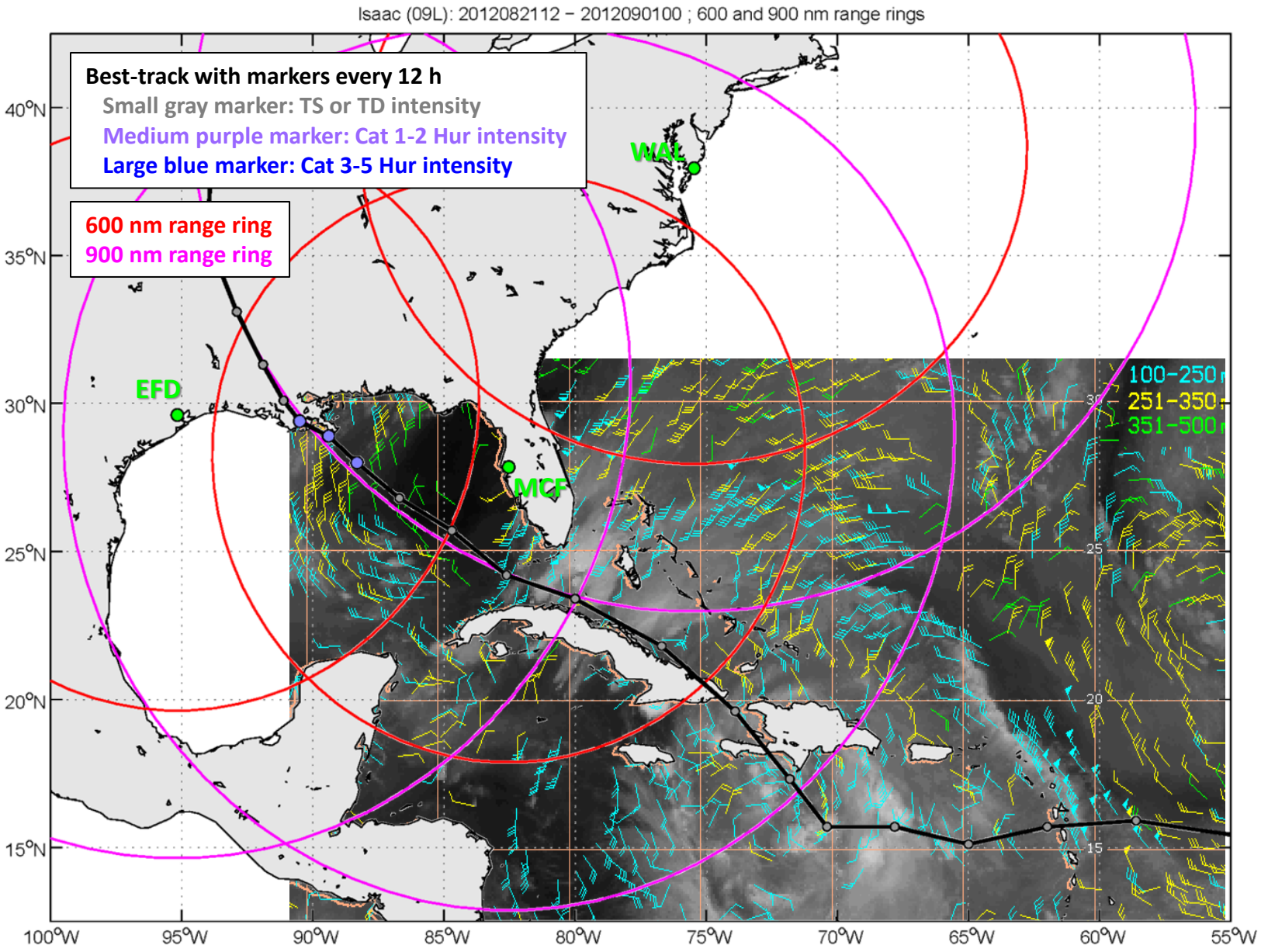
100-250 mb 251-350 mb 351-500 mb



Isaac (09L): 2012082112-2012090100

CIMSS Upper-level AMVs: 2012082400

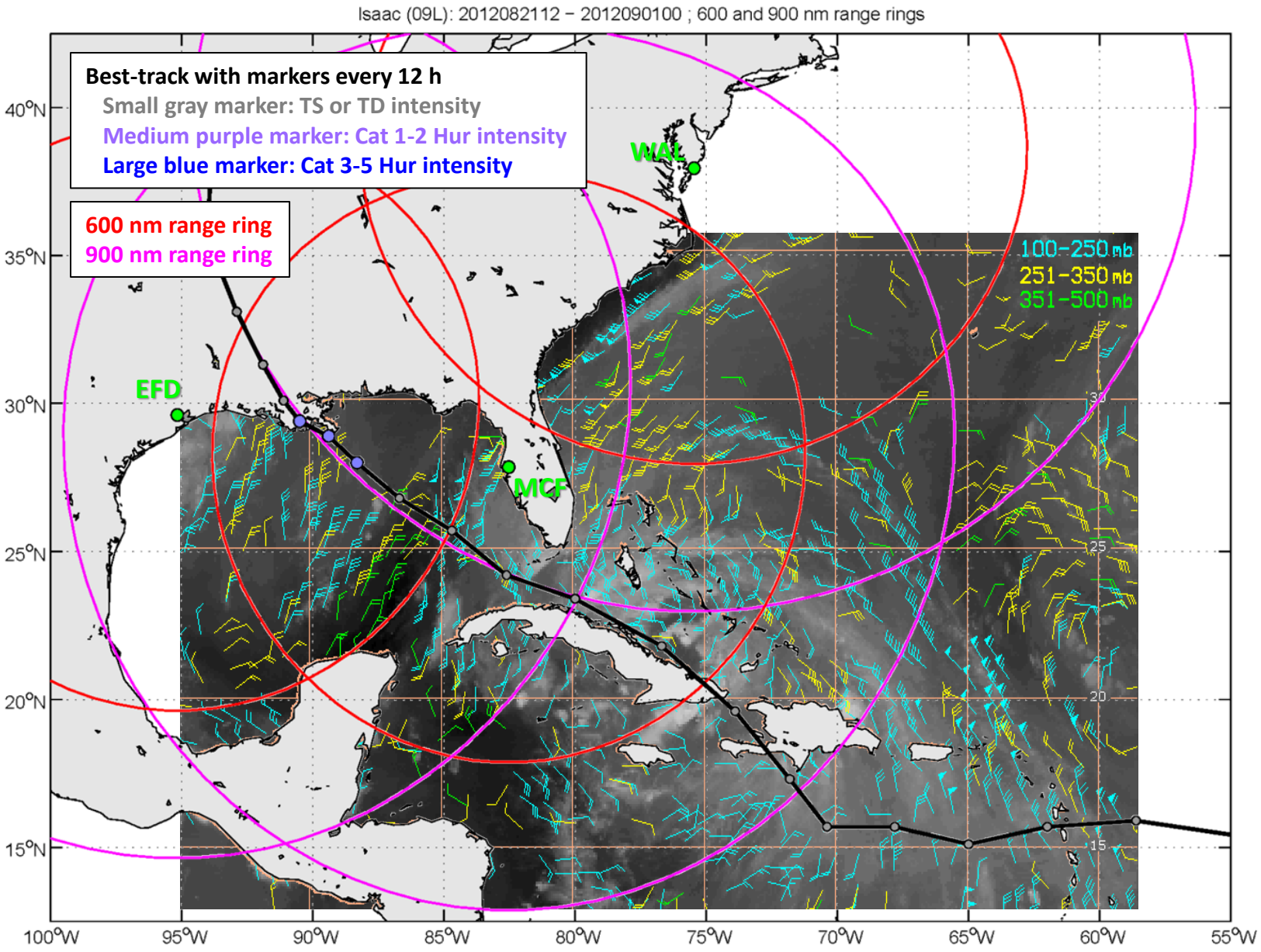
100-250 mb 251-350 mb 351-500 mb



Isaac (09L): 2012082112-2012090100

CIMSS Upper-level AMVs: 2012082500

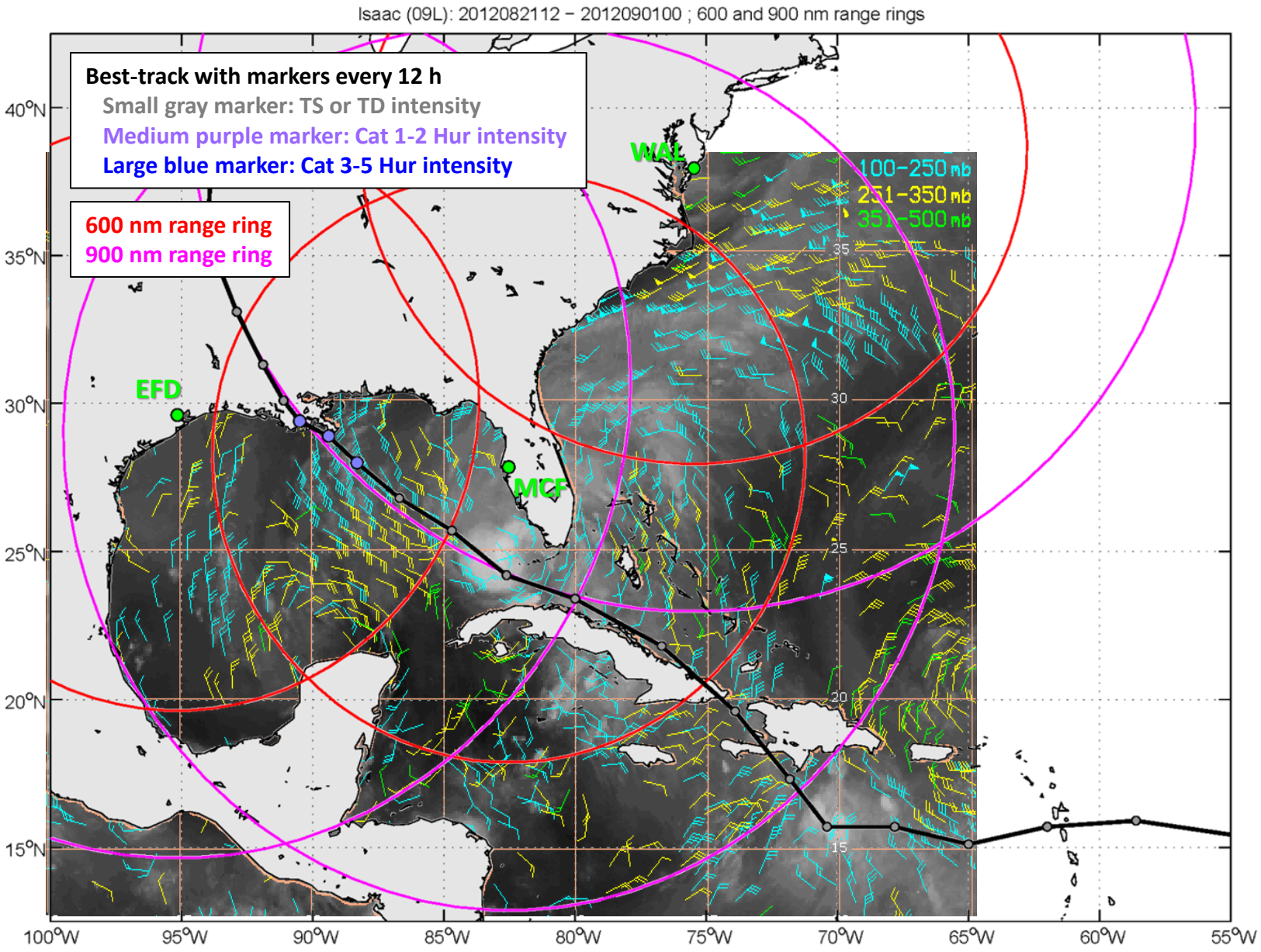
100-250 mb 251-350 mb 351-500 mb



Isaac (09L): 2012082112-2012090100

CIMSS Upper-level AMVs: 2012082600

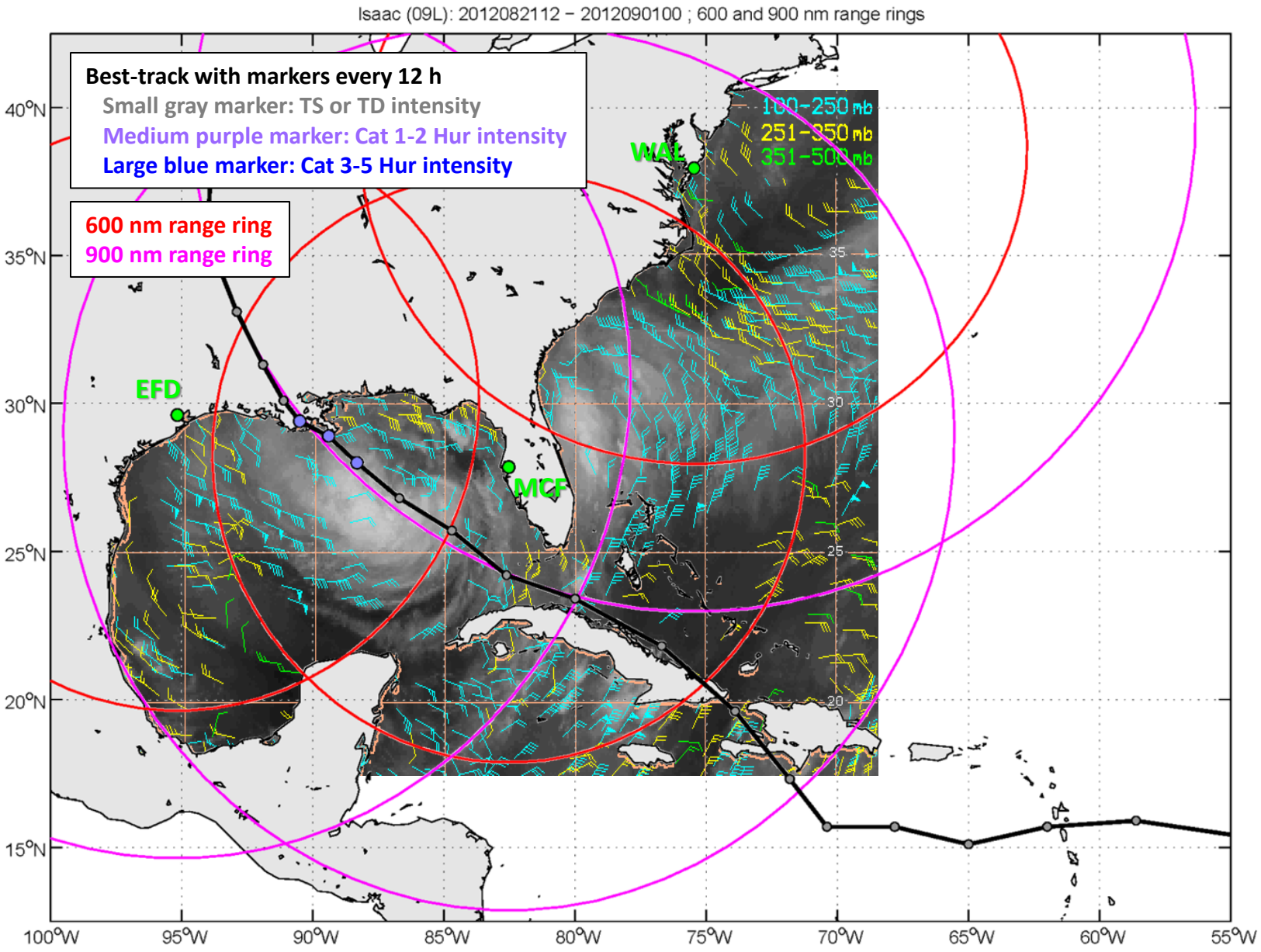
100-250 mb 251-350 mb 351-500 mb



Isaac (09L): 2012082112-2012090100

CIMSS Upper-level AMVs: 2012082700

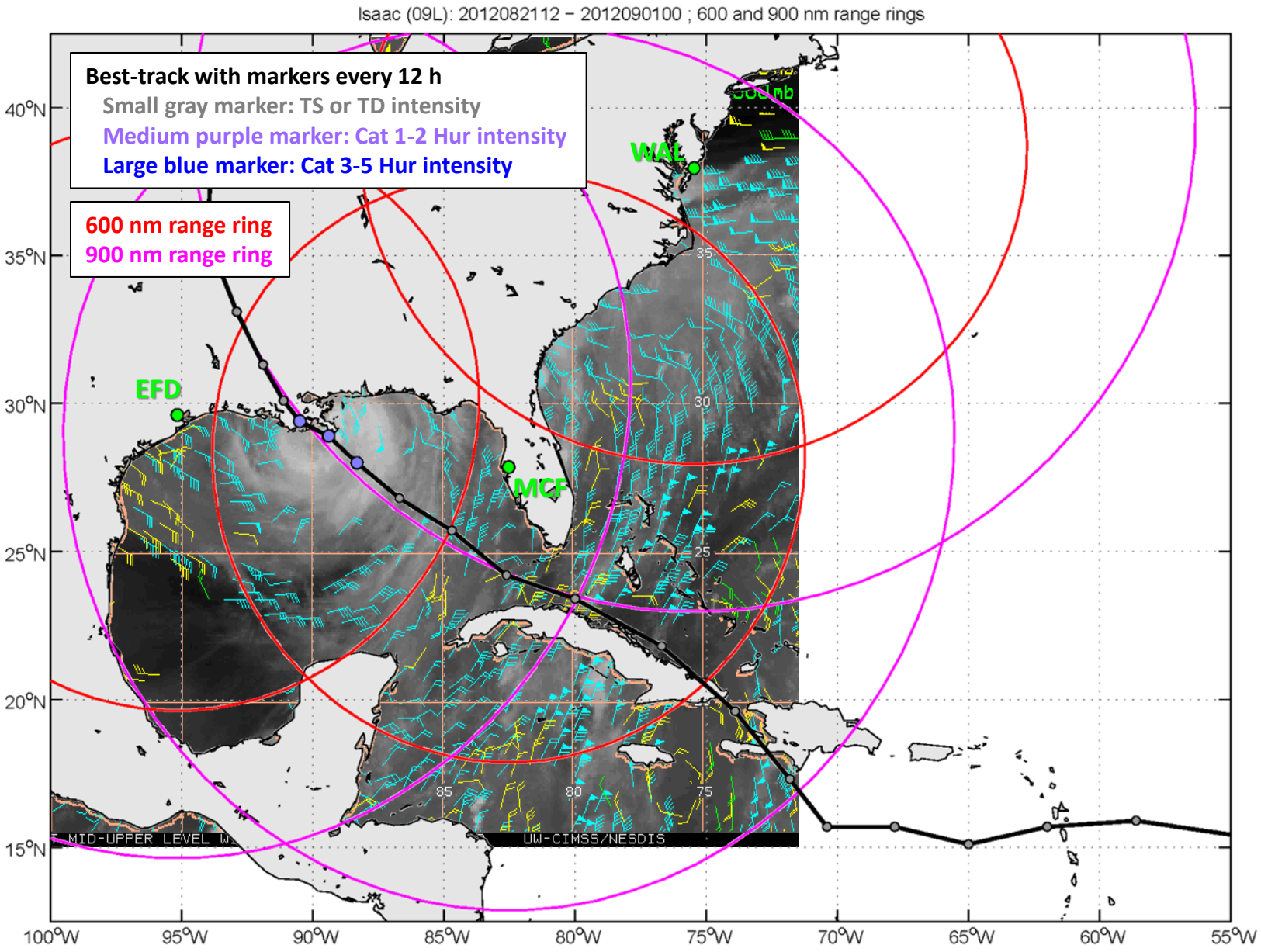
100-250 mb 251-350 mb 351-500 mb



Isaac (09L): 2012082112-2012090100

CIMSS Upper-level AMVs: 2012082800

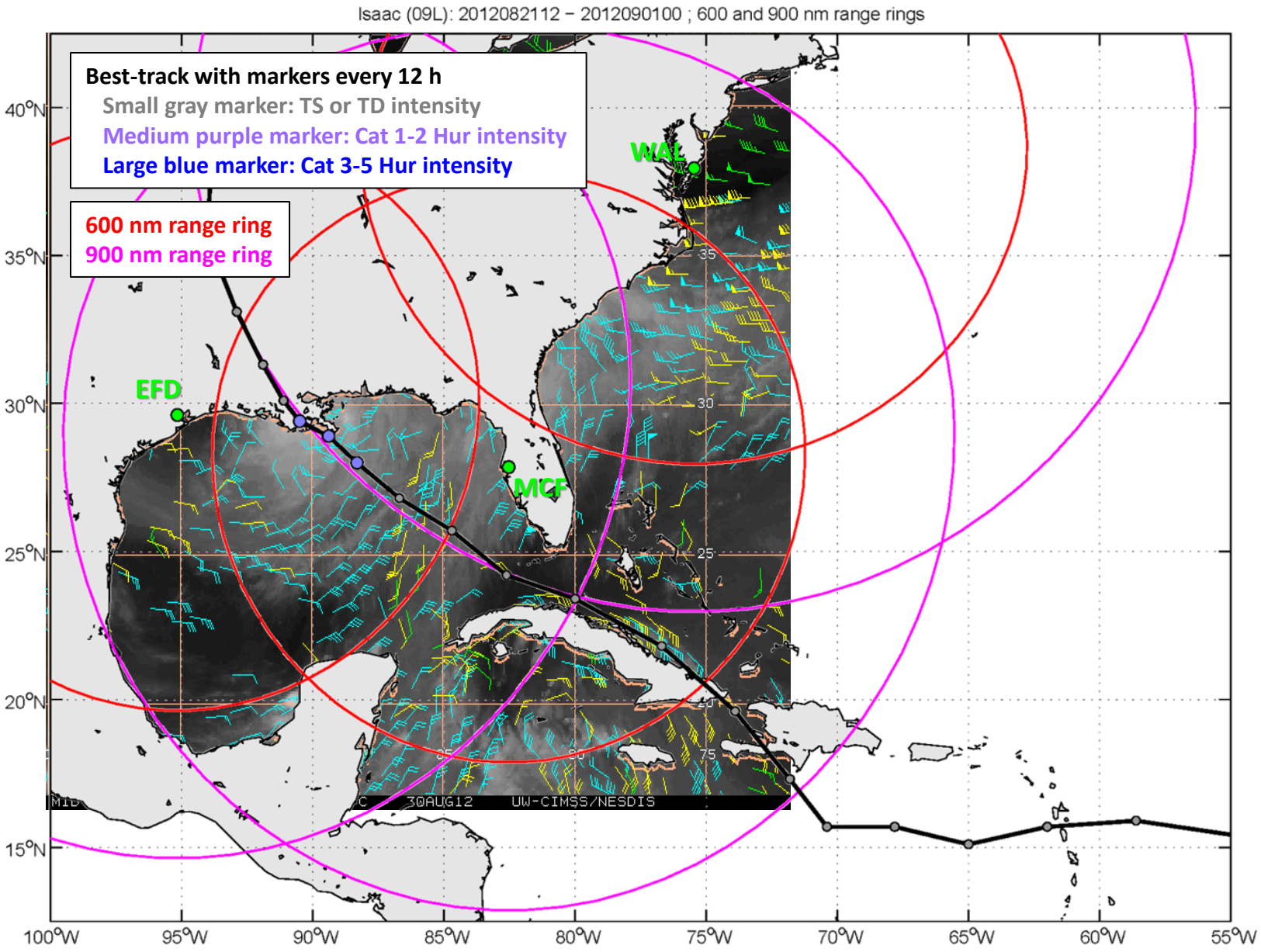
100-250 mb 251-350 mb 351-500 mb



Isaac (09L): 2012082112-2012090100

CIMSS Upper-level AMVs: 2012082900

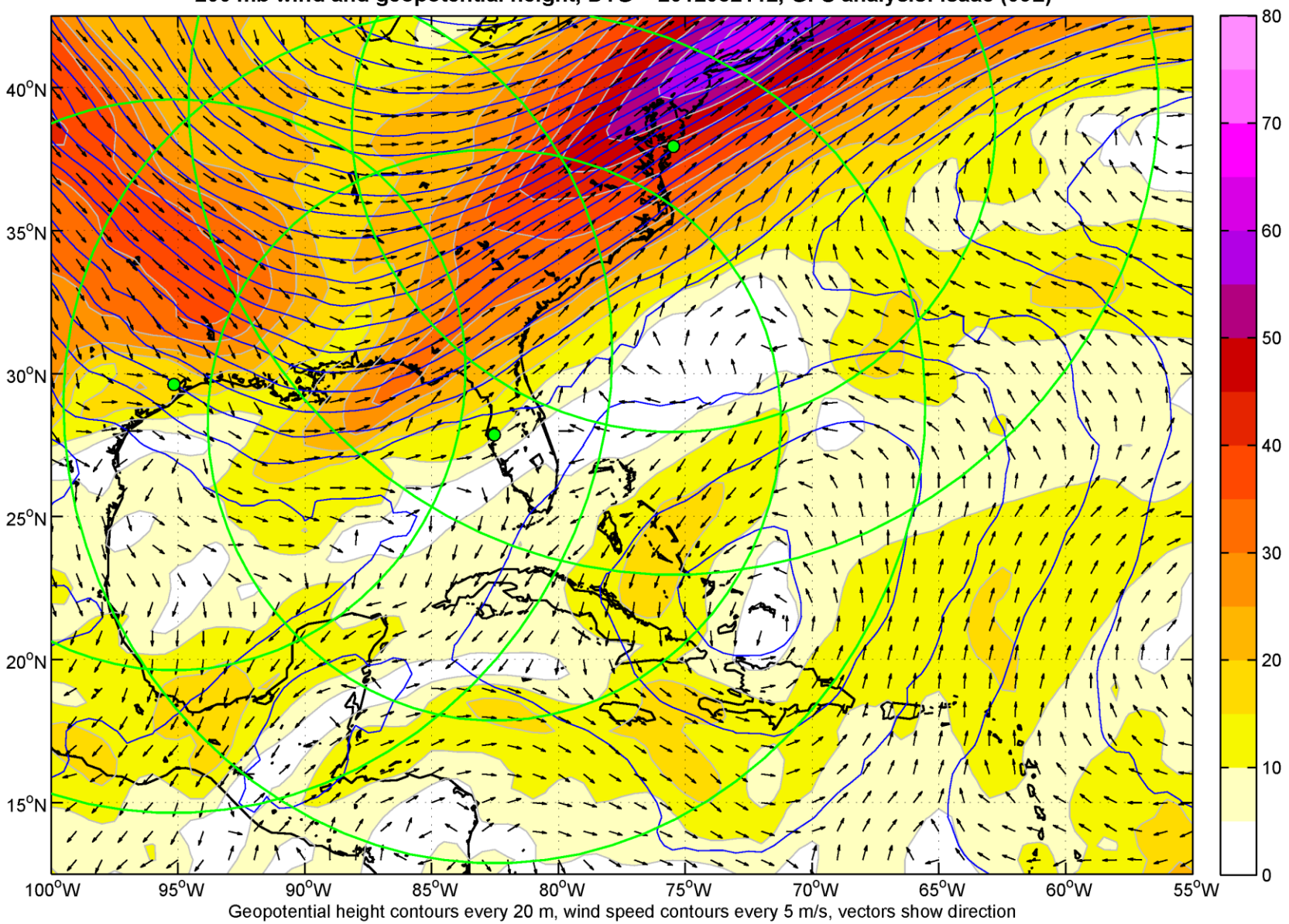
100-250 mb 251-350 mb 351-500 mb



Isaac (09L): 2012082112-2012090100

CIMSS Upper-level AMVs: 2012083000

100-250 mb **251-350 mb** **351-500 mb**



Isaac was a broad circulation with a very large quasi-symmetric outflow pattern.
The inner core did not organize until the TC reached the open waters of the GoM.

Questions for Isaac:

Q1: Isaac is accessible much earlier from MCF than from EFD. You can have more flights by forward deploying to MCF. Is this worthwhile, given its proximity to Cuba and relatively disorganized state at the time?

Q2: Say the storm is in the Gulf. There is plenty of time to fly a pattern out of EFD or MCF, but options are constrained by land. What objective(s) do we try to satisfy?

Q3: How do we handle uncertainty about the TC impacting one of our bases?

Scenario #2: TC develops in Gulf of Mexico

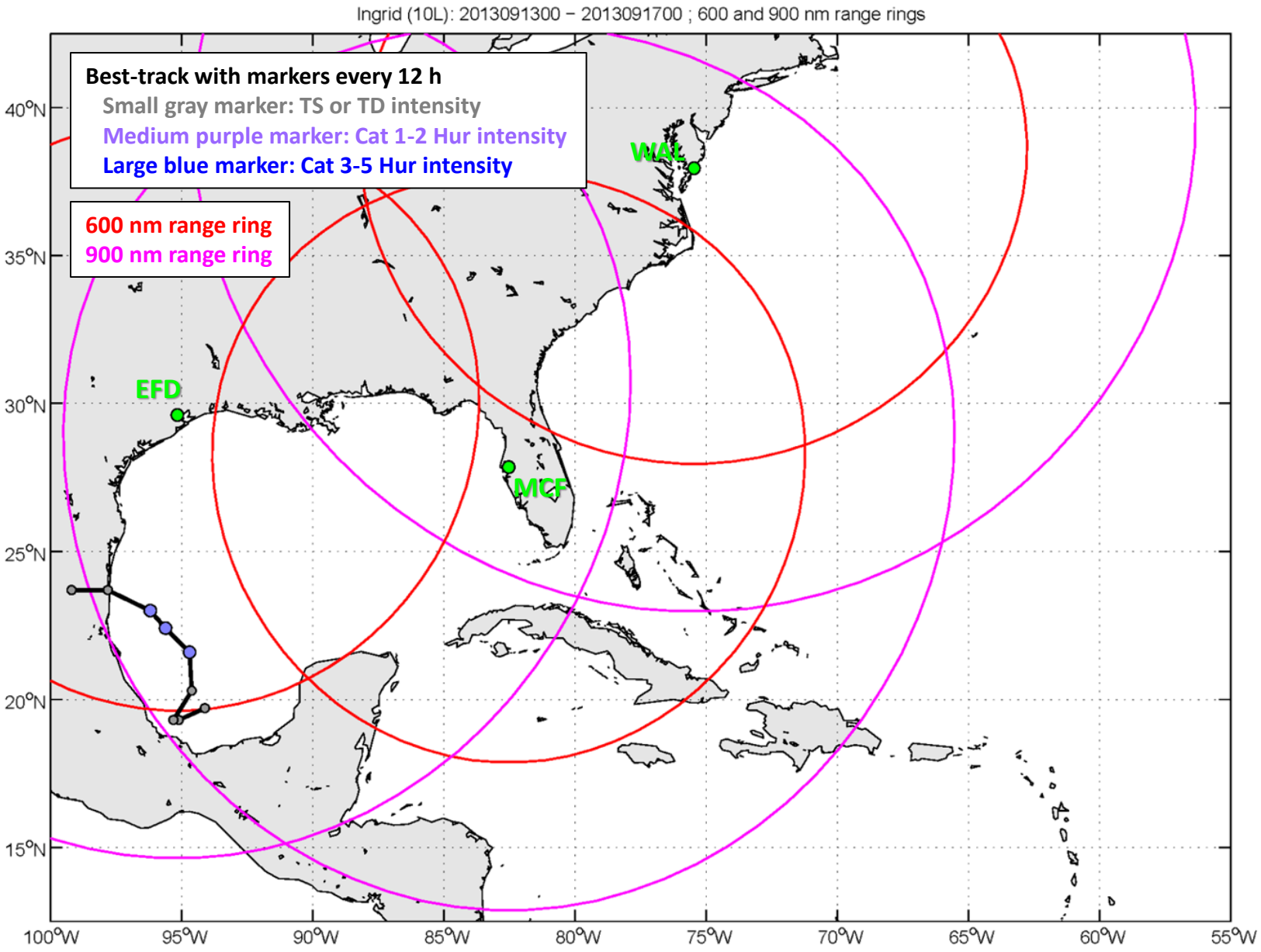
Case Studies:

- Ingrid (10L, 2013)
- Karen (12L, 2013)

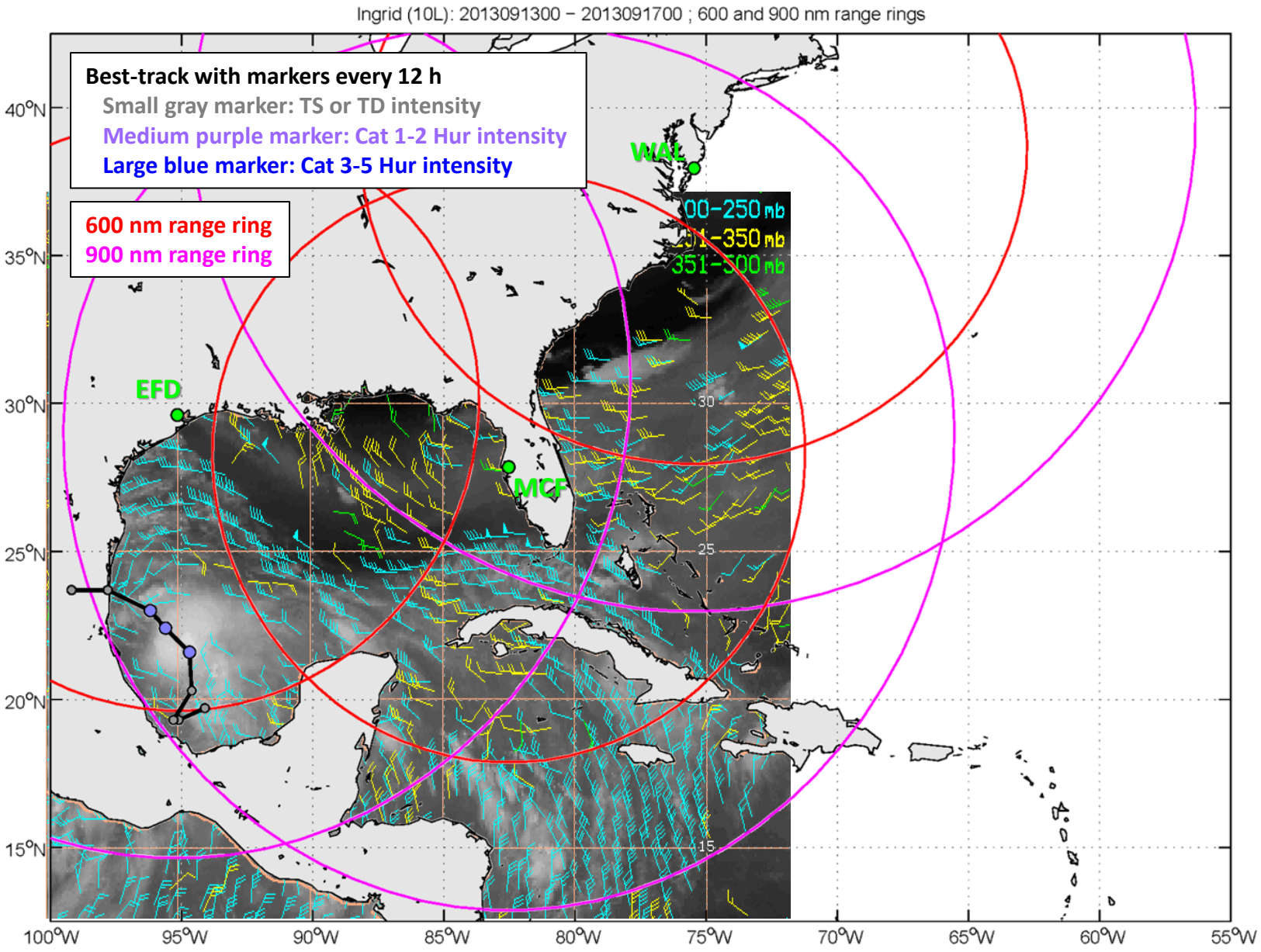
Other examples:

- Dolly* (05L, 2014)
- Nate (15L, 2011)
- Lee (13L, 2011)
- Hermine (10L, 2010)
- Humberto (09L, 2007)

* AMV/range ring plots available, but not included in presentation



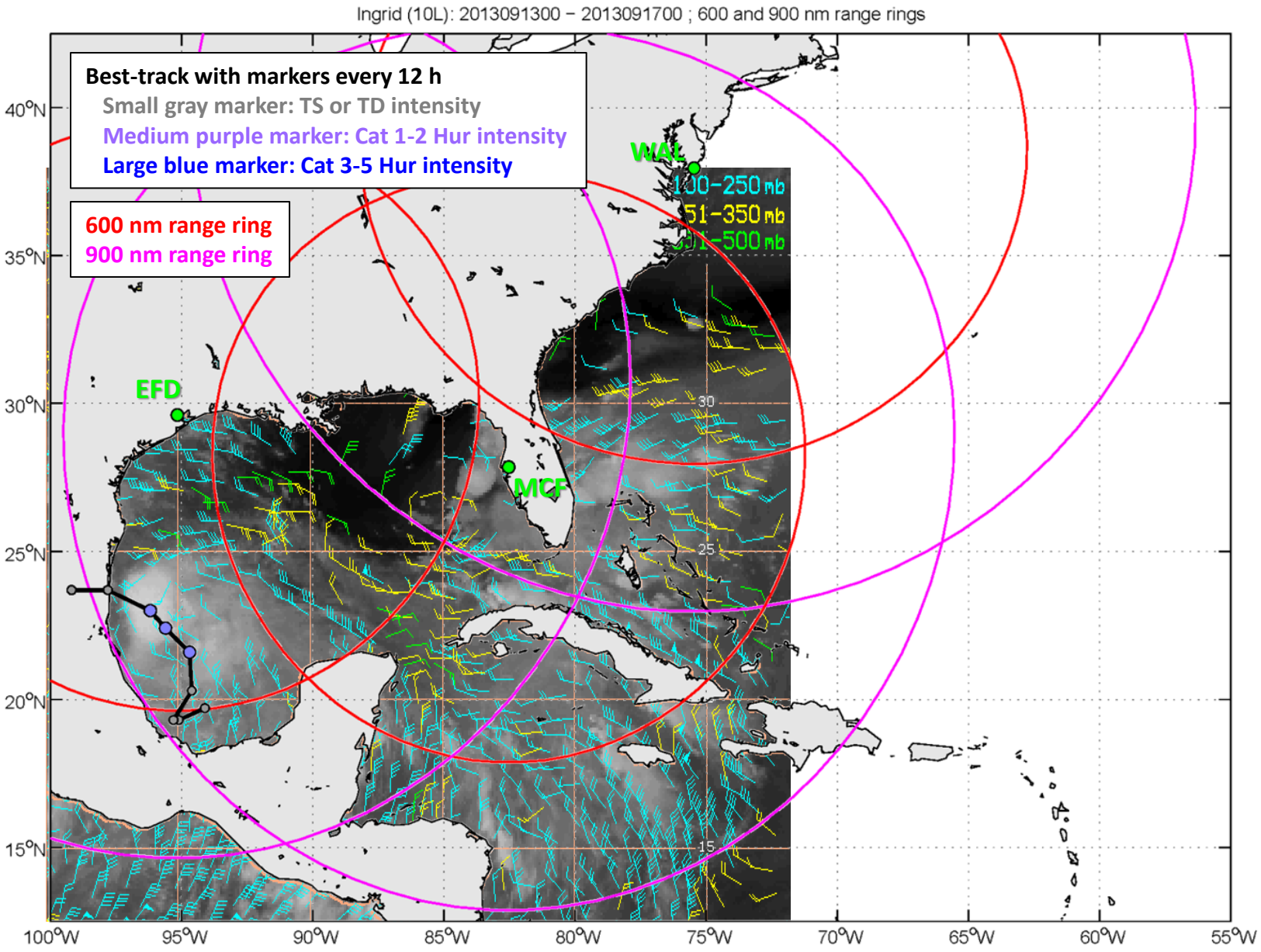
Ingrid (10L): 2013091300-2013091700



Ingrid (10L): 2013091300-2013091700

CIMSS Upper-level AMVs: 2013091503

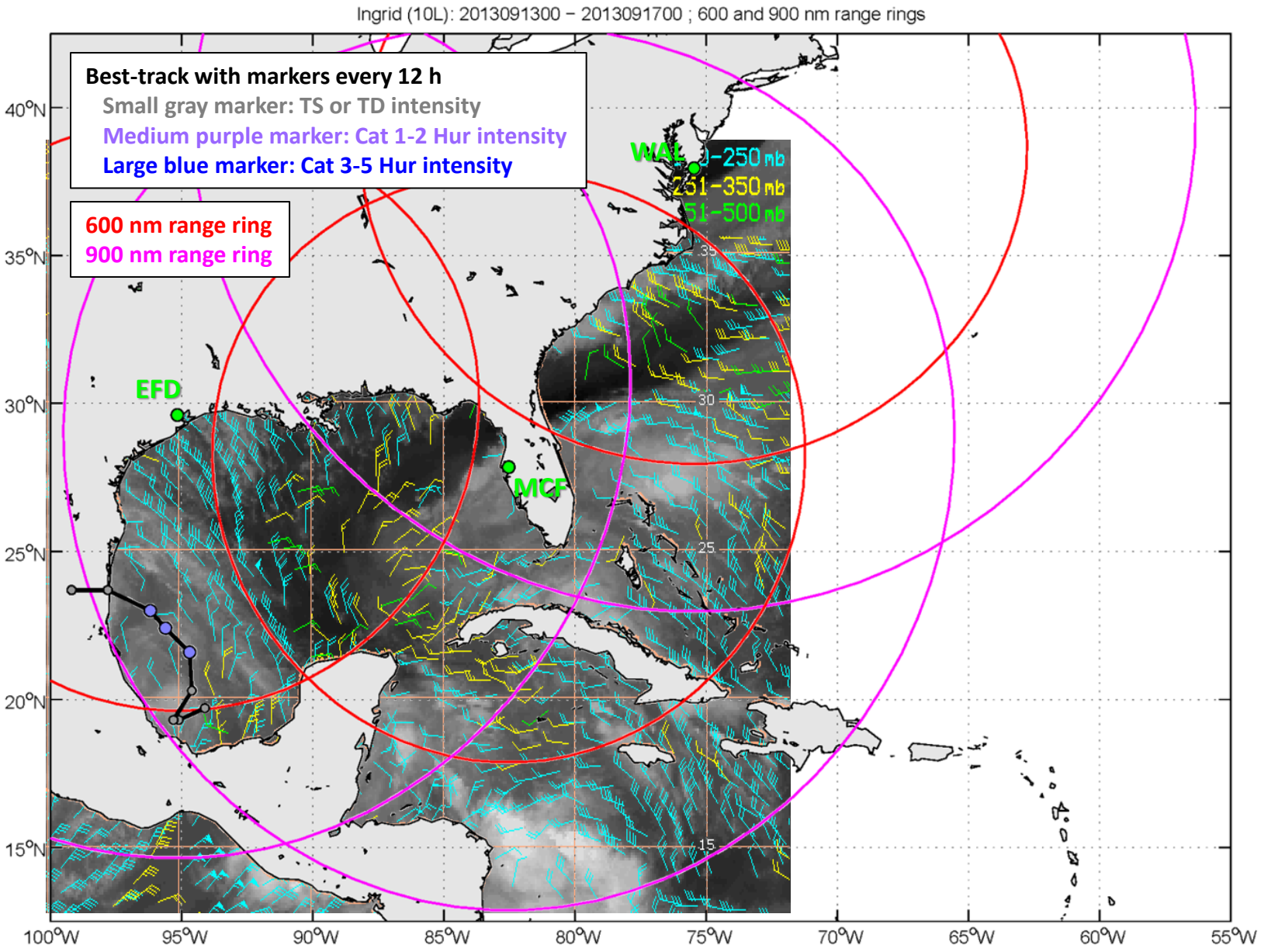
100-250 mb 251-350 mb 351-500 mb



Ingrid (10L): 2013091300-2013091700

CIMSS Upper-level AMVs: 2013091600

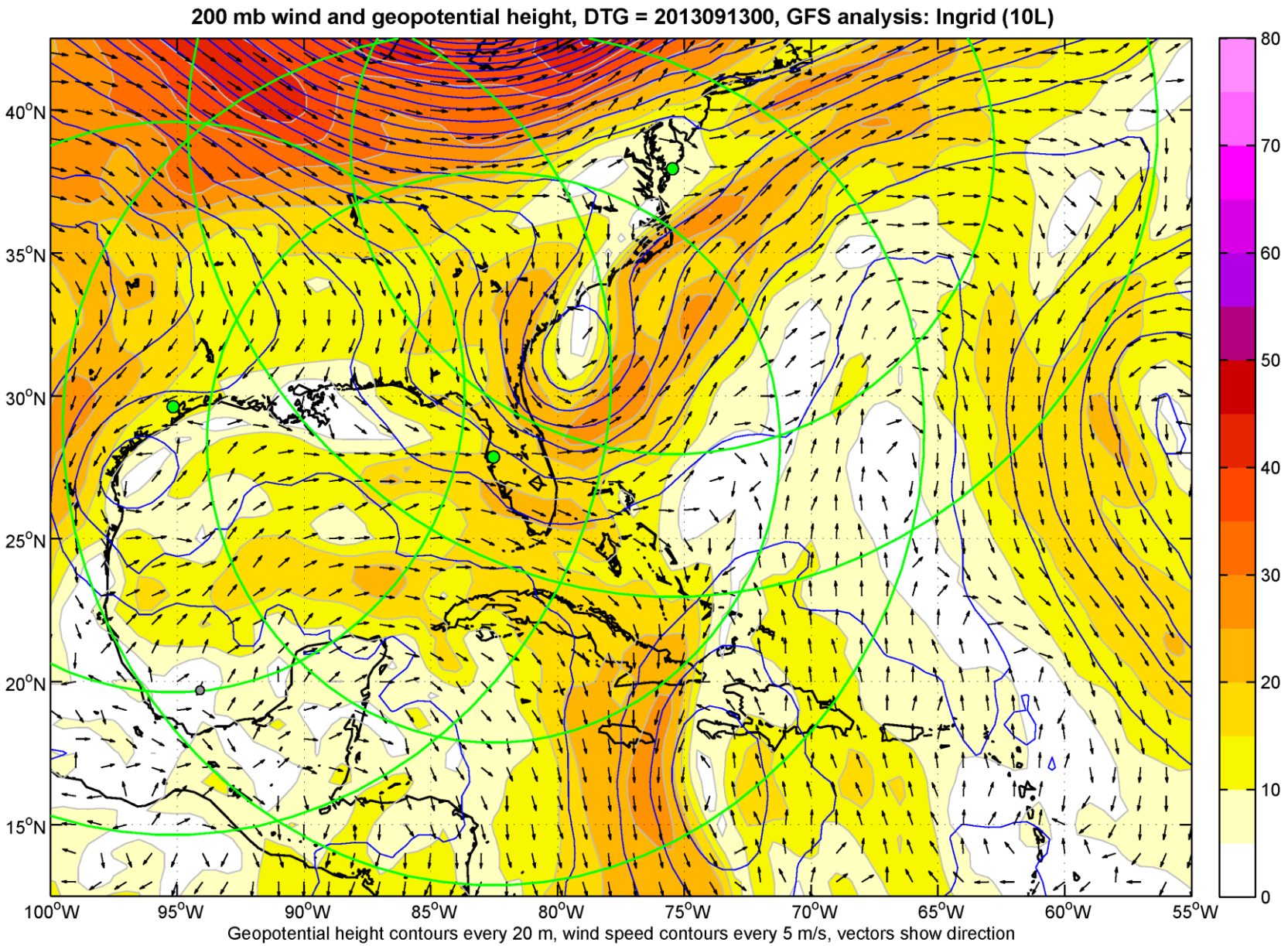
100-250 mb 251-350 mb 351-500 mb



Ingrid (10L): 2013091300-2013091700

CIMSS Upper-level AMVs: 2013091700

100-250 mb 251-350 mb 351-500 mb

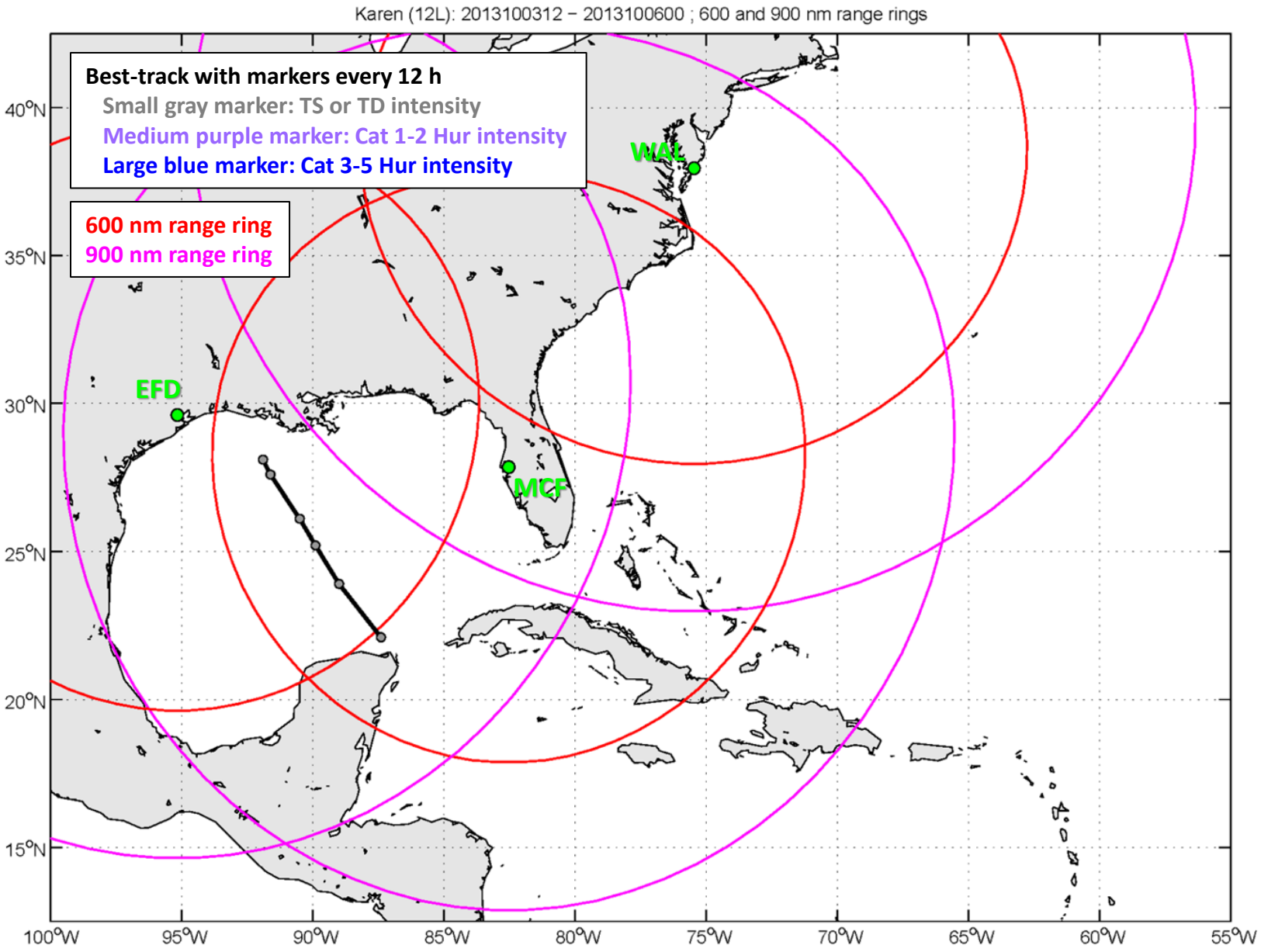


Ingrid's outflow mostly traveled east and south as part of a large anticyclonic flow feature centered over Mexico

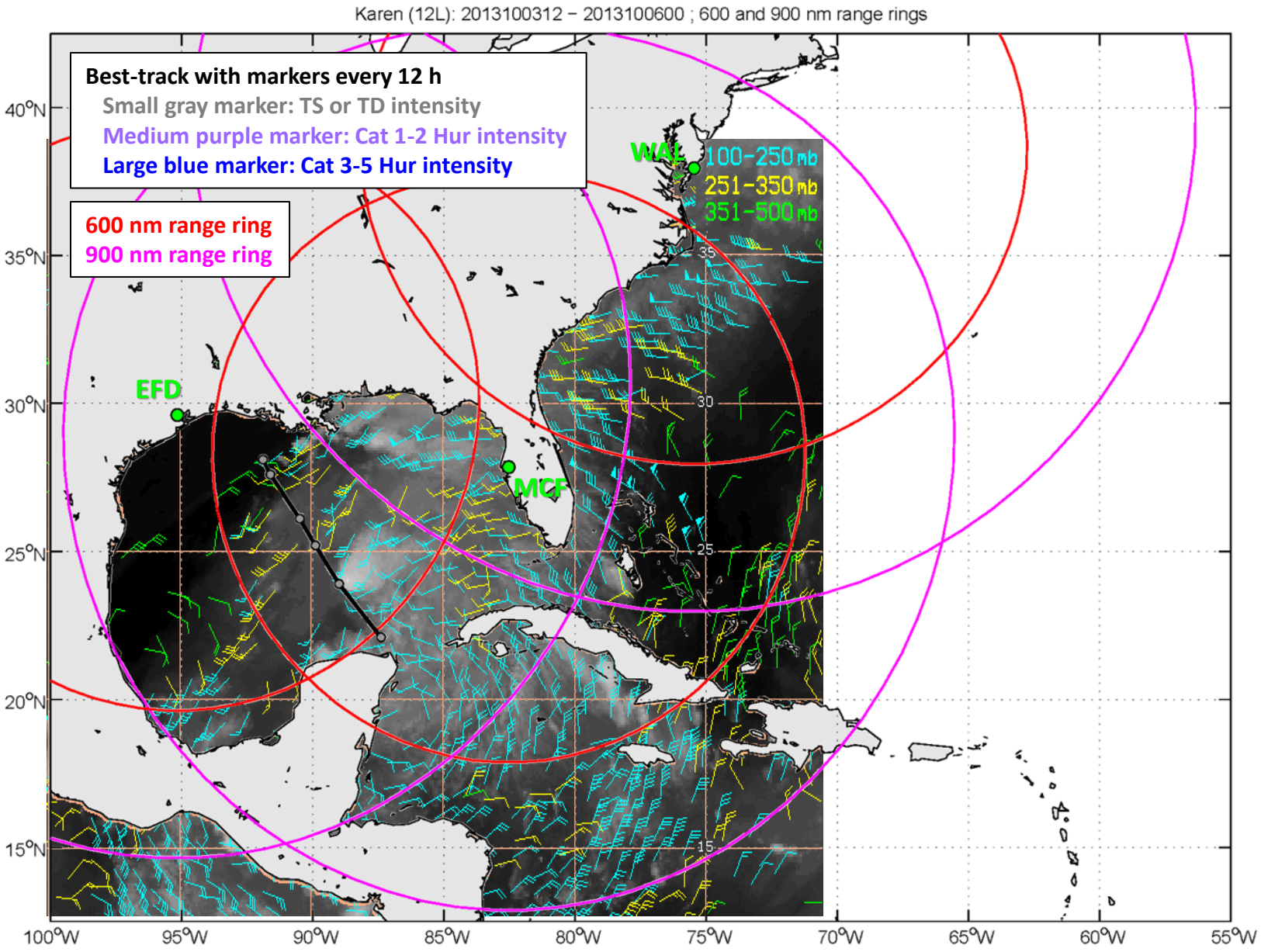
Questions for Ingrid:

Q1: Given it's a hurricane accessible from EFD, it is likely worthwhile to fly this storm. What scientific objectives could this storm satisfy? Would be possible to fly inner core, or southwards-directed outflow away from the core.

Q2: Is a flight desirable as a disturbance is undergoing genesis? A storm in the Gulf is likely the best opportunity to do this, since forward deployment (with a more advanced lead time prediction of genesis) is not needed.



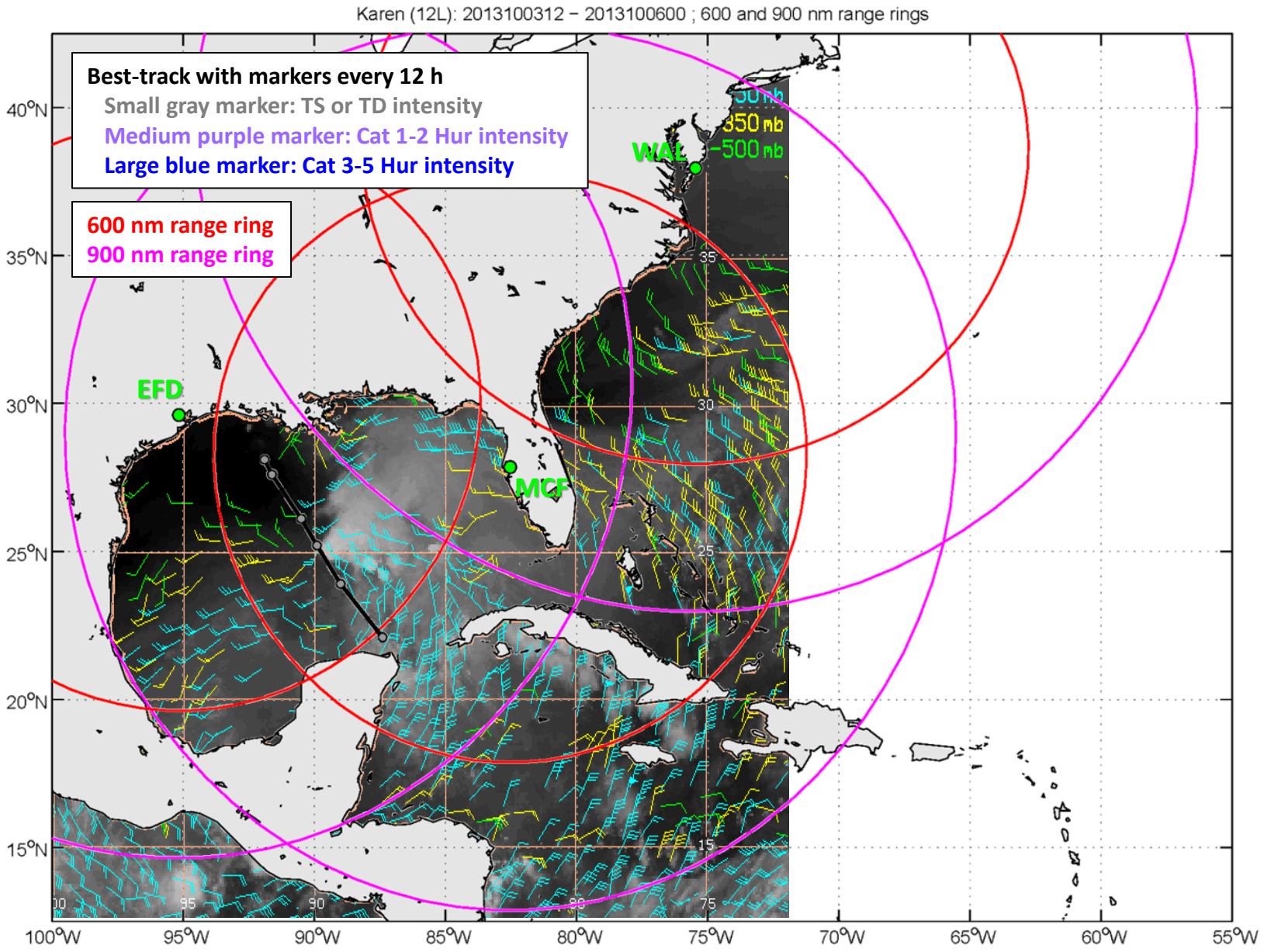
Karen (12L): 2013100312-2013100600



Karen (12L): 2013100312-2013100600

CIMSS Upper-level AMVs: 2013100400

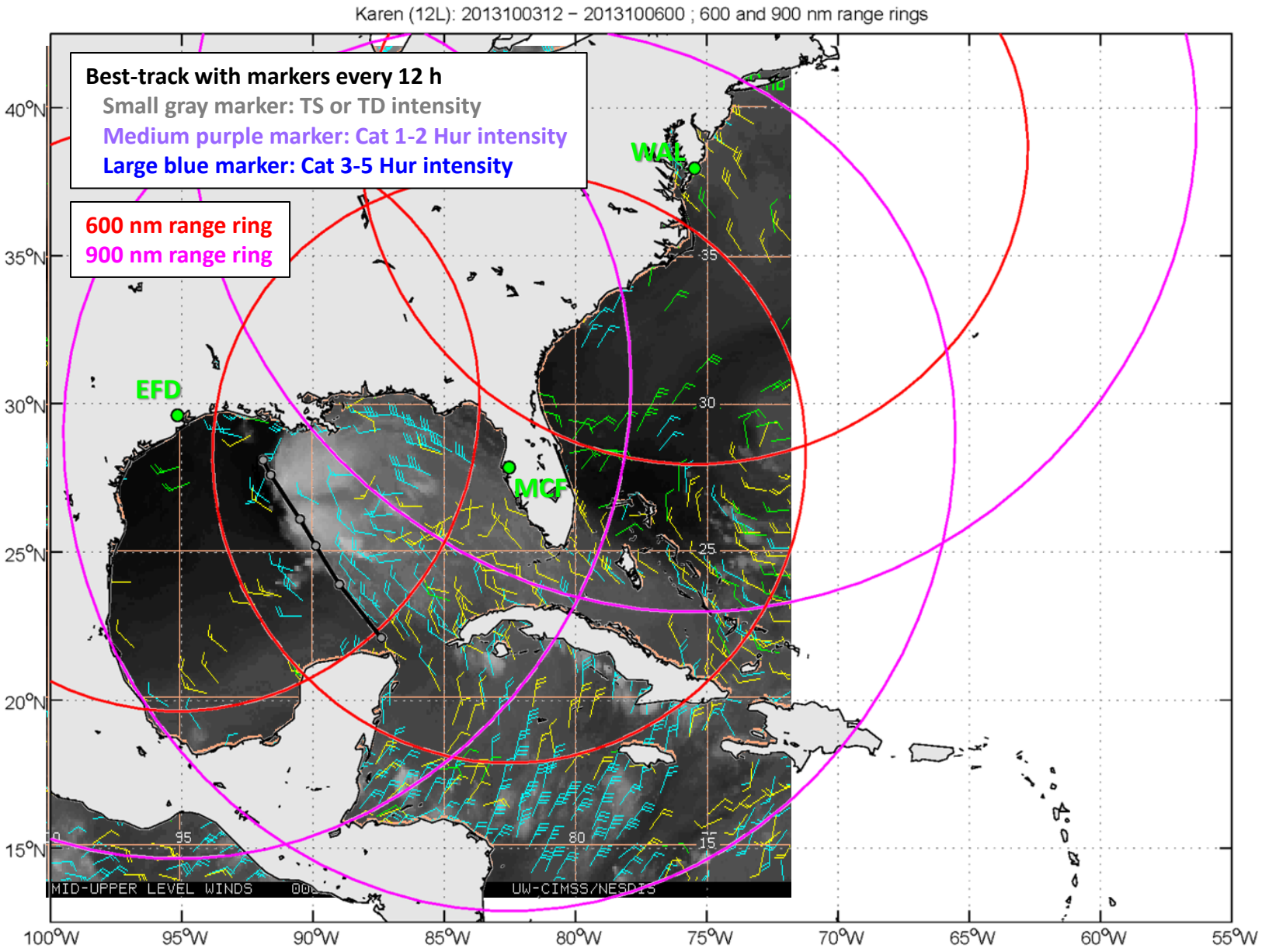
100-250 mb 251-350 mb 351-500 mb



Karen (12L): 2013100312-2013100600

CIMSS Upper-level AMVs: 2013100500

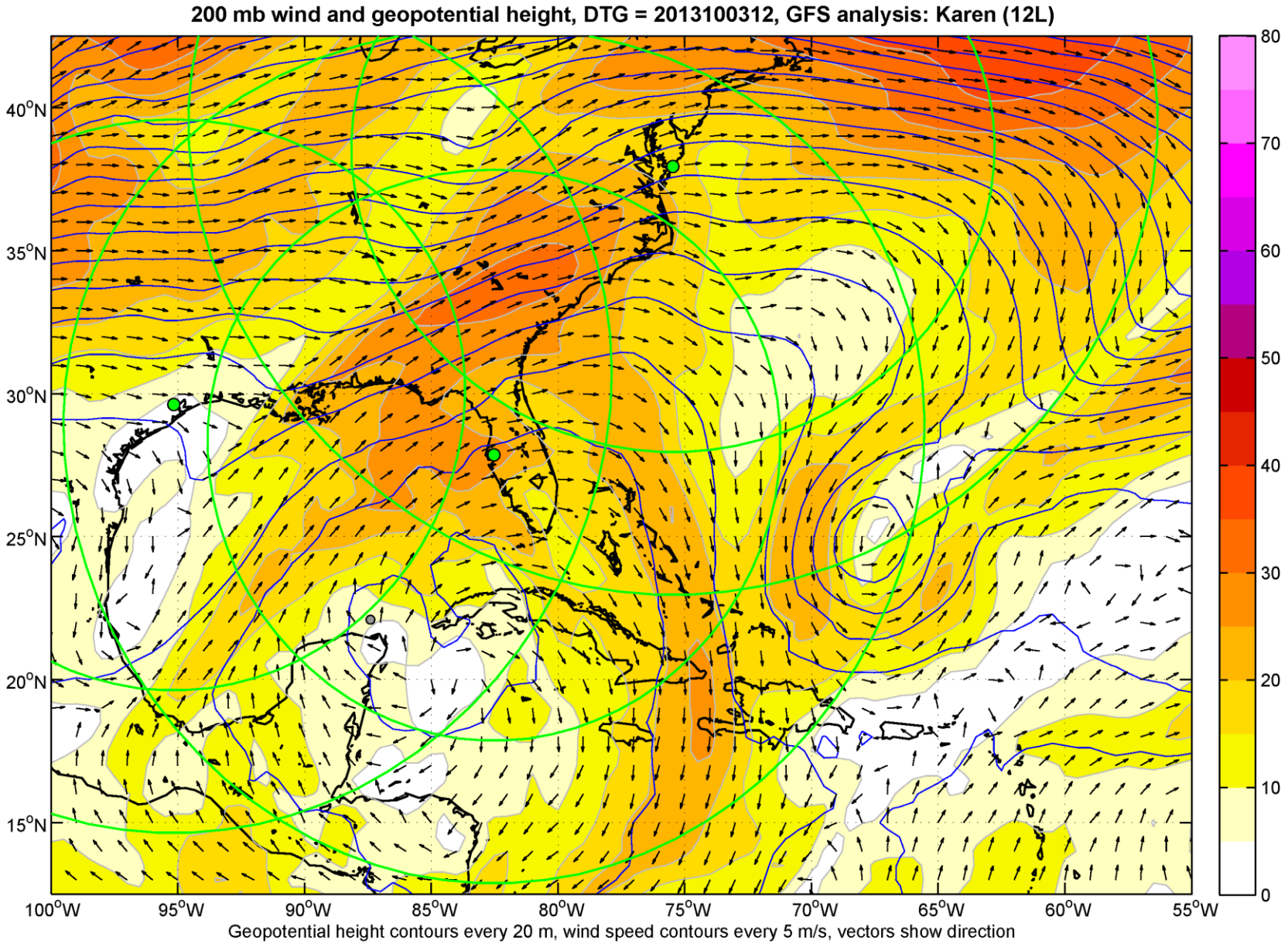
100-250 mb 251-350 mb 351-500 mb



Karen (12L): 2013100312-2013100600

CIMSS Upper-level AMVs: 2013100600

100-250 mb 251-350 mb 351-500 mb



Karen is in strong shear, the convection is highly asymmetric with outflow toward the east

Questions for Karen:

Q1: Is this a TC we would like to fly? It is an opportunity to sample a strongly sheared TC. At the time, there was considerable uncertainty regarding whether or not it would be able to intensify and make landfall as a tropical cyclone. But is there interesting science to be done?

Scenario #3: Yucatan landfall and potential redevelopment in southern GoM

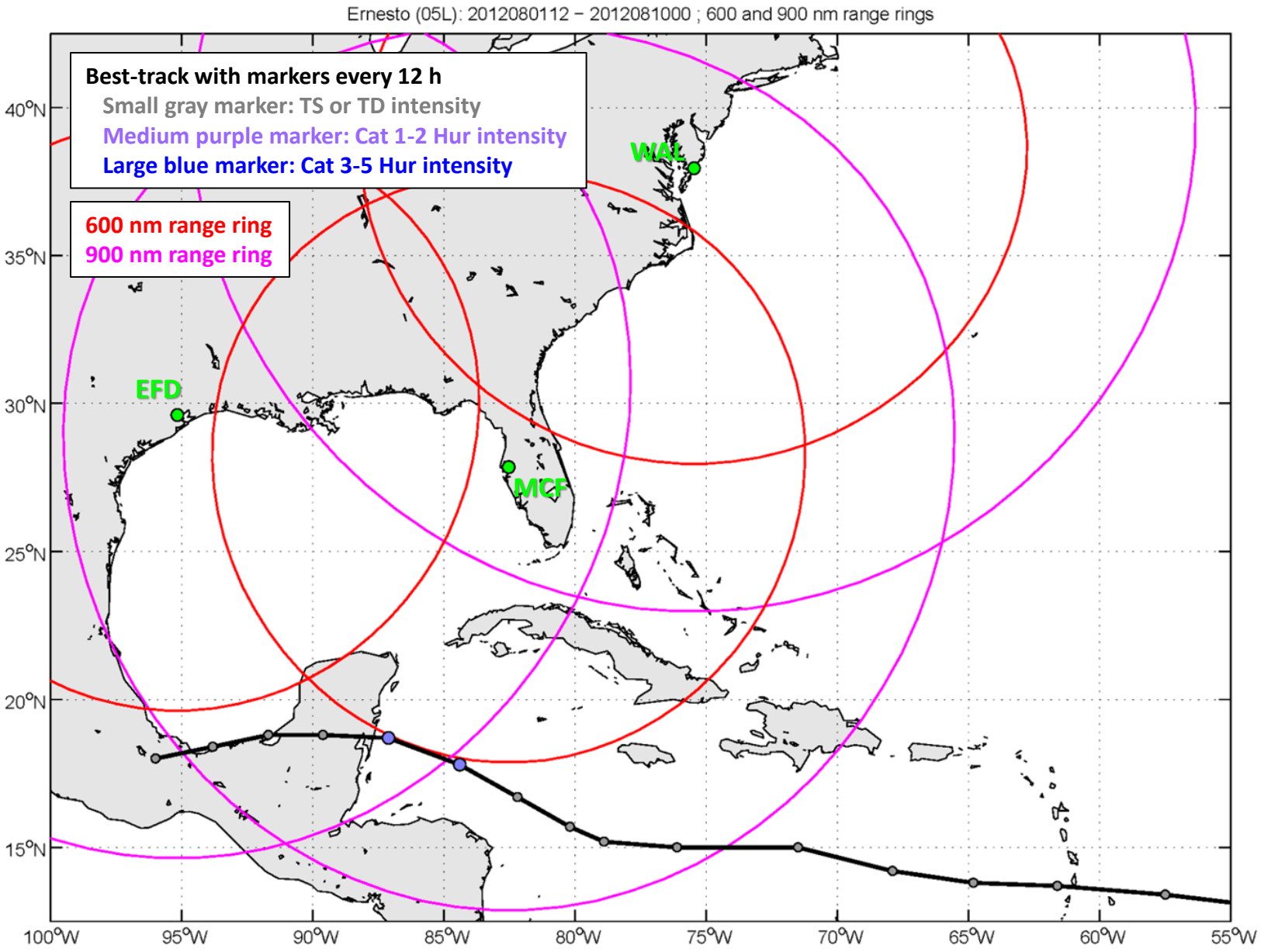
Case Study:

- Ernesto (09L, 2012)

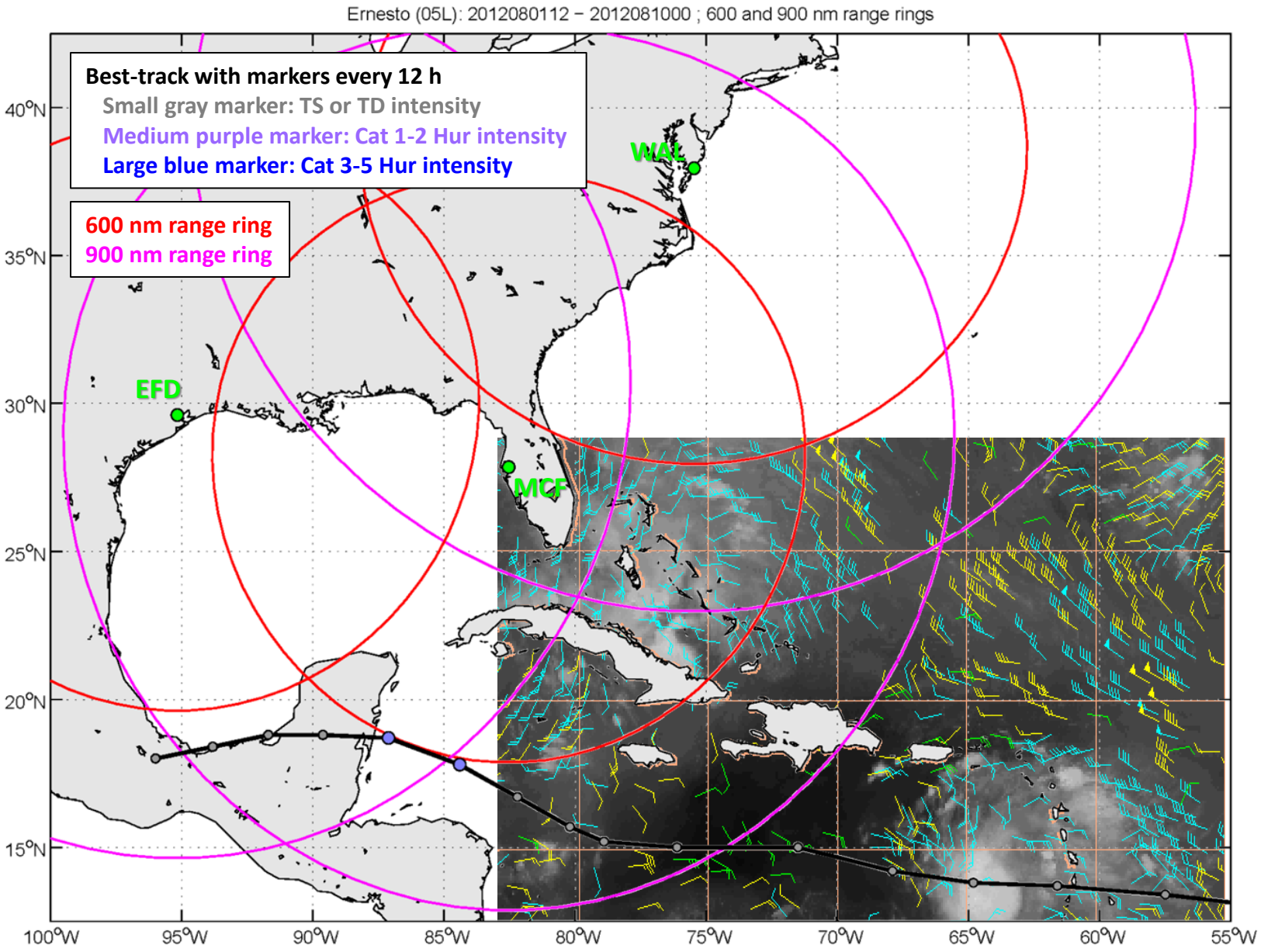
Other examples:

- Karl (13L, 2010)
- Dean* (04L, 2007)

* AMV/range ring plots available, but not included in presentation



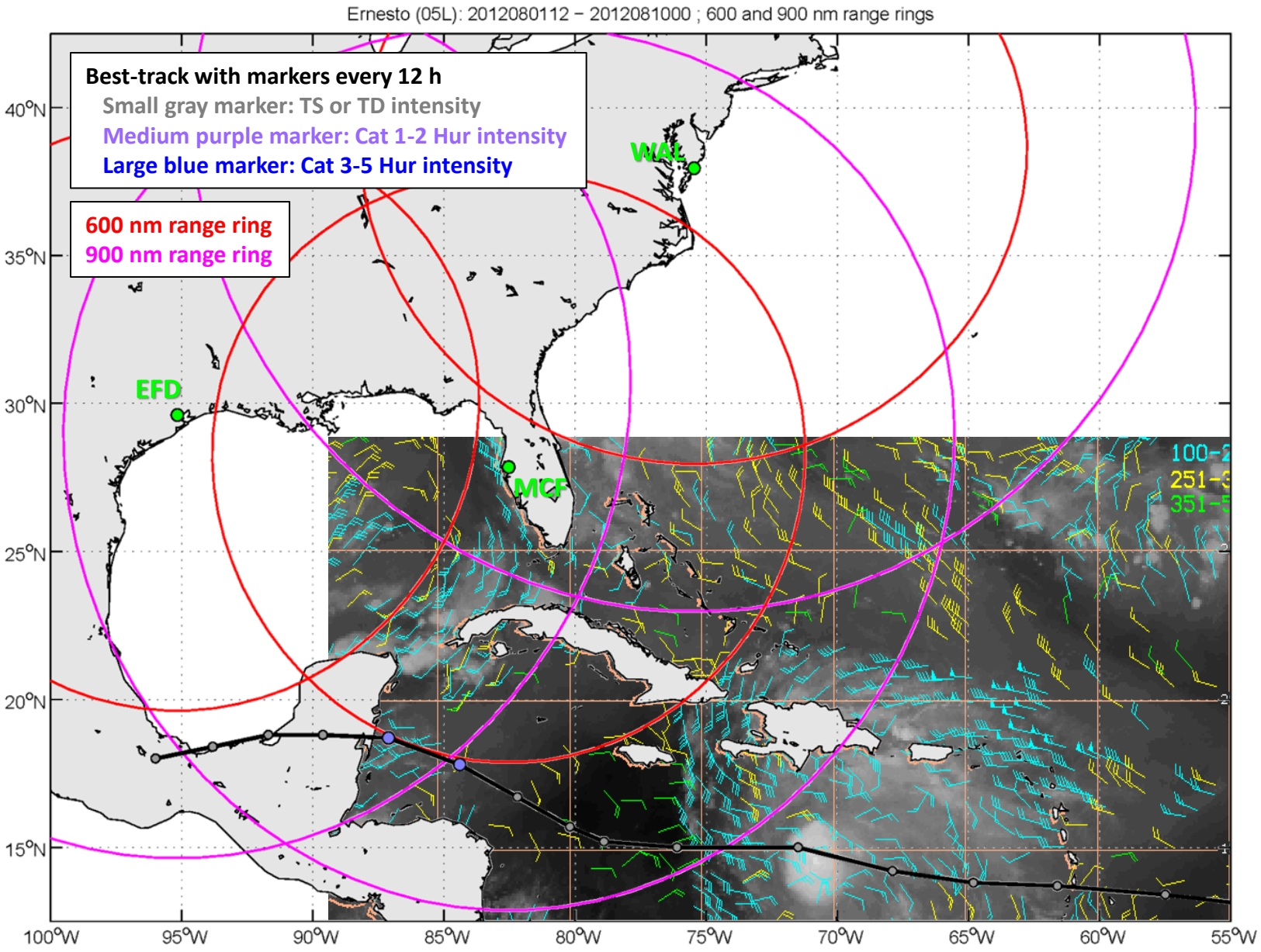
Ernesto (05L): 2012080100-2012081000



Ernesto (05L): 2012080100-2012081000

CIMSS Upper-level AMVs: 2012080400

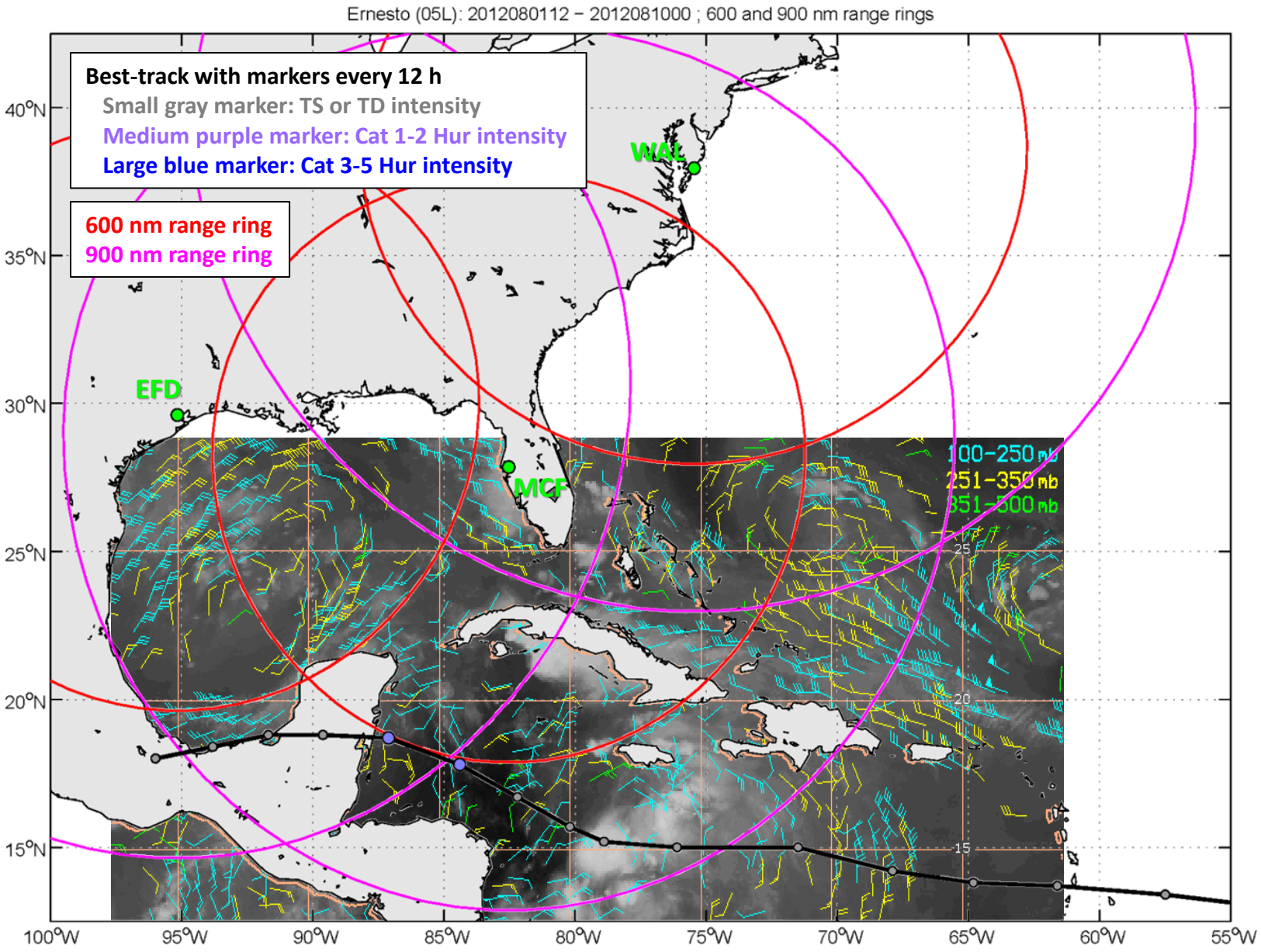
100-250 mb 251-350 mb 351-500 mb



Ernesto (05L): 2012080100-2012081000

CIMSS Upper-level AMVs: 2012080500

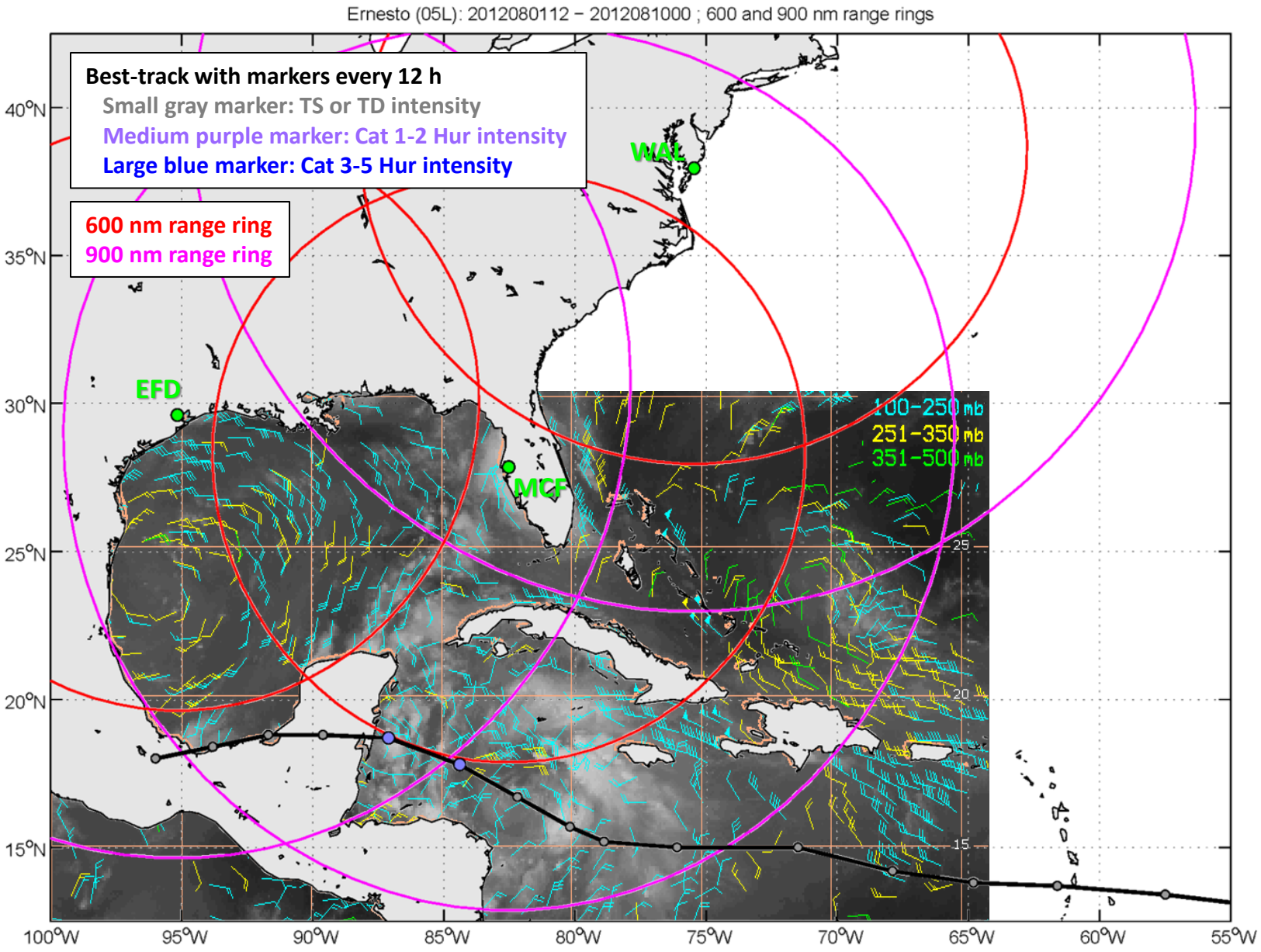
100-250 mb 251-350 mb 351-500 mb



Ernesto (05L): 2012080100-2012081000

CIMSS Upper-level AMVs: 2012080600

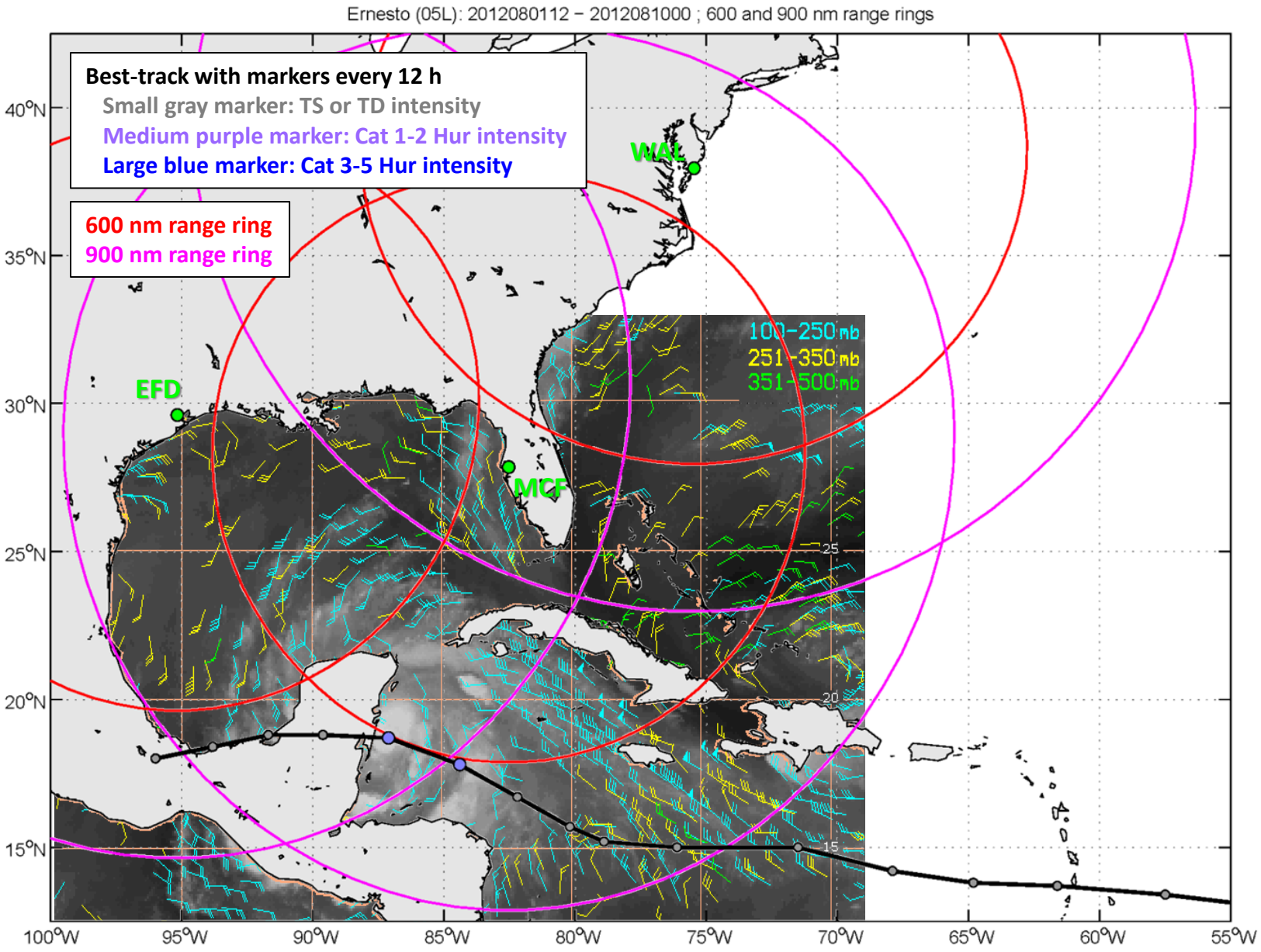
100-250 mb 251-350 mb 351-500 mb



Ernesto (05L): 2012080100-2012081000

CIMSS Upper-level AMVs: 2012080700

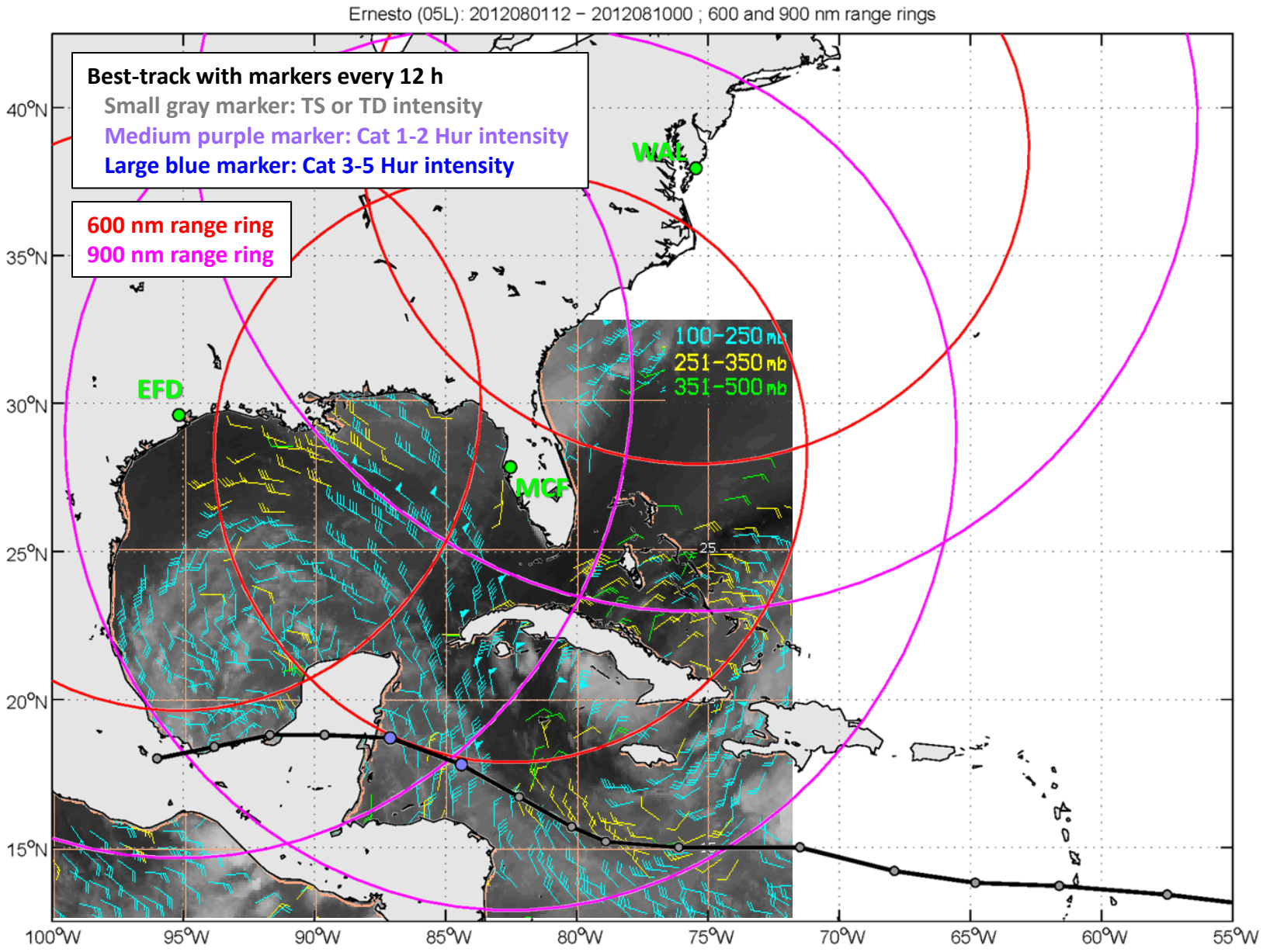
100-250 mb 251-350 mb 351-500 mb



Ernesto (05L): 2012080100-2012081000

CIMSS Upper-level AMVs: 2012080800

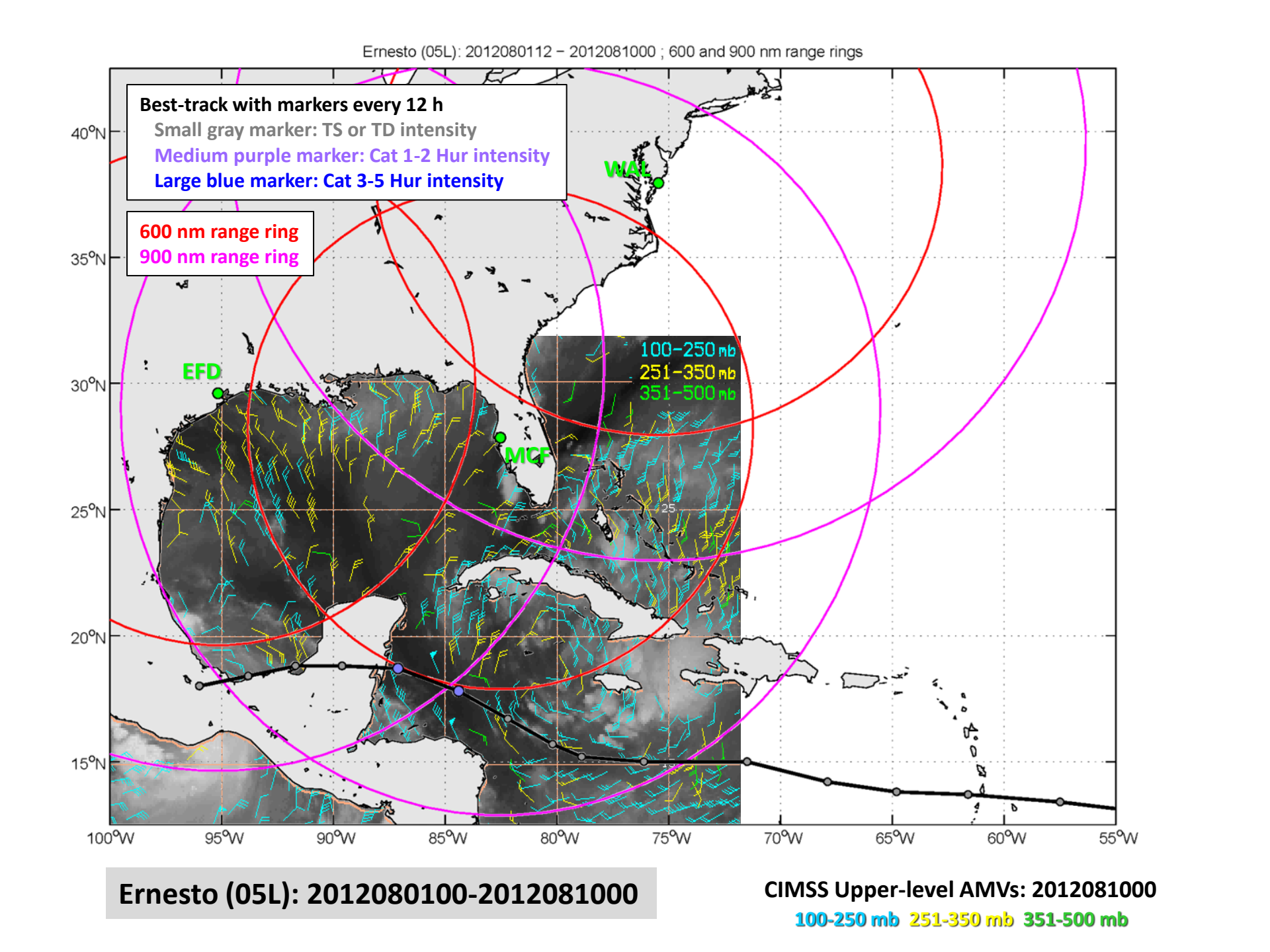
100-250 mb 251-350 mb 351-500 mb



Ernesto (05L): 2012080100-2012081000

CIMSS Upper-level AMVs: 2012080900

100-250 mb 251-350 mb 351-500 mb



Ernesto (05L): 2012080100-2012081000

CIMSS Upper-level AMVs: 2012081000

100-250 mb 251-350 mb 351-500 mb

Questions for Ernesto:

Q1: Do we forward deploy to MCF or not? MCF gives us the option of flying over the core while the TC is in the Caribbean (probably have one shot at this), but is somewhat further away from the TC center than EFD once Ernesto is in the GoM. If we stay at EFD, we could fly the outflow shield north of the TC when it is centered in NW Caribbean and have better access to the TC center and outflow once it reaches the GoM.

Q2: Or is this not a good enough case to fly in the first place? Ernesto occurred in the beginning of August. Is it prudent to wait, instead? (2012 would have had Isaac, Sandy, Rafael, and Leslie as potential targets).

Scenario #4: Late-season NW Caribbean TC

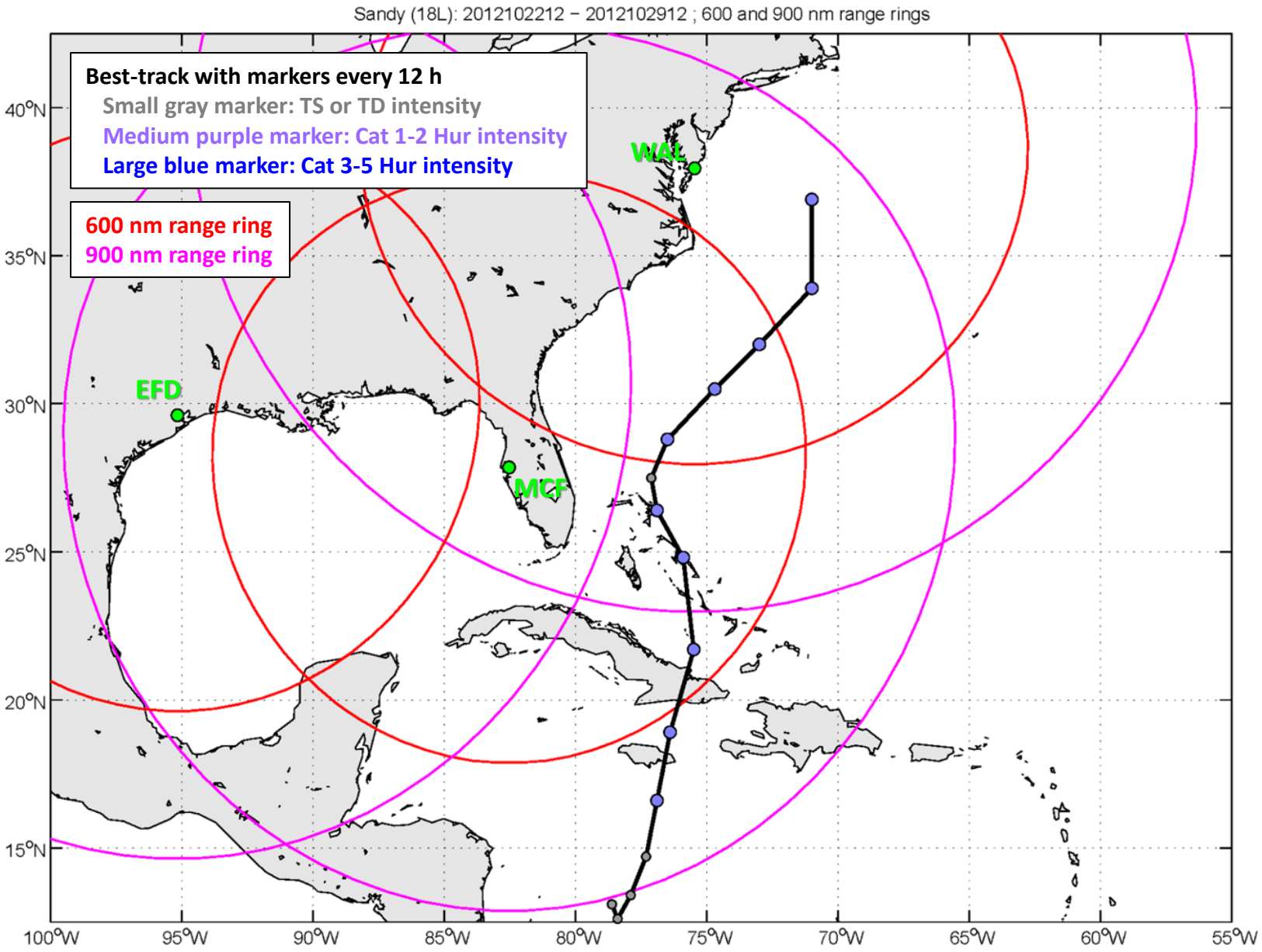
Case Study:

- Sandy (18L, 2012)

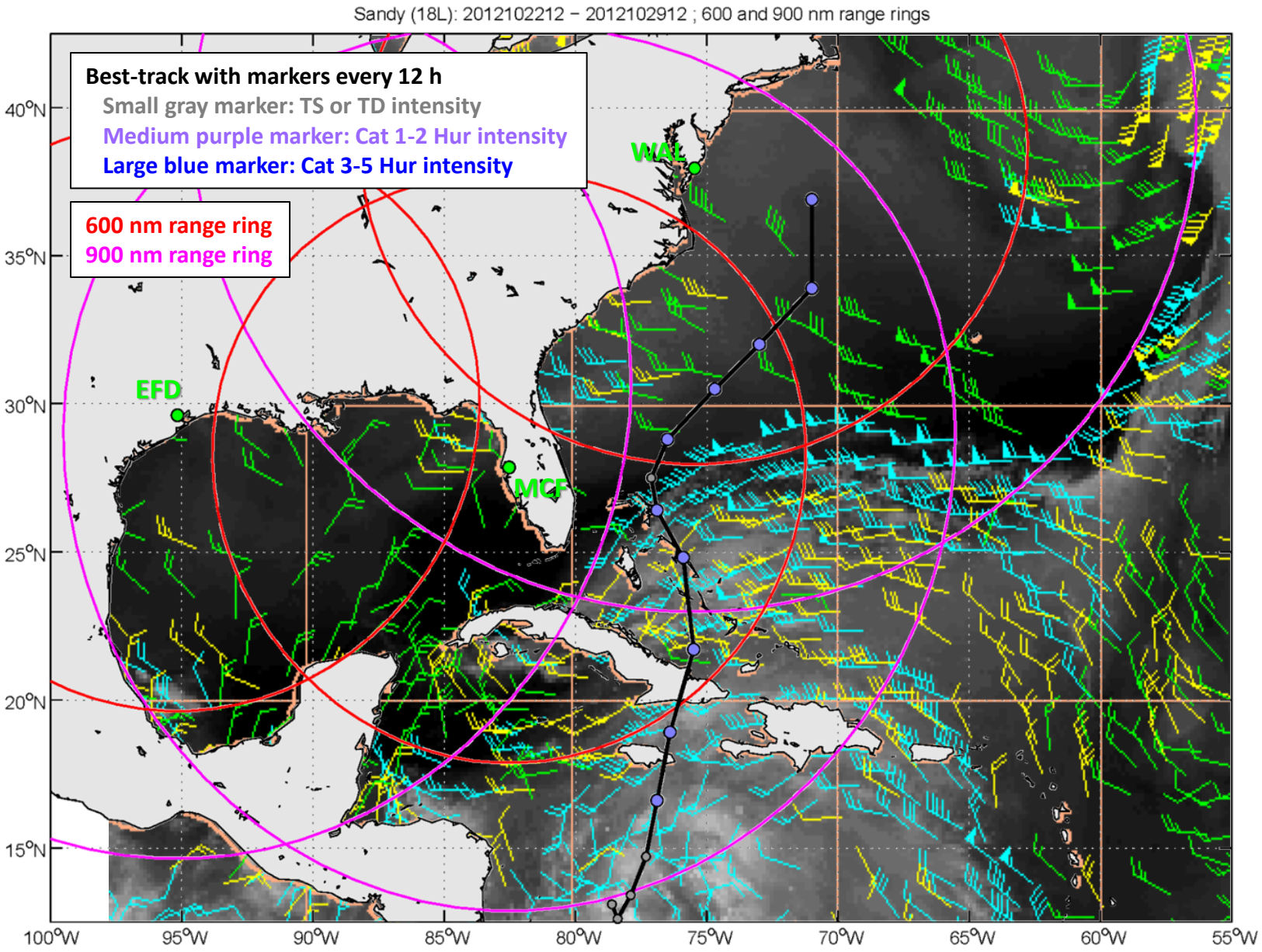
Other examples:

- Rina* (18L, 2011)
- Paula* (18L, 2010)
- Tomas (21L, 2010)
- Paloma (15L, 2008)

* AMV/range ring plots available, but not included in presentation



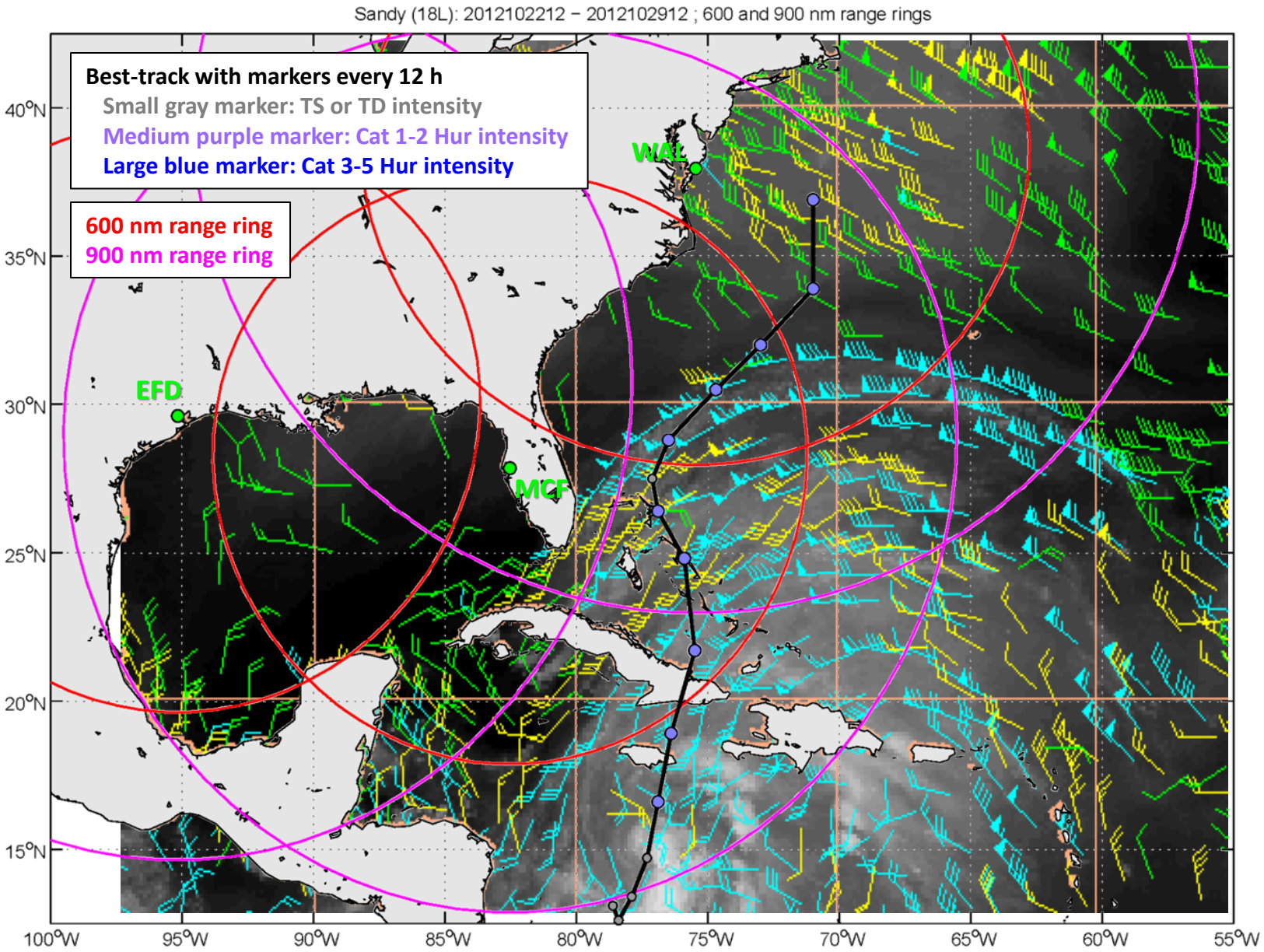
Sandy (18L): 2012102212-2012102912



Sandy (18L): 2012102212-2012102912

CIMSS Upper-level AMVs: 2012102300

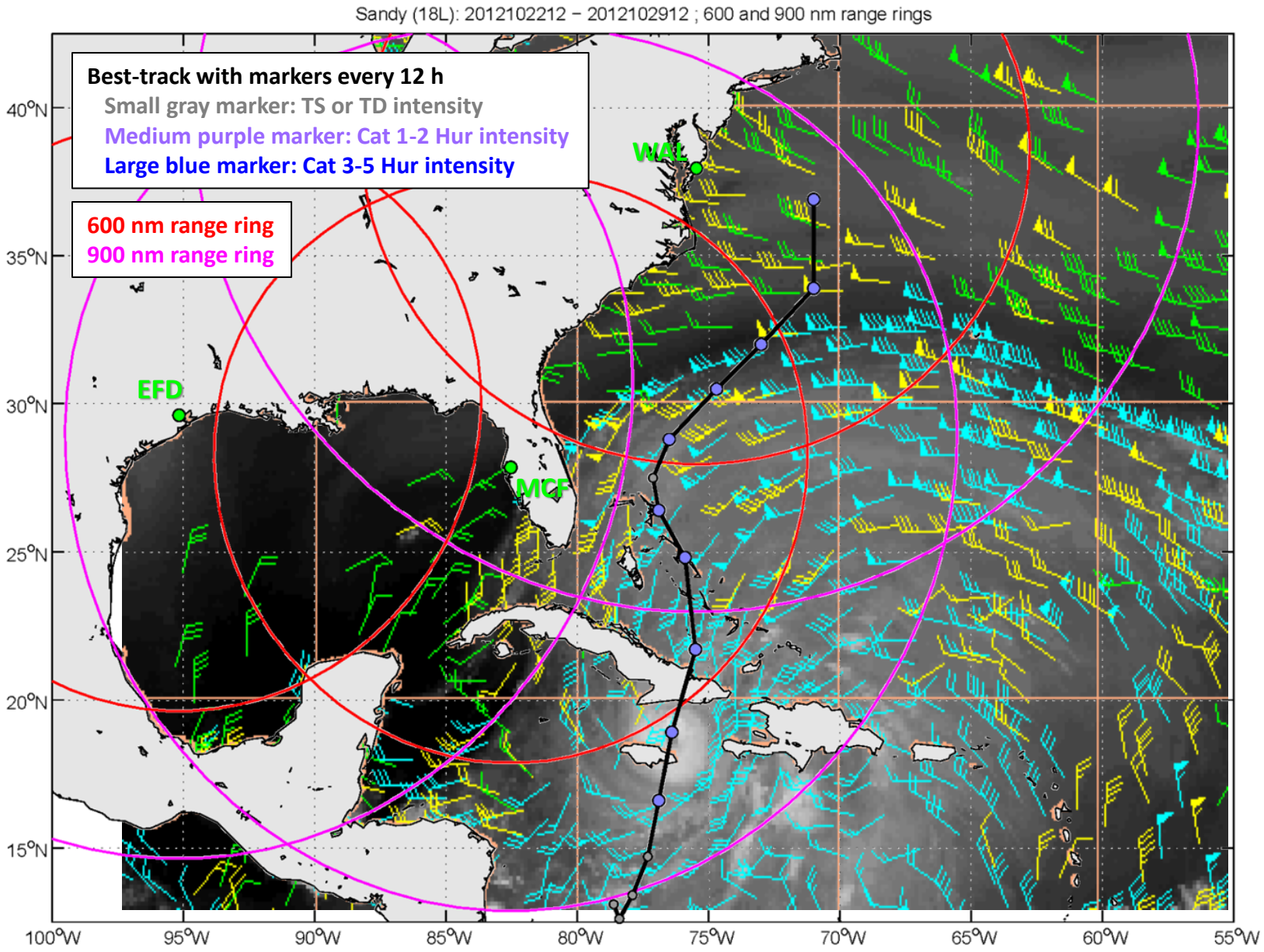
100-250 mb 251-350 mb 351-500 mb



Sandy (18L): 2012102212-2012102912

CIMSS Upper-level AMVs: 2012102400

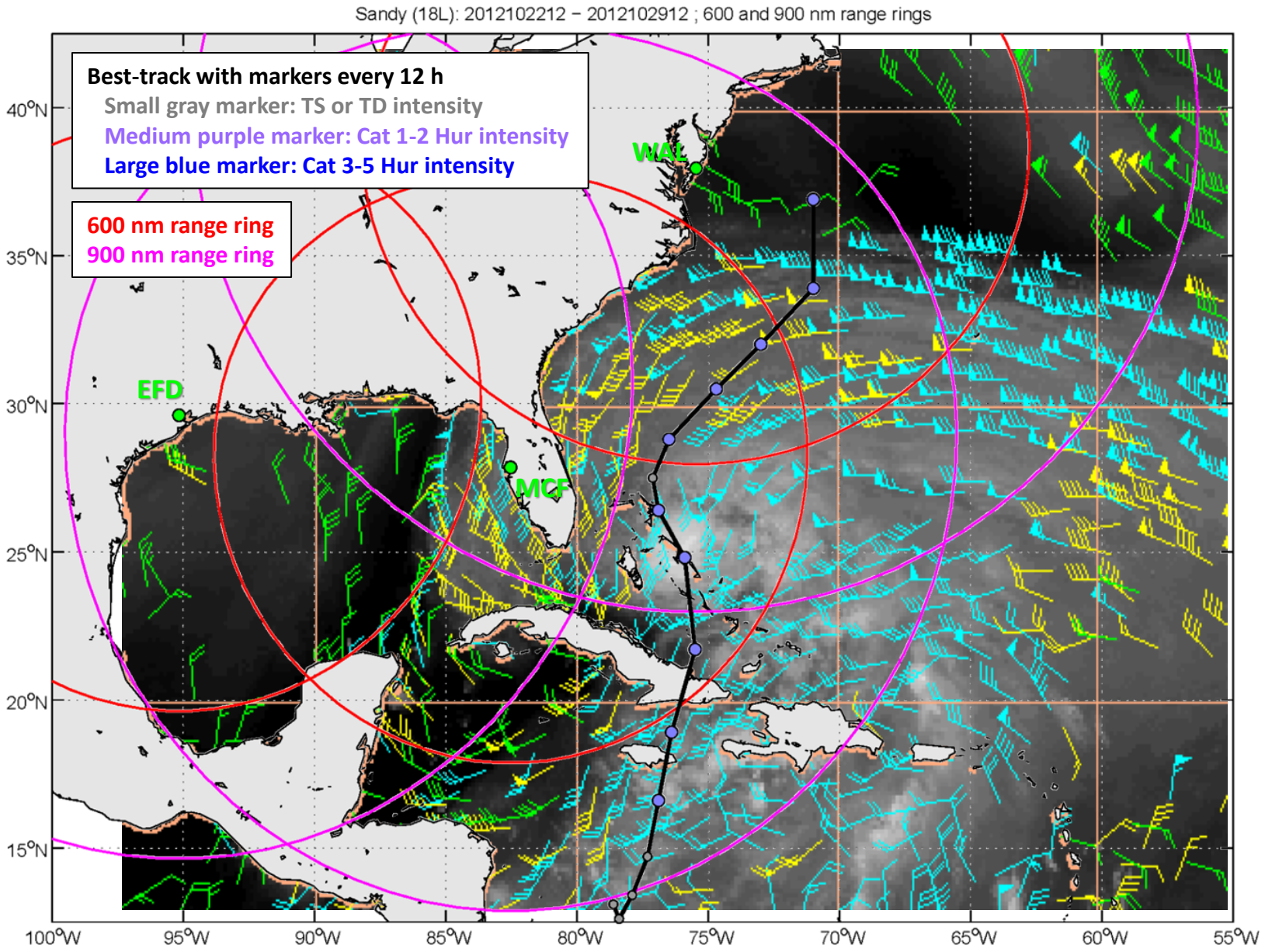
100-250 mb 251-350 mb 351-500 mb



Sandy (18L): 2012102212-2012102912

CIMSS Upper-level AMVs: 2012102500

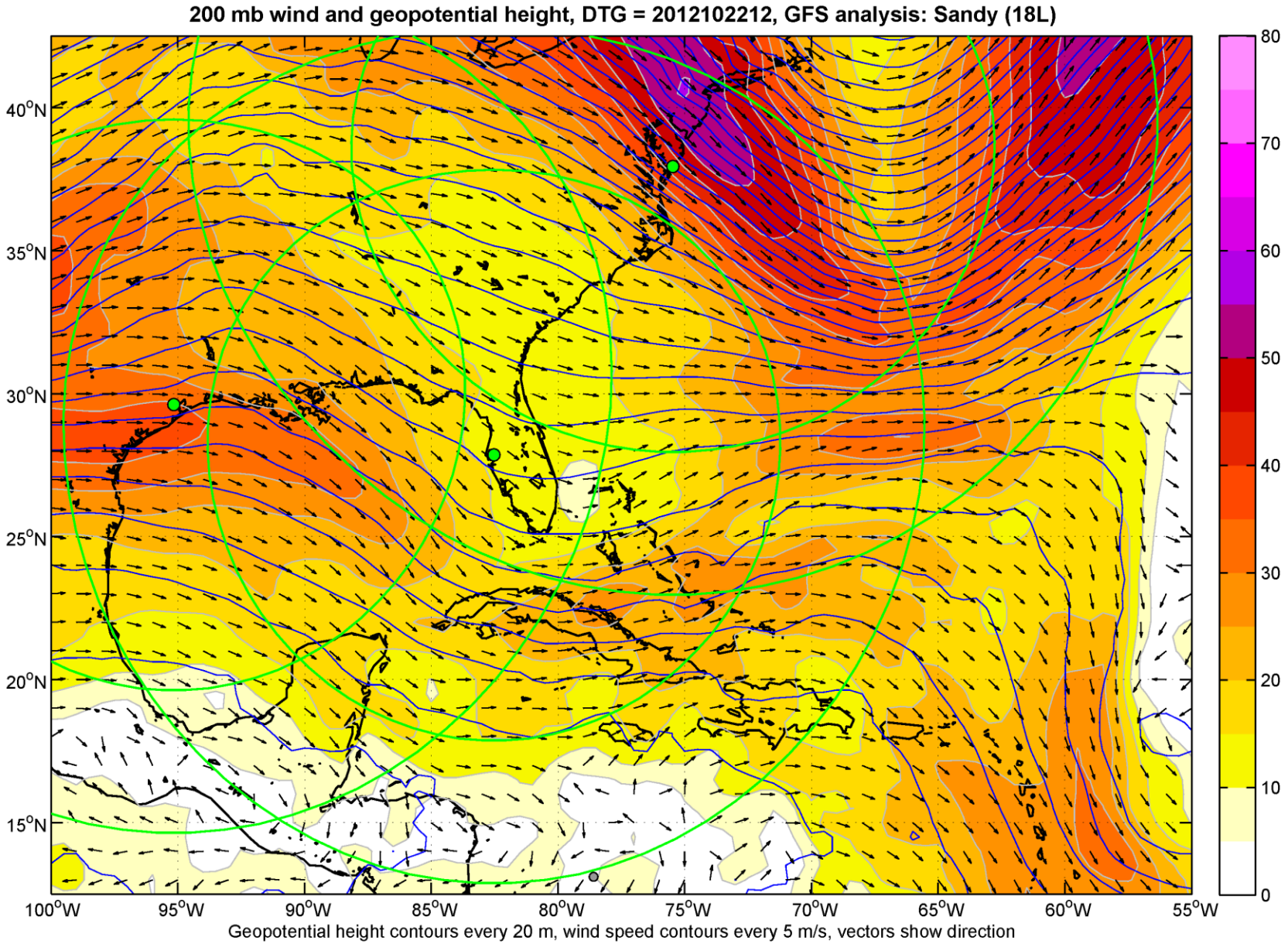
100-250 mb 251-350 mb 351-500 mb



Sandy (18L): 2012102212-2012102912

CIMSS Upper-level AMVs: 2012102600

100-250 mb 251-350 mb 351-500 mb



While centered in the Caribbean, Sandy produced an enormous amount of northwards-directed outflow as the TC interacted with the upper-level trough to its west.

Questions for Sandy:

Q1: Without overflying Cuba, Sandy's core is inaccessible from MCF while it is in the Caribbean. At that time is it worthwhile to fly the outflow north of Cuba?

Scenario #5: East Coast TC: In range from MCF & WAL

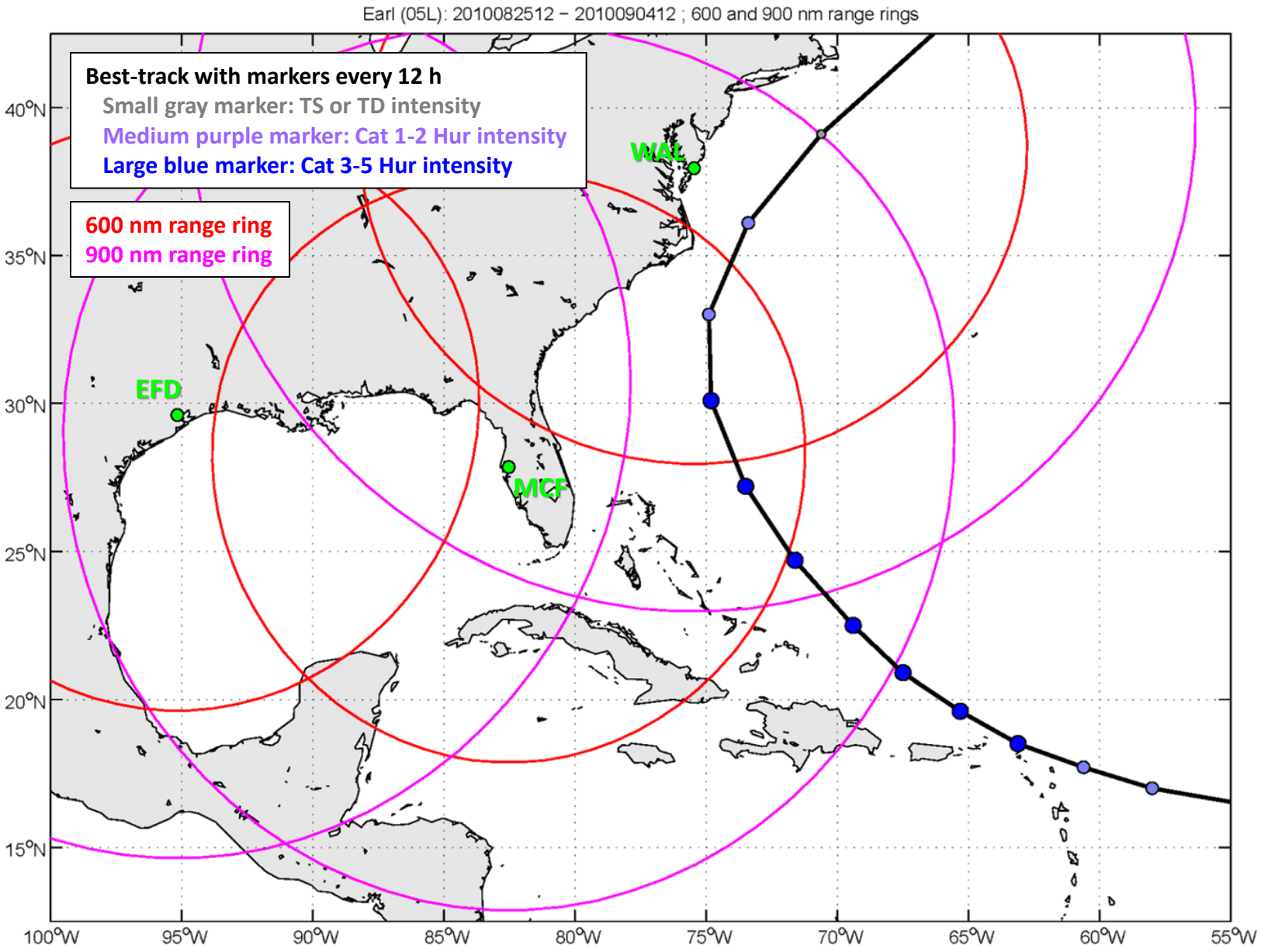
Case Study:

- Earl (05L, 2010)

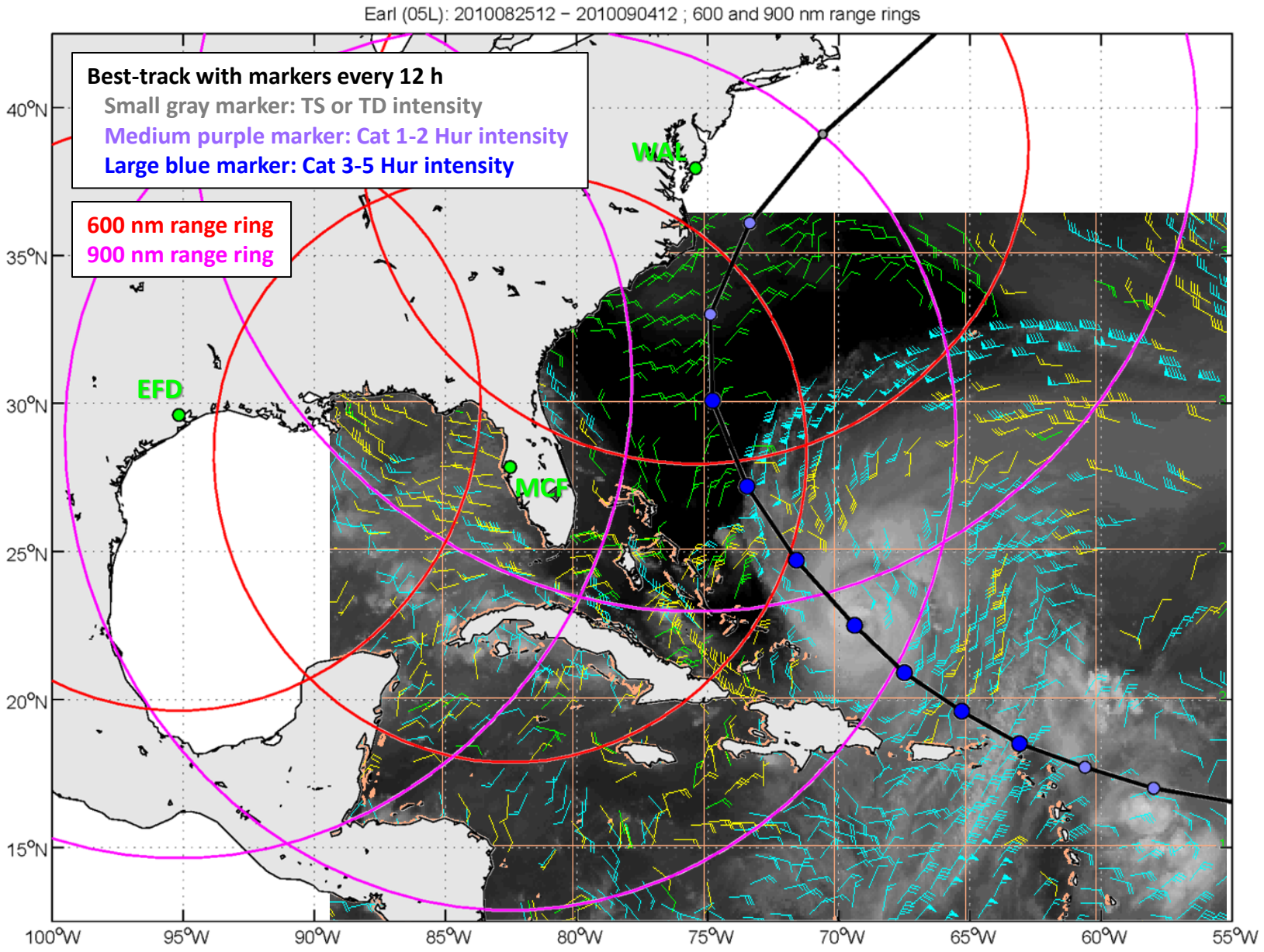
Other examples:

- Arthur* (01L, 2014)
- Bertha* (02L, 2014)
- Cristobal* (04L, 2014)
- Fay* (07L, 2014)
- Gonzalo* (08L, 2014)
- Gabrielle (07L, 2013)
- Irene* (09L, 2011)
- Maria (14L, 2011)

* AMV/range ring plots available, but not included in presentation



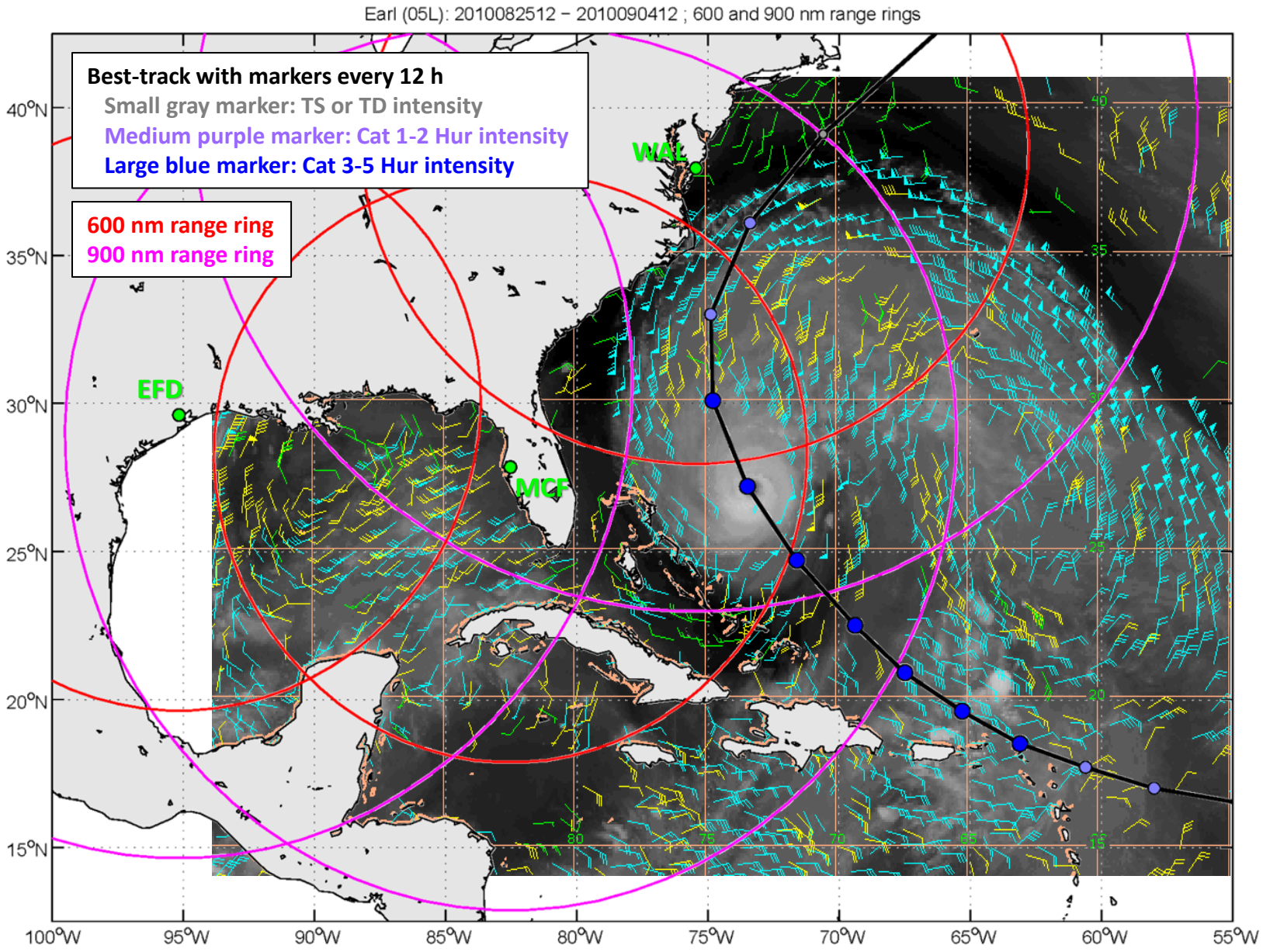
Earl (05L): 2010082512-2010090412



Earl (05L): 2010082512-2010090412

CIMSS Upper-level AMVs: 2010090100

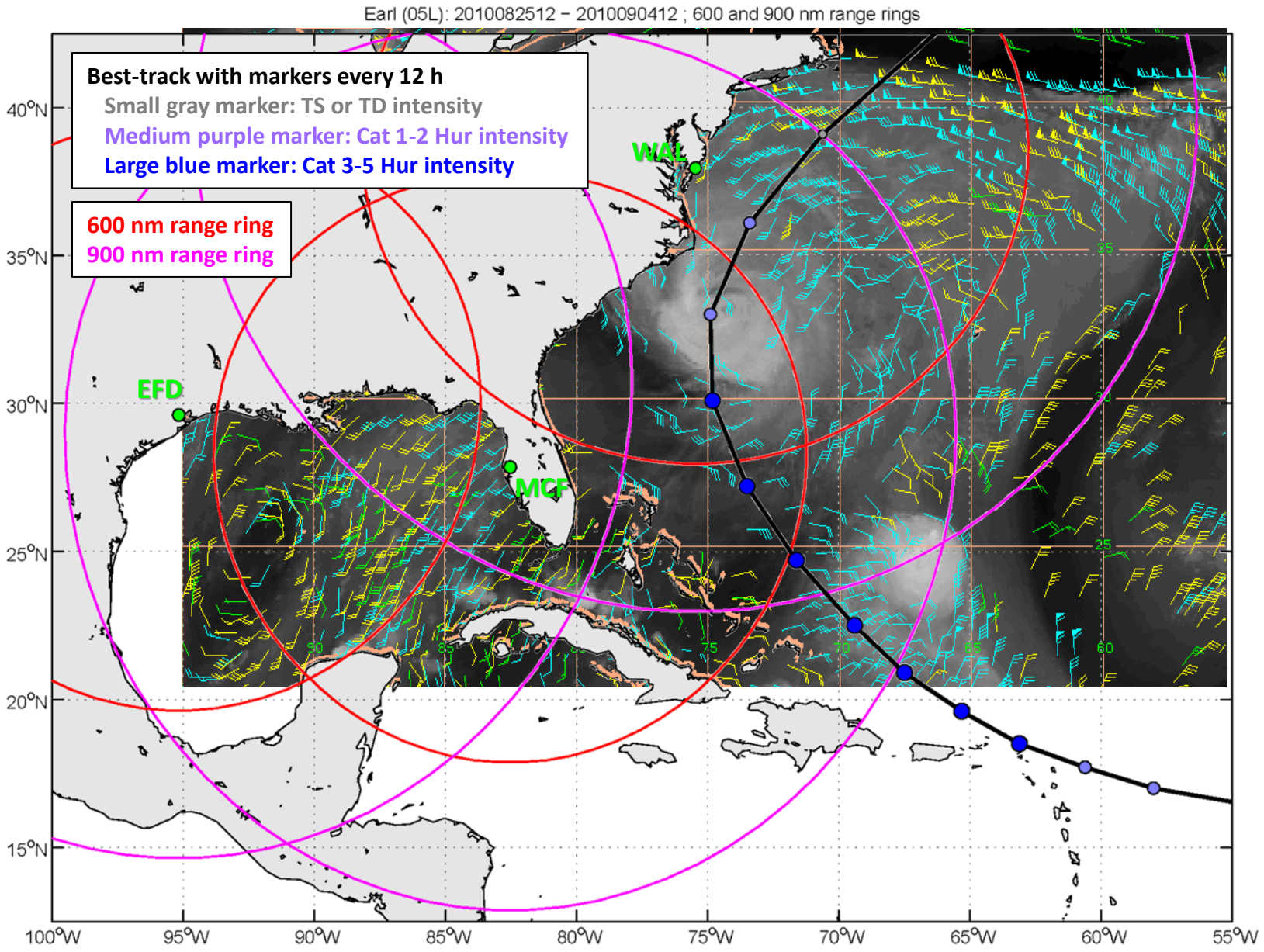
100-250 mb 251-350 mb 351-500 mb



Earl (05L): 2010082512-2010090412

CIMSS Upper-level AMVs: 2010090200

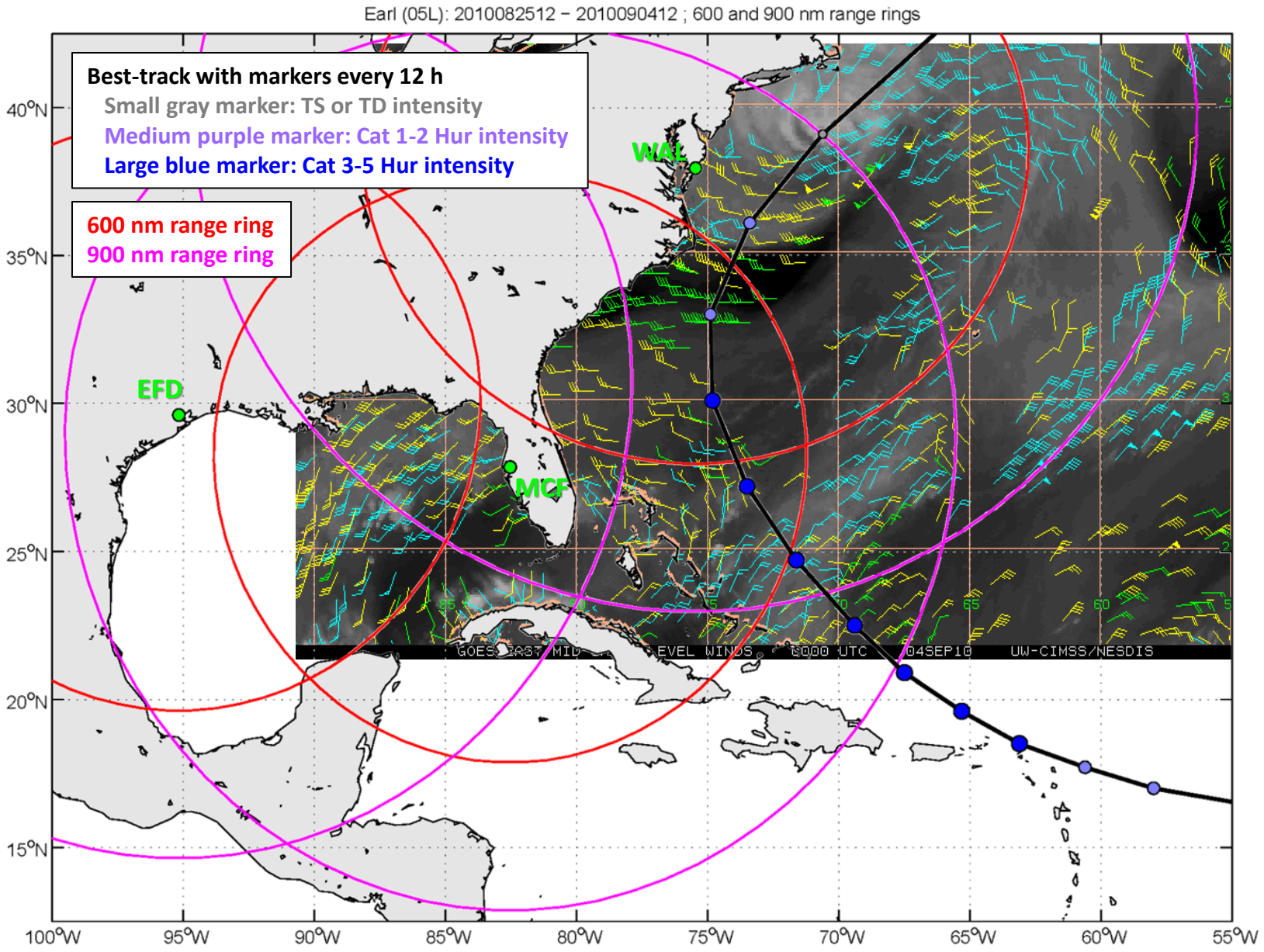
100-250 mb 251-350 mb 351-500 mb



Earl (05L): 2010082512-2010090412

CIMSS Upper-level AMVs: 2010090300

100-250 mb 251-350 mb 351-500 mb



Earl (05L): 2010082512-2010090412

CIMSS Upper-level AMVs: 2010090400

100-250 mb 251-350 mb 351-500 mb

Questions for Earl:

Q1: With the TC threatening WAL, MCF is the clear choice for forward deployment. There would have been plenty of lead time to deploy; Earl was a TC many days before it moved within range of MCF. Flying once per day, definitely 3 and maybe 4 flights would have been possible from MCF. What do we do with this golden opportunity. Repeat the same module day after day to see how the storm evolves. Different modules for different flights to address multiple scientific objectives?

Q2: What if we could deploy to St. Croix? Would we do it, or is it better to deploy to MCF and wait for Earl to get in range?

Scenario #6: East Coast TC: In range from WAL only

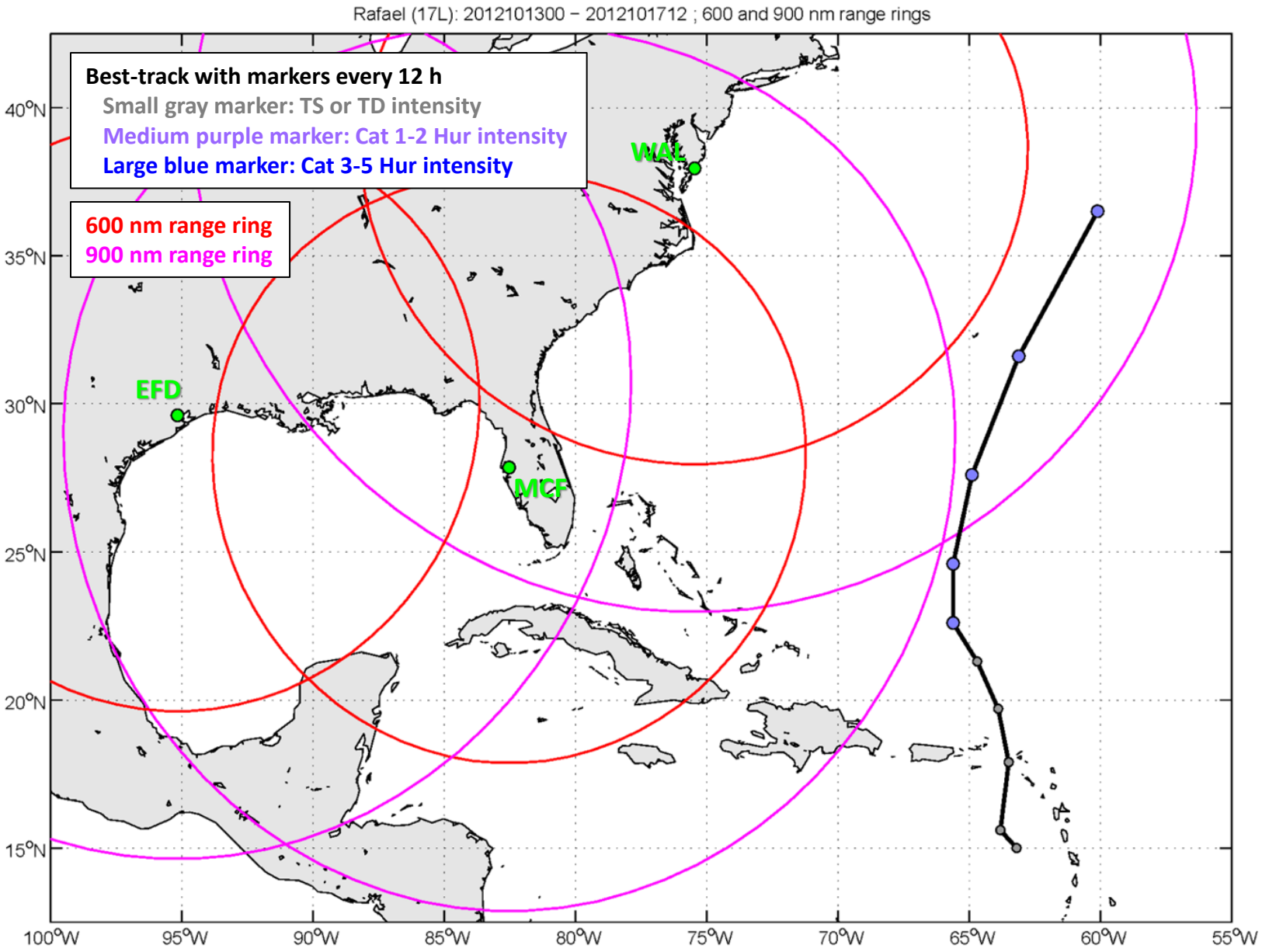
Case Study:

- Rafael (17L, 2012)

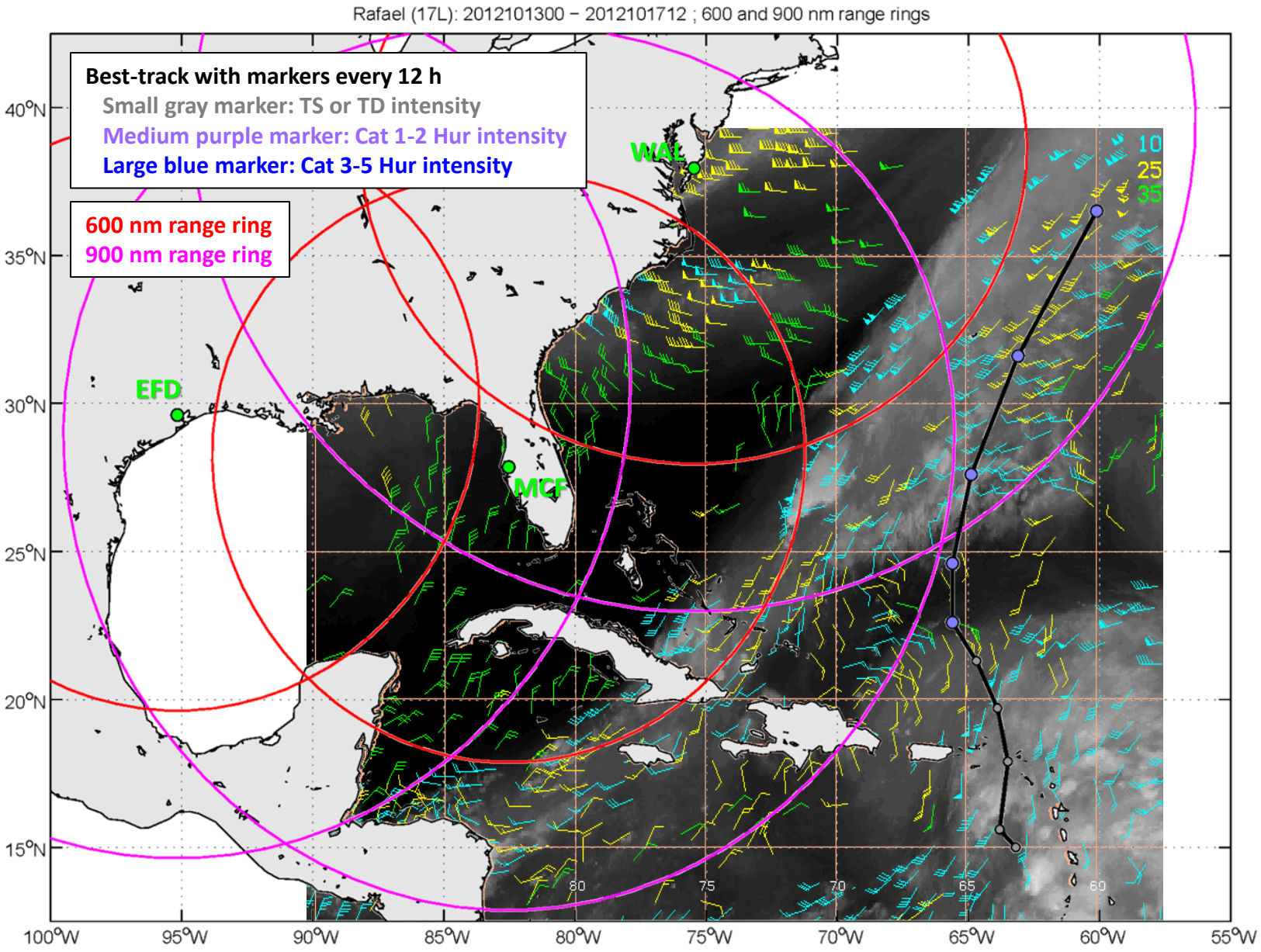
Other examples:

- Leslie (12L, 2012)
- Katia (12L, 2011)
- Ophelia (16L, 2011)
- Igor* (11L, 2010)
- Bill (03L, 2009)

* AMV/range ring plots available, but not included in presentation



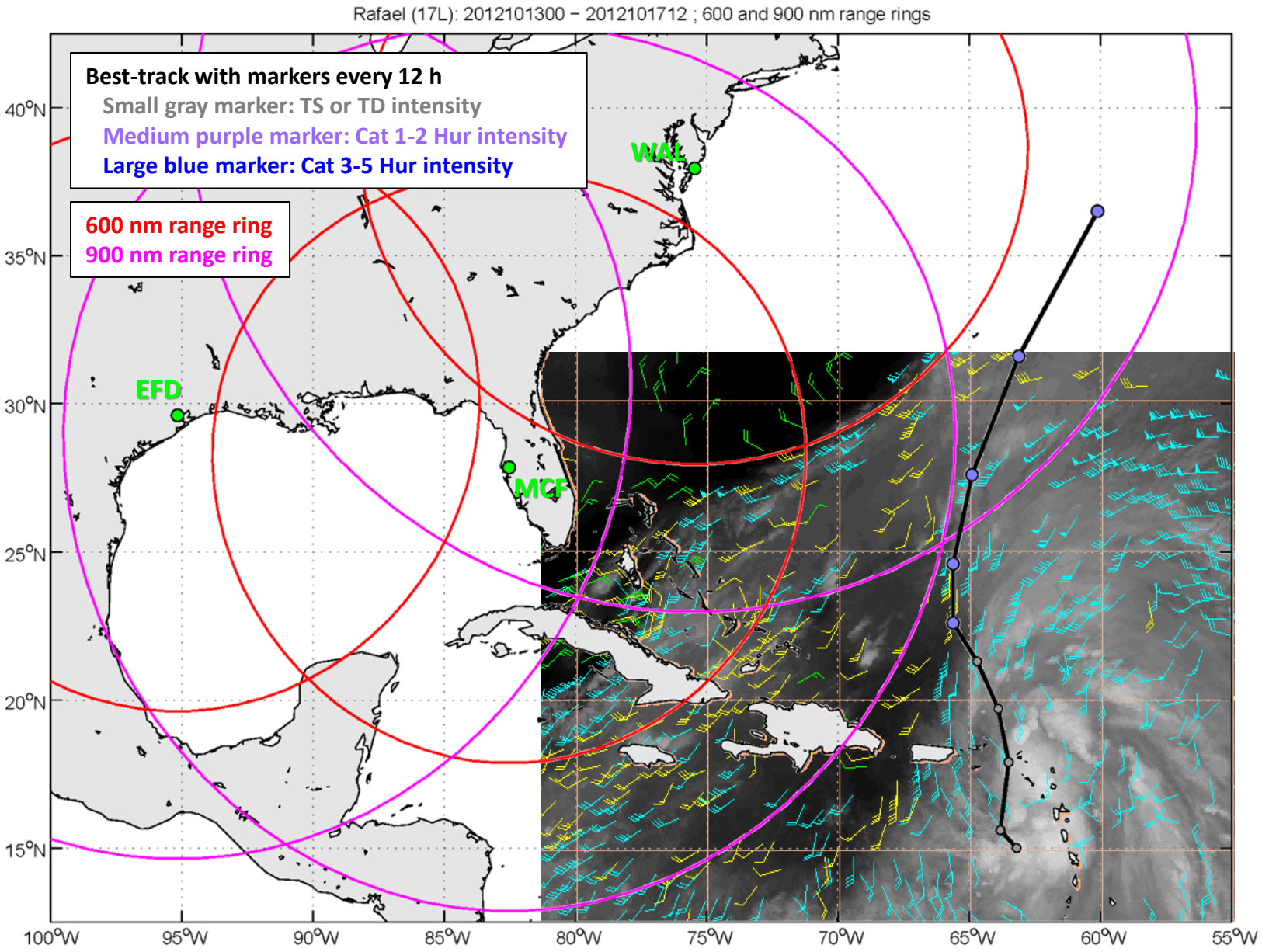
Rafael (17L): 2012101300-2012101712



Rafael (17L): 2012101300-2012101712

CIMSS Upper-level AMVs: 2012101300

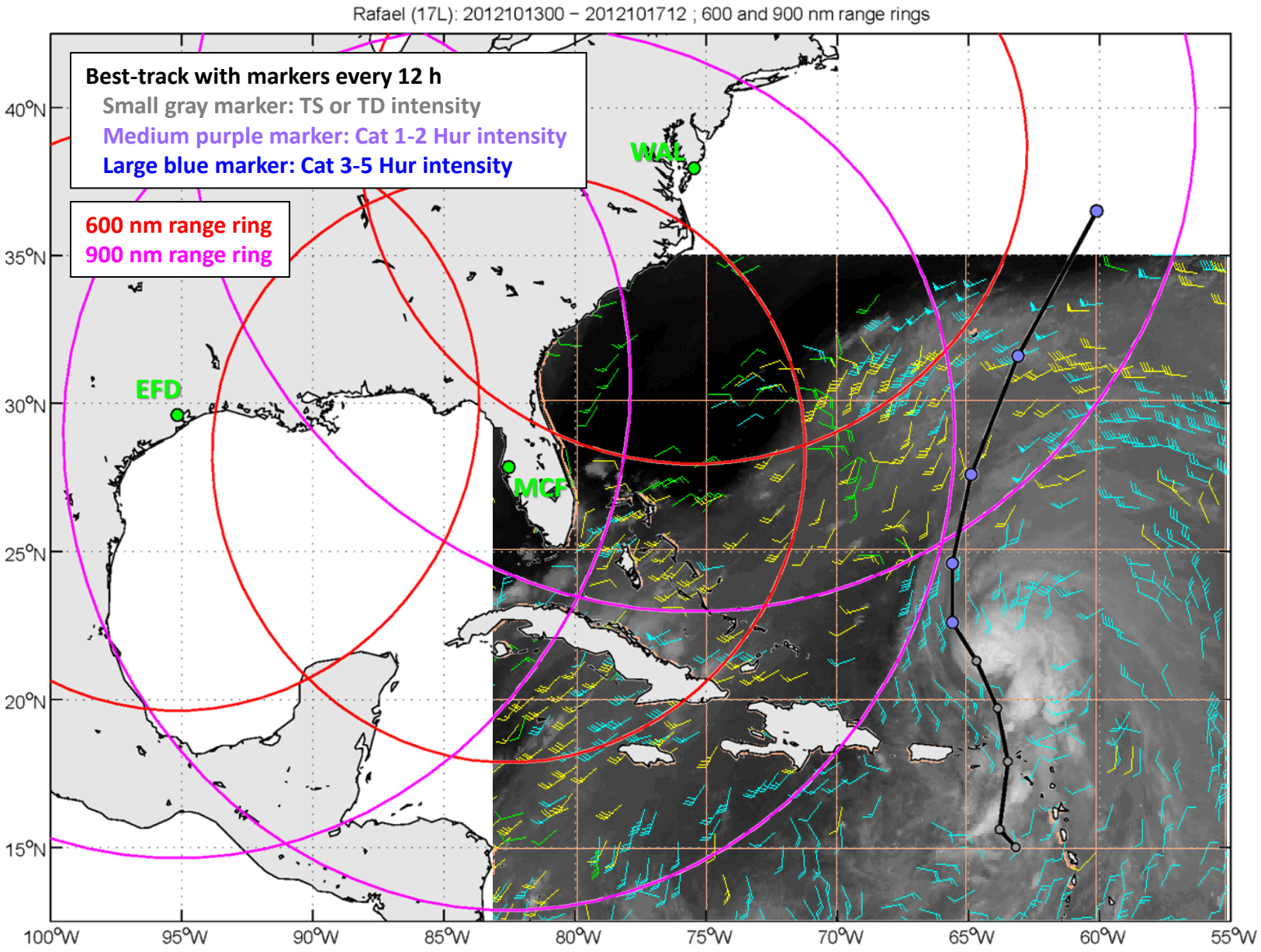
100-250 mb 251-350 mb 351-500 mb



Rafael (17L): 2012101300-2012101712

CIMSS Upper-level AMVs: 2012101400

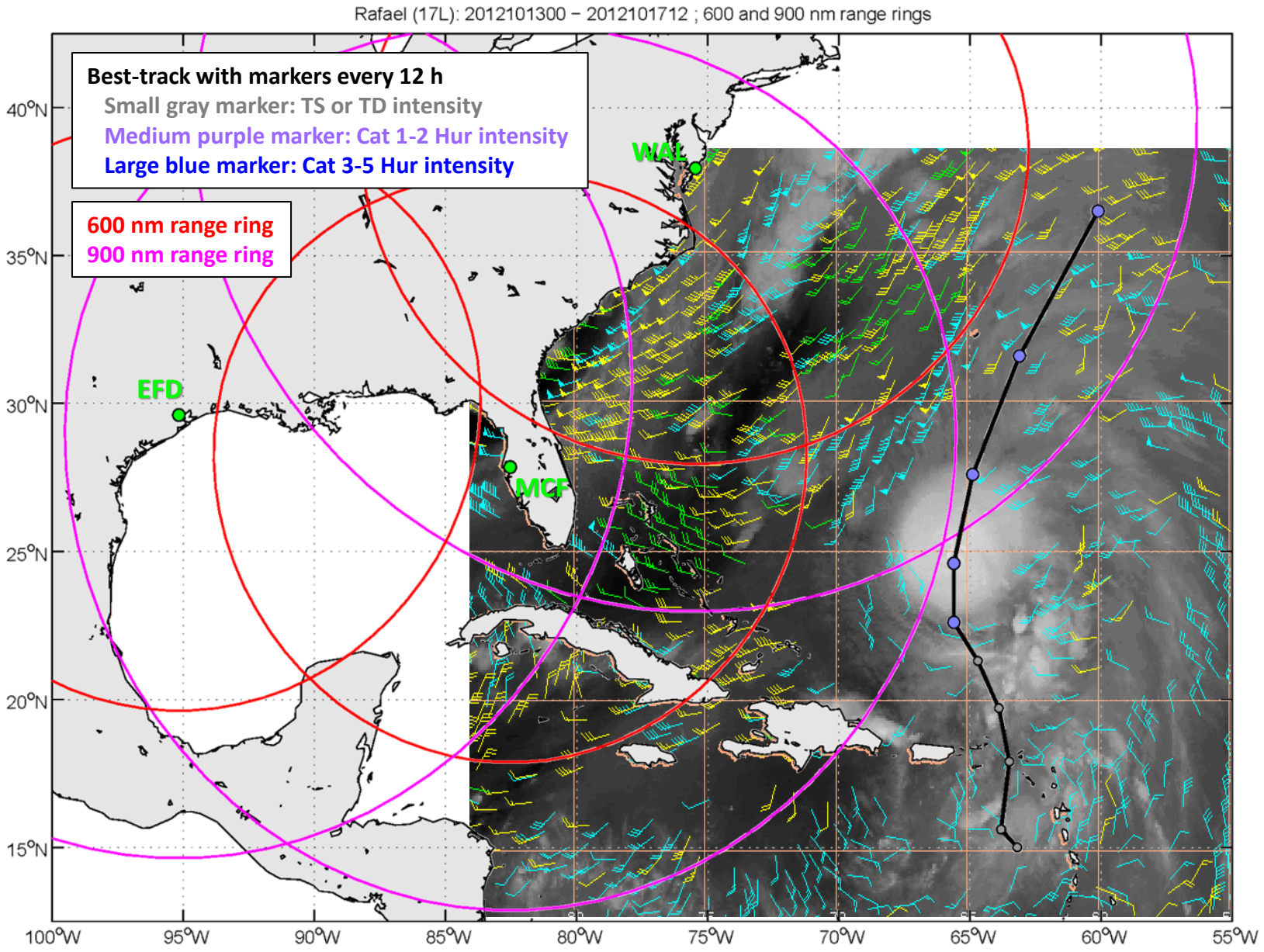
100-250 mb 251-350 mb 351-500 mb



Rafael (17L): 2012101300-2012101712

CIMSS Upper-level AMVs: 2012101500

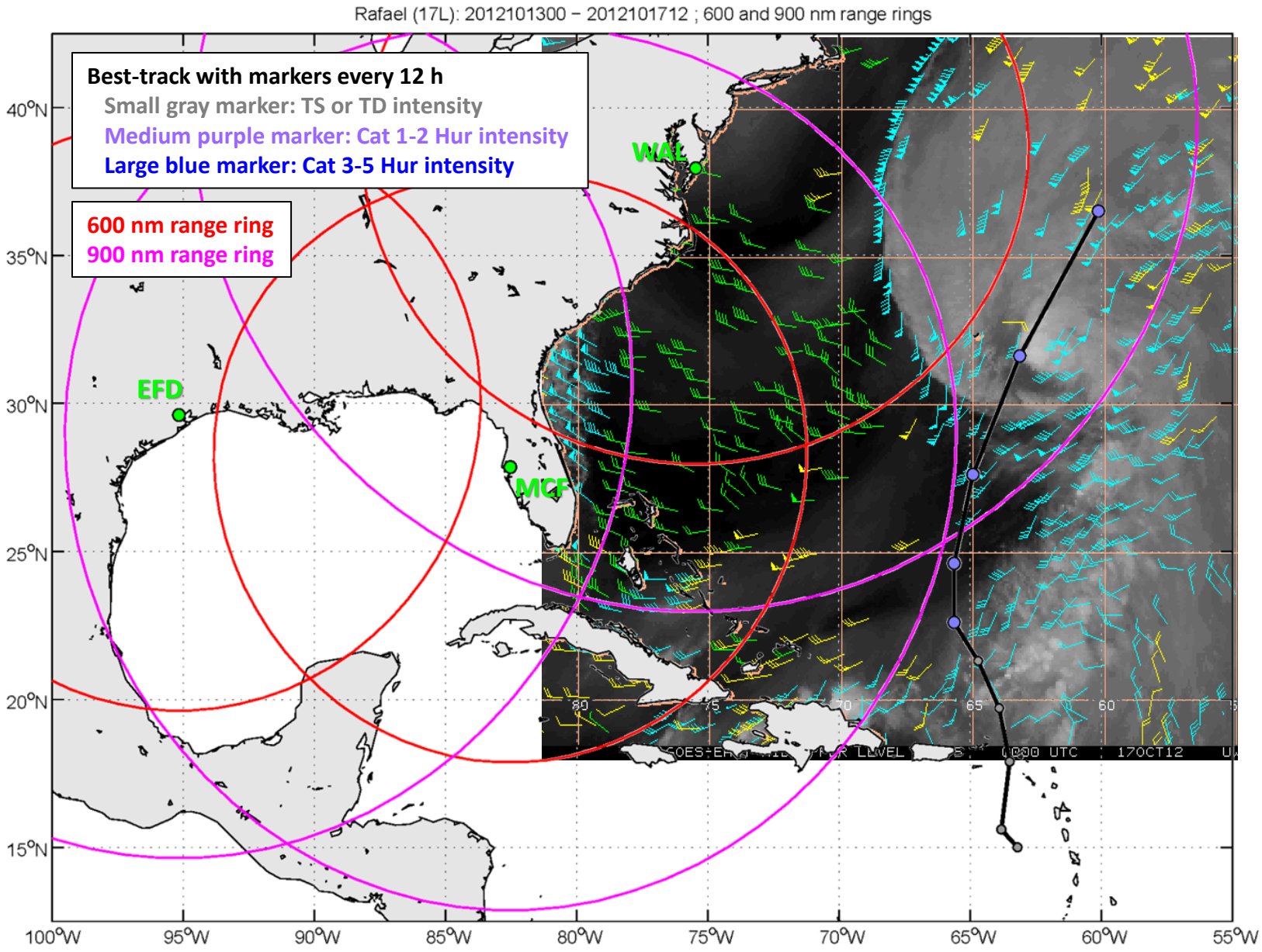
100-250 mb 251-350 mb 351-500 mb



Rafael (17L): 2012101300-2012101712

CIMSS Upper-level AMVs: 2012101600

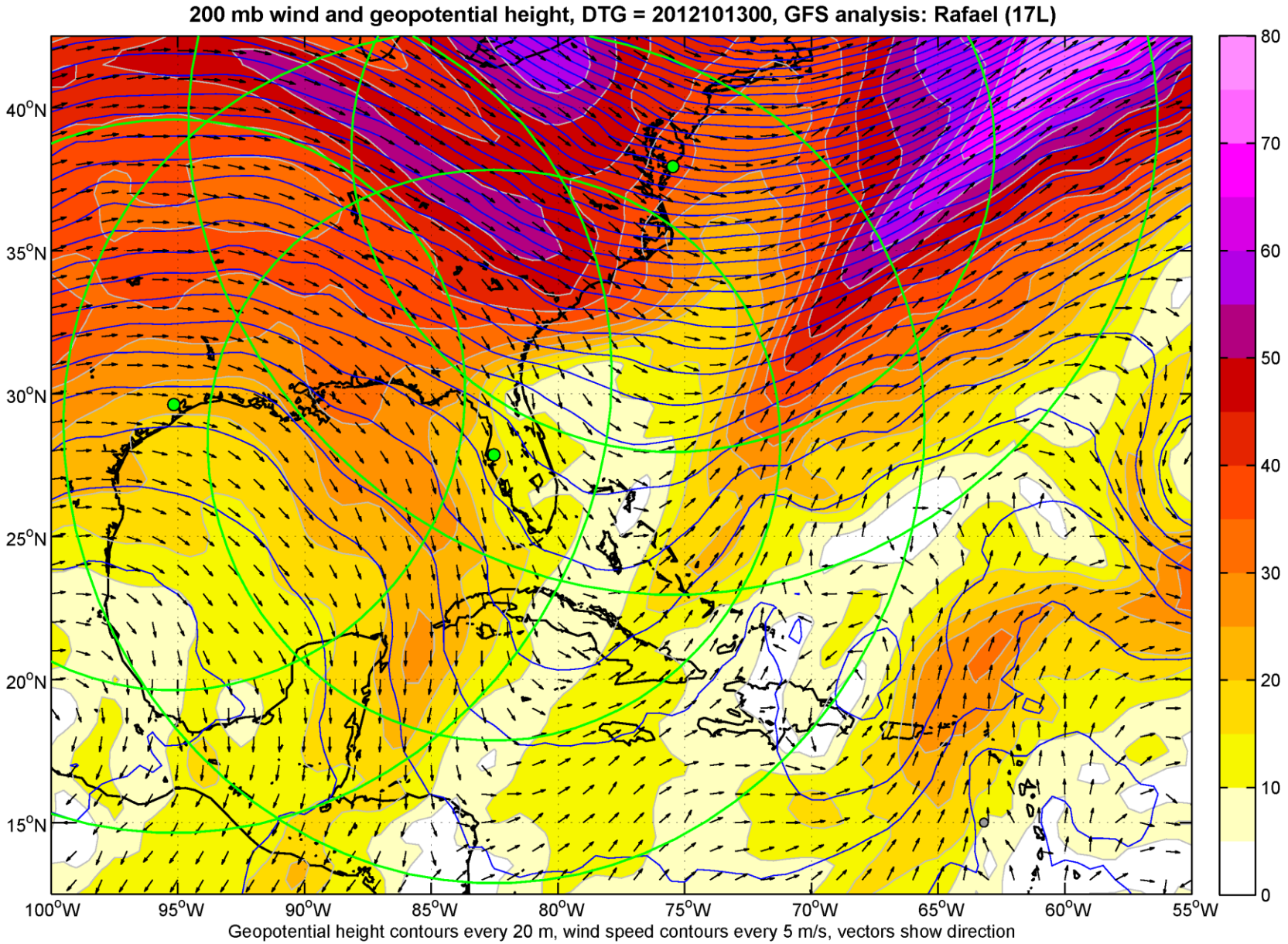
100-250 mb 251-350 mb 351-500 mb



Rafael (17L): 2012101300-2012101712

CIMSS Upper-level AMVs: 2012101700

100-250 mb 251-350 mb 351-500 mb



Typical outflow pattern for the TC interacting with a large-scale trough approaching from the west

Questions for Rafael:

Q1: From Wallops, with daily flights you can get 1 or perhaps 2 flights into Rafael, as it is interacting with the mid-latitude plot and undergoing extratropical transition. Is it worth deploying to Wallops for this?

Q2: Once you get far enough north, commercial air traffic wants to ride the outflow on the way to Europe. What do we know about how commercial air traffic will affect our ability to do drops?