Water Vapor and Cloud Prediction Model

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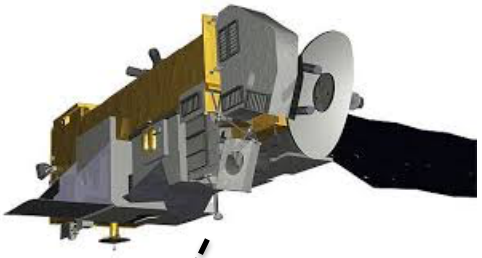
How does the model work?

- **The model uses the RDF technique to create a high resolution water vapor, O3 and CO field.**
  - The RDF technique used back trajectories initialized on a *regular grid.*
  - Using the GFS forecast data the trajectories are moved backward in time to where NRT MLS measurements of water vapor, ozone and CO are measured.
  - The measurements are then interpolated onto the trajectory end points.
  - The values are then moved forward in time to tine initialization point – which is the *regular grid*.
- **For water vapor, the model uses the temperature along the trajectory along with a simple cloud model to dehydrate the air parcel and compute where there would be clouds.**
  - The cloud model needs to know the nucleation threshold (which can be varied – I have been using 130%)
  - There is also a GFS temperature offset. GFS during ATTREX was warm biased – I have been using -0.5K. This accounts for bias and other errors like lack of gravity waves and the finite vertical resolution of the tropopause.
  - Convective moistening in included GFS convection forecast. If the air parcels encounter convection, the parcel RH is set to 100%
- **Model results are posted on Bocachica – when it up. Calculations are run on NASA Ames Pixels computer**

Picture of this process …



Initiate regular grid (1)

Run backward to here (2)

Irregular grid

Interpolate MLS Data to points (3)

Follow path forward (4)

Saturation

Cloud model

Convection

MLS NRT

Now

12

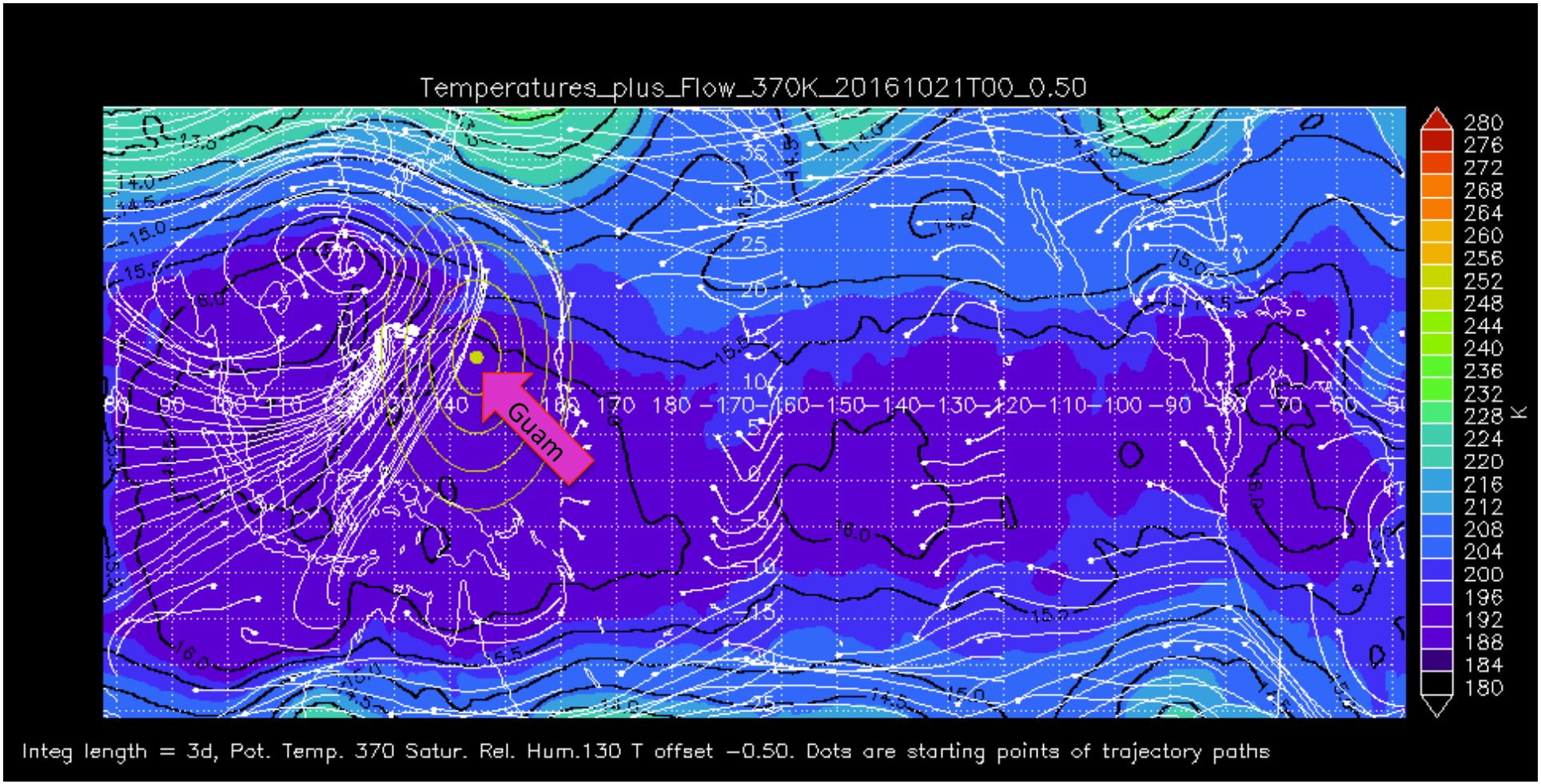
24

36

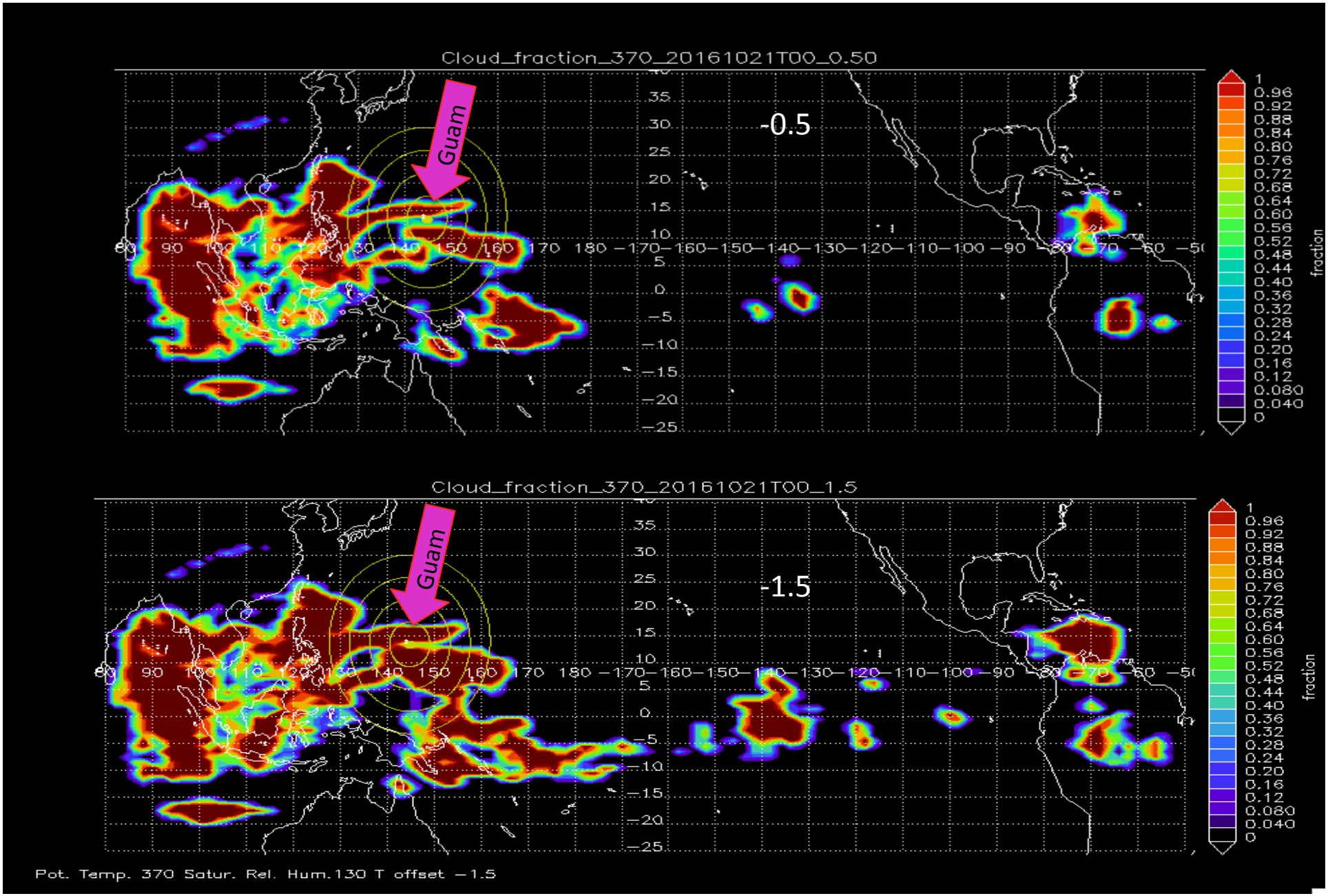
48

Forecasts

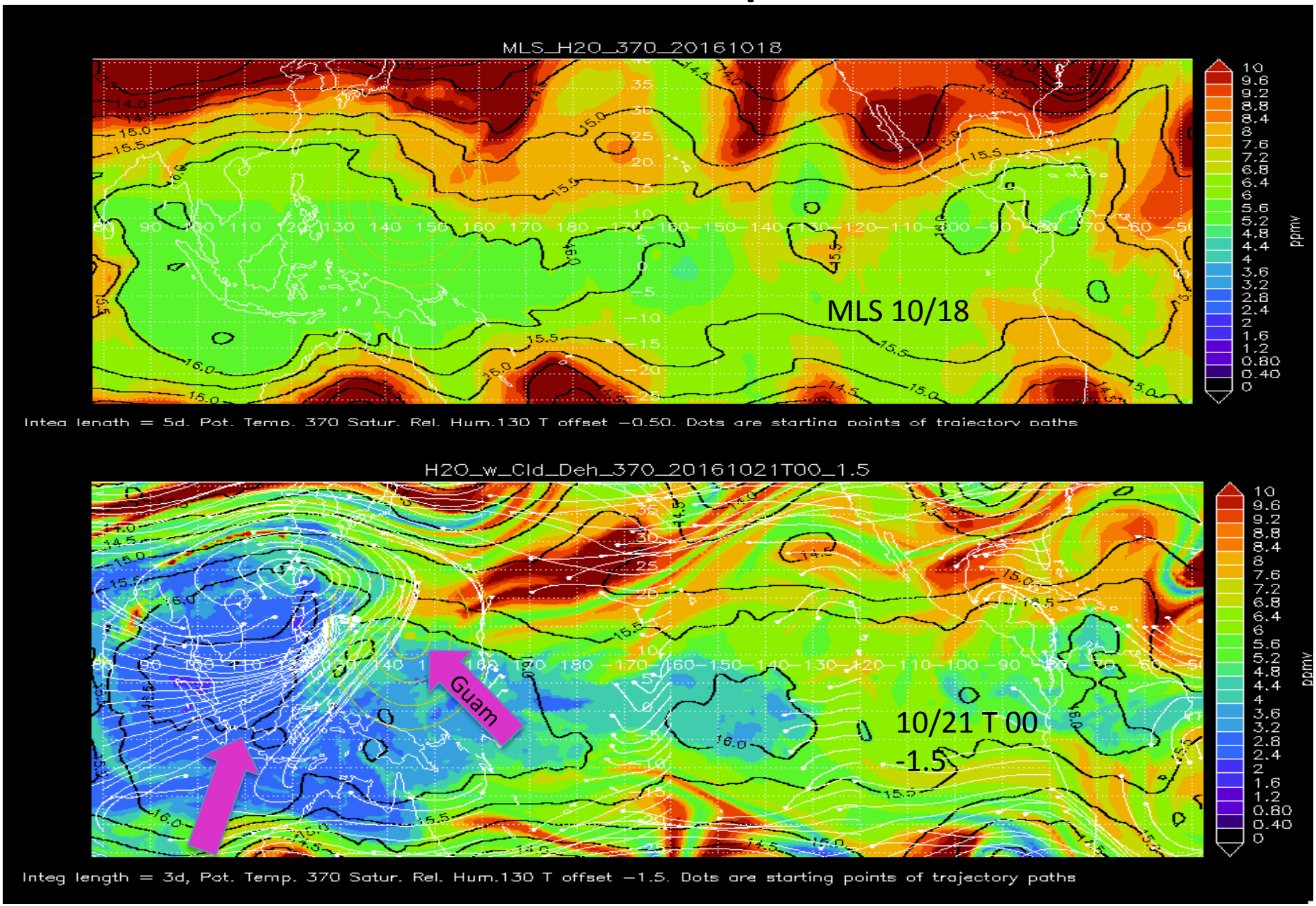
Temperature and Flow



Cloud Fraction



Water vapor


MLS_H2O_370_20161018
MLS 10/18
ppmv
Integ length = 5d, Pot. Temp. 370 Satur. Rel. Hum.130 T offset −0.50. Dots are starting points of trajectory paths
H2O_w_Cld_Deh_370_20161021T00_1.5
Guam
10/21 T 00
-1.5
ppmv
Integ length = 3d, Pot. Temp. 370 Satur. Rel. Hum.130 T offset −1.5. Dots are starting points of trajectory paths

What we hope to learn

- Better tune the cloud model – this model is being used for global calculations. Input variables include nucleation threshold, ambient aerosols, cloud depth, etc..
- Determine the role of convective moistening. My global model suggests that convection above 360K contributes to only 0.7 ppmv water to the stratosphere.
- Role of convection in ozone – in principle convection brings up low ozone just as it moistens. This should affect the O_3 RDF…