Observation System Simulation Experiments (OSSE)

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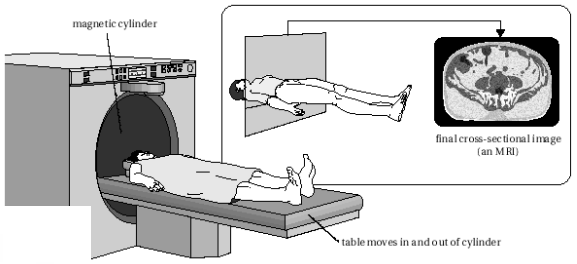
Design of an observation system

-- Integration into existing systems

- Extremely expensive to build and maintain new observation systems;
- Unknown potential impact on weather and climate in addition to existing systems;
- Proper implementation and operation may maximize its impact.

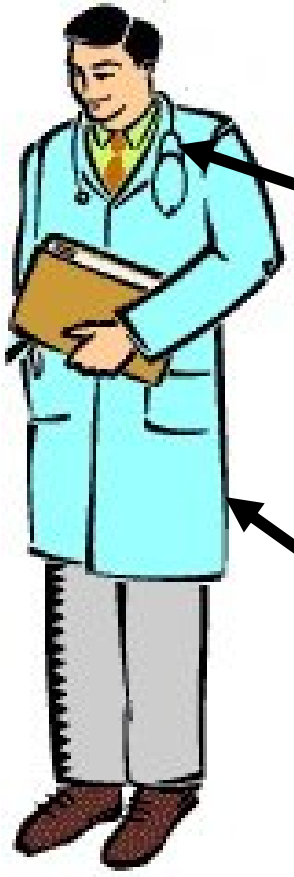
OSSE

New instrument?



“ True” Atmosphere

Nature Run



Old Observation instrument

Analysis and Forecast system

OSSE

Design, Simulation and Demonstration

- Benefit - Cost evaluation (*design and decision*);
- Operational experience (*simulation and learning*);
- Optimal design: where, when and what to observe for gaining best results (*design and demonstration*).

More importantly, OSSE can be done even before an observation network is physically built.

OSSE is a complex system

Analysis, forecast, and verification

- A nature run (a model forecast as "true atmosphere") closely reflecting the reality;
- Construction of existing observation datasets and new observations from the nature run;
- Introduction of errors (obs, representative errors) representing those in reality;
- Calibration so that the existing obs impact in real and simulated atmospheres is similar based the forecast model and data assimilation technique.

ECMWF nature run

Low Resolution Nature Run

Spectral resolution : T511
Vertical levels: L91
3 hourly dump, total 3.8 TB
Initial conditions: 12Z May 1st, 2005
Ends at: 0Z Jun 1,2006
Daily SST and ICE: provided by NCEP
Model: Version cy31r1
Completed in July 2006, rerun October 2006

ESRL copy saved at GSD mass storage

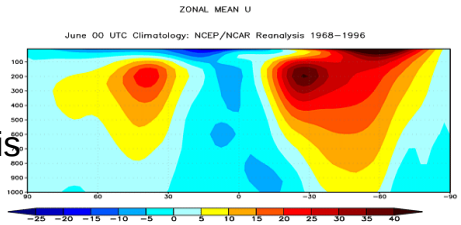
High Resolution Nature Run

for a selected period
Hurricane season is recommended
T799 resolution, 91 levels,
one hourly dump
Get initial conditions from low resolution-NR

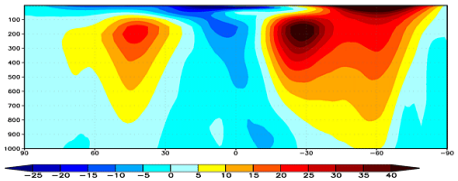
Initial Diagnostics of the Nature run

Zonal wind June 2006
By Juan Carlos Jusem (NASA/GSFC)

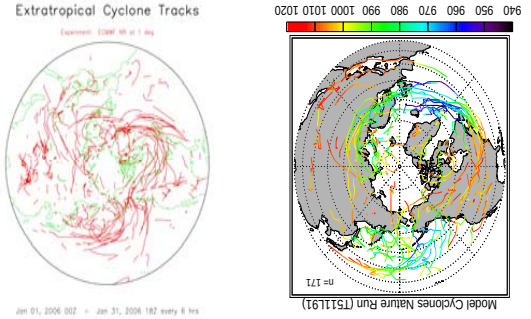
NCEP reanalysis



Nature Run



NH Cyclones Track
Joe Terry NASA/GSFC and Thomas Jung (ECMWF)



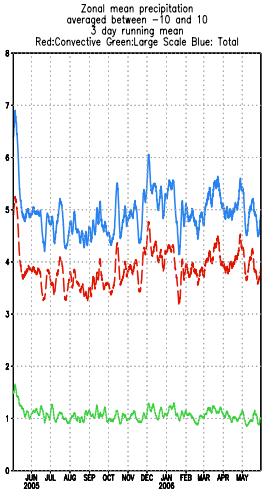
Study of drift in NR
Michiko Masutani (NCEP)

Area averaged precipitation

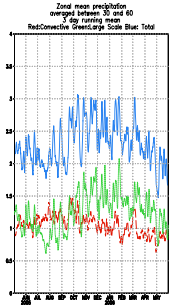
It takes about two to three weeks to settle tropical precipitation.
- Michiko Masutani (NCEP/EMC)

Convective precipitation
Large Scale precipitation
Total precipitation

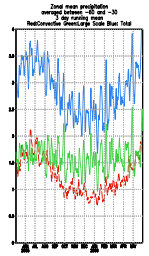
Tropics



NH mid-latitudes

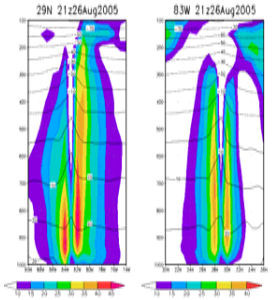


SH mid-latitudes



The African Monsoon Region and the Tropical Atlantic
Oreste Reale NASA/GSFC

HL vortices: vertical structure



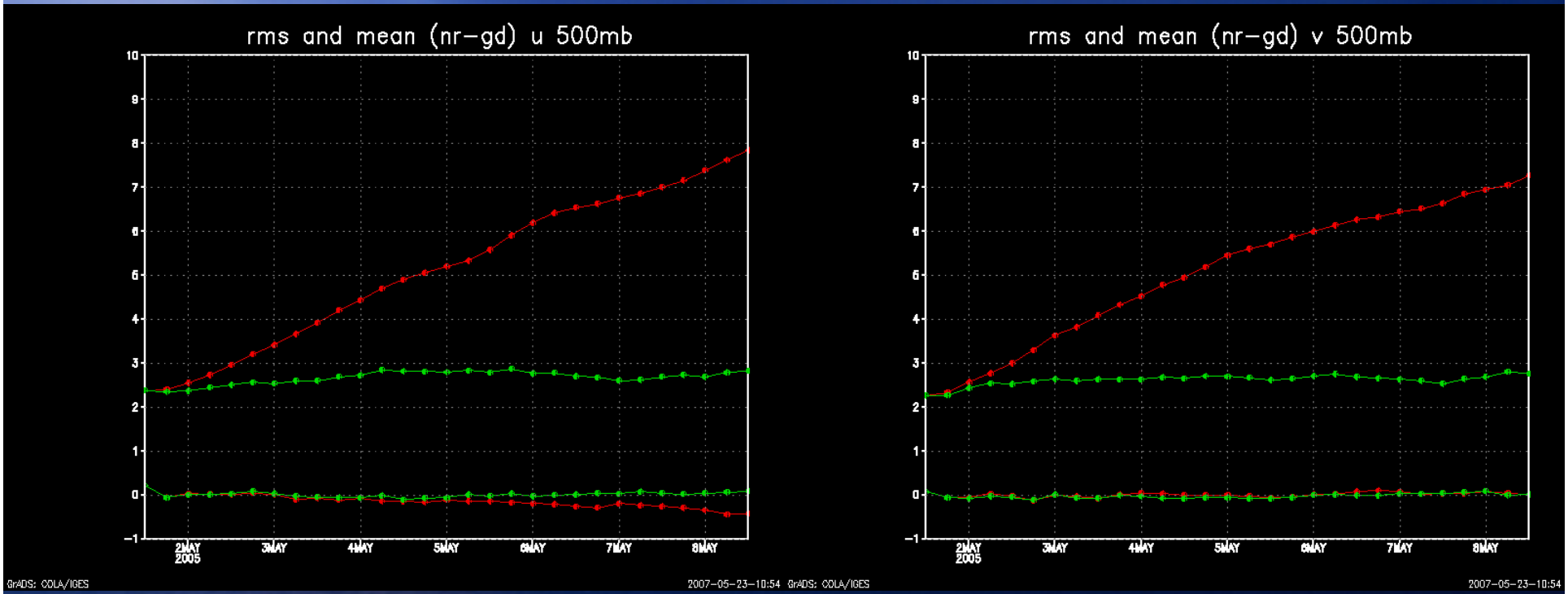
Vertical structure of a HL vortex shows, even at the degraded resolution of 1 deg, a distinct eye-like feature and a very prominent warm core.
-- Oreste Reale (NASA/GSFC/GLA)

A global OSSE test case

Model: Global Forecast System (GFS);
Analysis: Gridpoint Statistical Interpolation (GSI);
Nature Run: ECMWF forecast;
Platform: NCEP/IBM
Time period: May 1, to May 8, 2005;
Test dataset: 17,835 (spd); 64,458 (q); 48,104 (t)
477,874 (uv), 53,574 (ps)
Including:
raob, pibal, acar,airep,pirep,cloud
tracked wind,profilers,metar,ship,
buoy,ssmi/wind,quikscat,
generated
from the nature run.

Time sequence of RMS and mean at 500mb (wind)

red: NR-NO; green: NR-CO

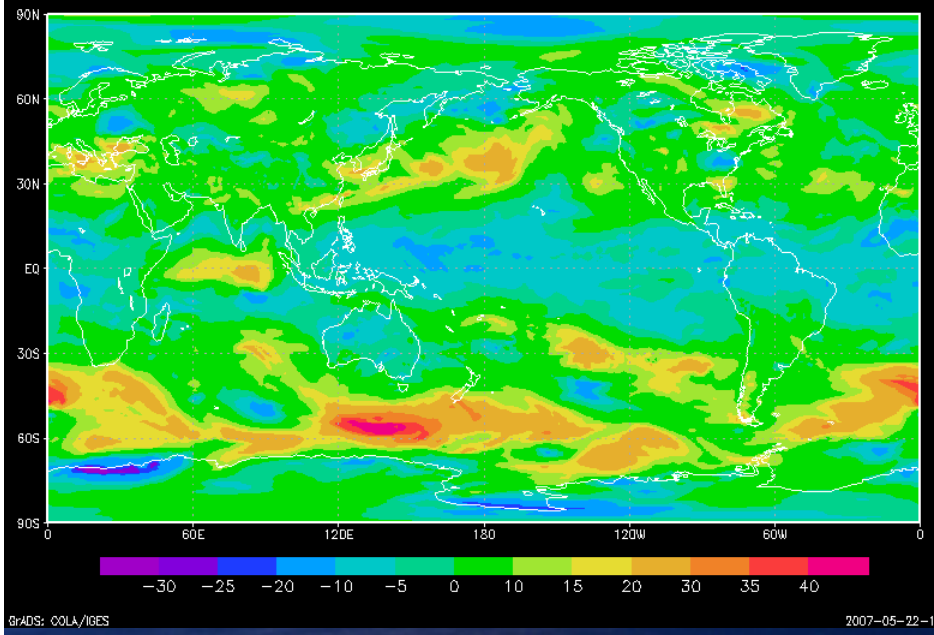


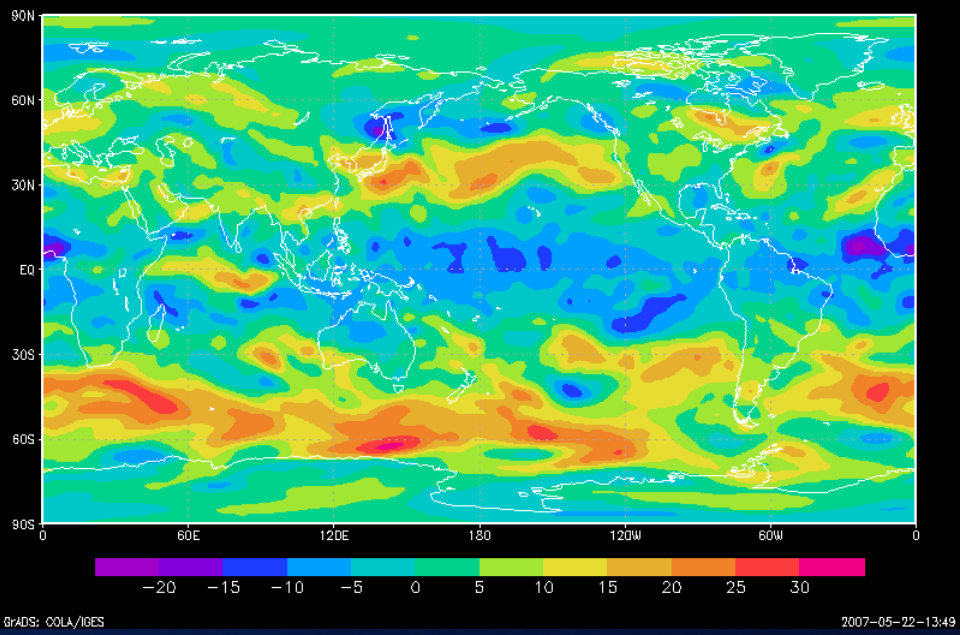
Wind (U) comparison (700mb)

at 12Z May 8, 2005

ECWMF nature run

OSSE without obs



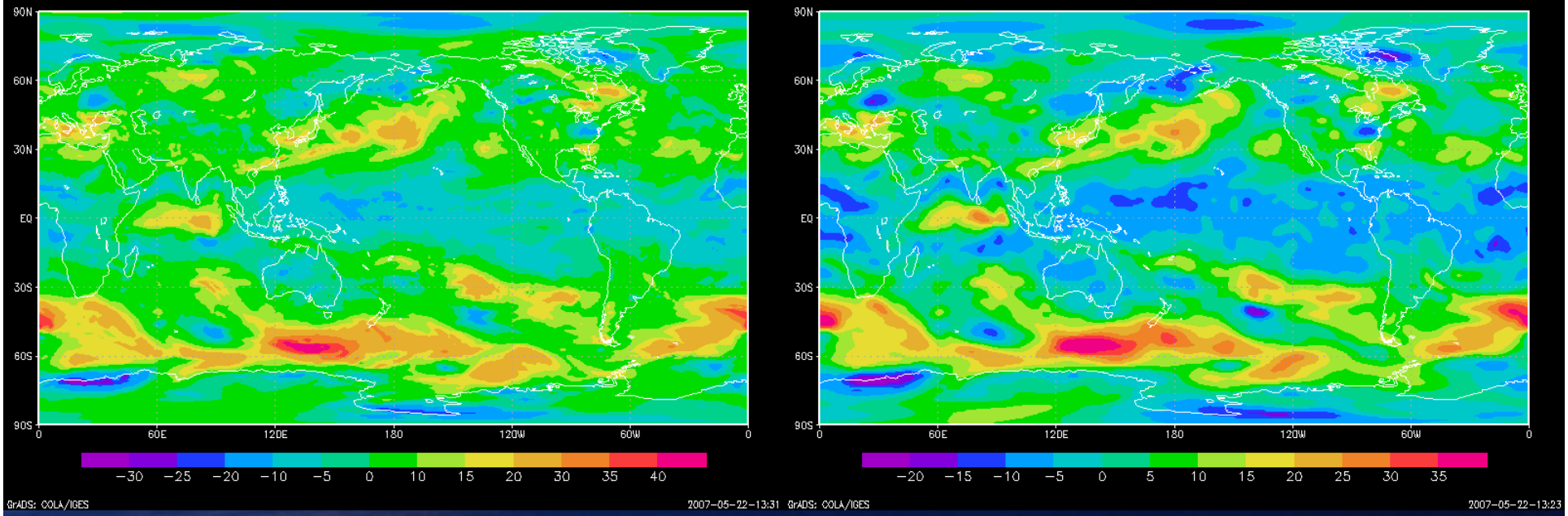


Wind (U) comparison (700mb)

at 12Z May 8, 2005

ECWMF nature run

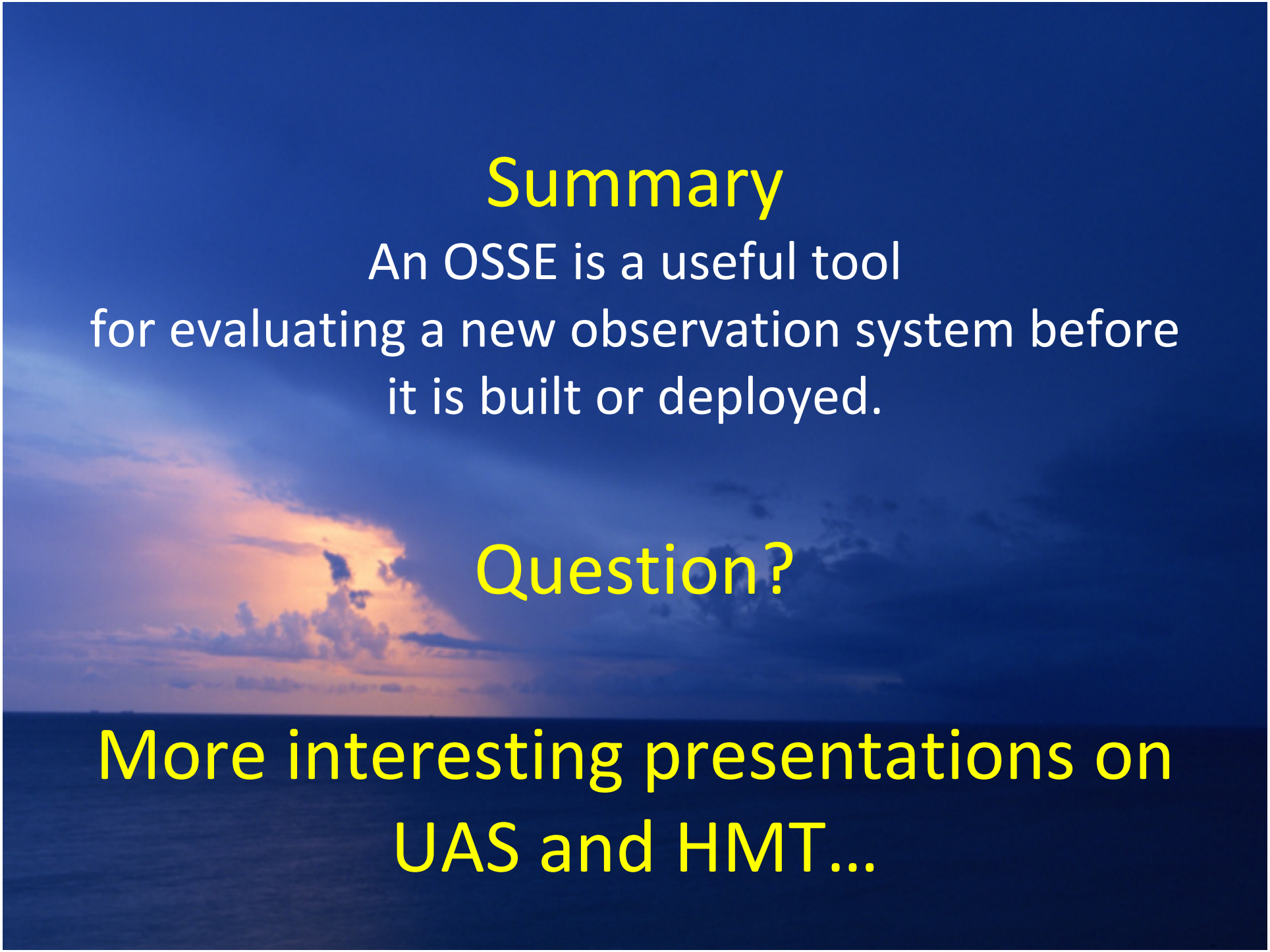
OSSE with “convention” obs



ESRL OSSE

Goal: support future observation systems

- Joint effort with several institutes, NCEP, JCSDA, NASA, ECWMF, SWA;
- Usage of ECMWF one year forecast as nature, GFS as forecast model, GSI as data assimilation technique;
- Potential applications to UAS and HMT.


Summary
An OSSE is a useful tool
for evaluating a new observation system before
it is built or deployed.
Question?
More interesting presentations on
UAS and HMT…