

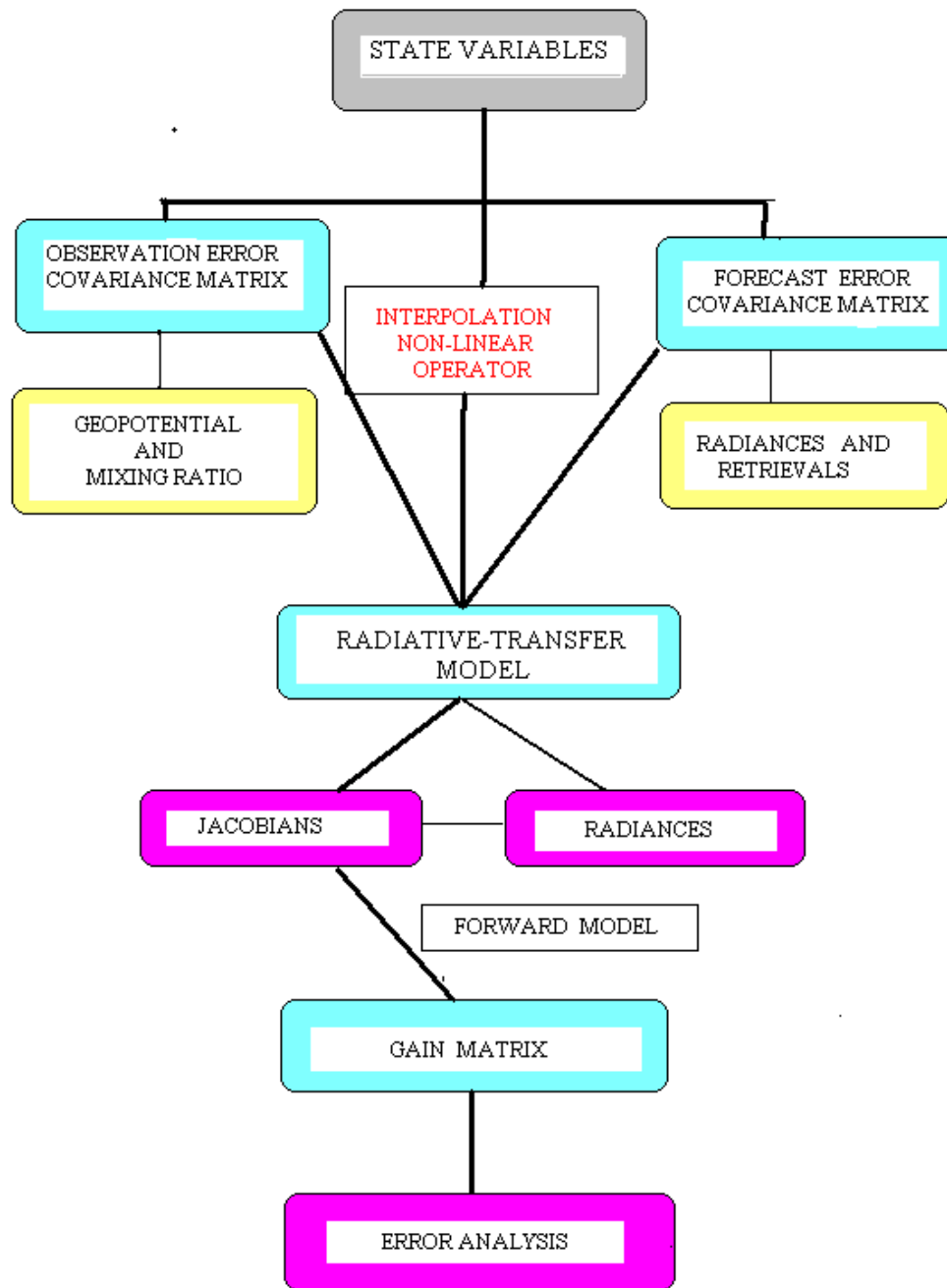
# **COMPARATION OF ERROR ANALYSIS IN 3D-VAR FOR ASSIMILATION OF RADIANCES AND RETRIEVALS USING NOAA-14**



**Elizabeth Silvestre Espinoza**

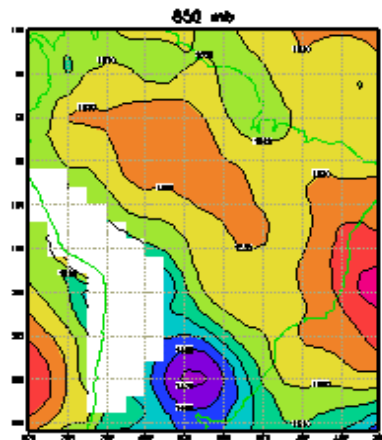
**Instituto Nacional de Pesquisas Espaciais – INPE**

**Centro de Previsão do Tempo e Estudos Climáticos- CPTEC**

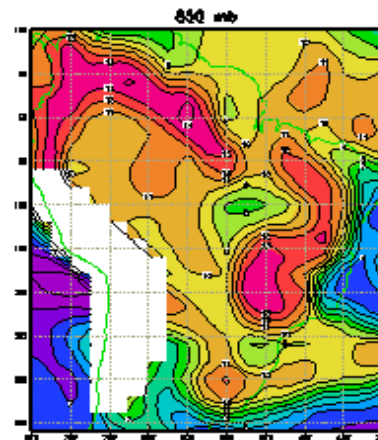


# STATE VARIABLES

- **FONT:** Modelo GEOS DAO/NASA
- **TIME:** 00:00 e 12:00UTC
- **AREA:** 10°N-35°S e 35°W-80°W
- **RESOLUTION:** 2°x2.5°

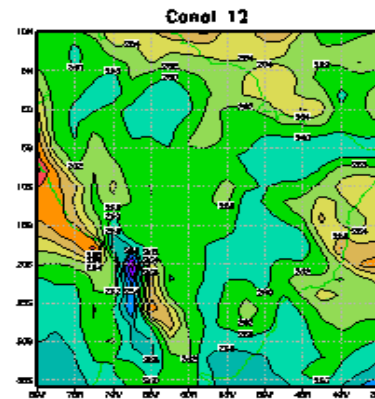
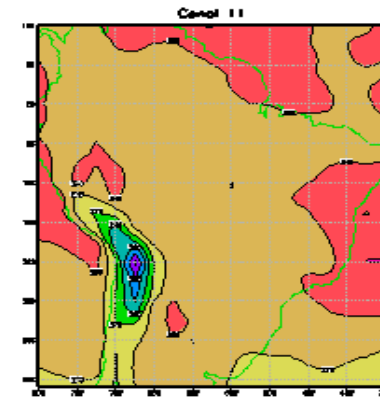
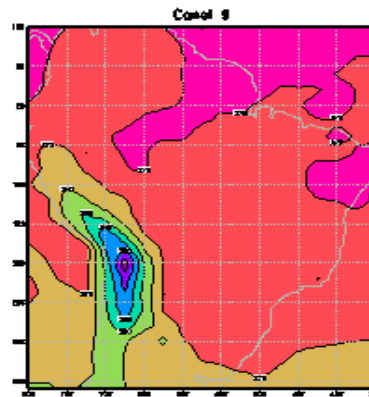
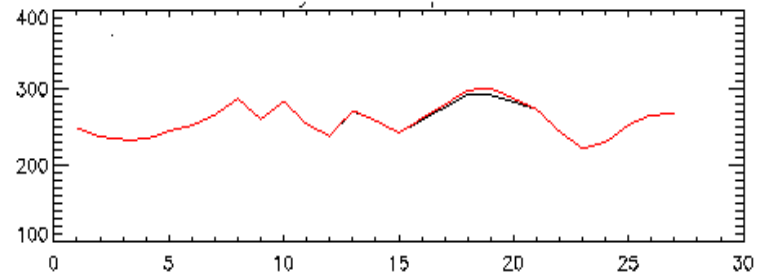


**GEOPOTENTIAL**



**HUMIDITY**

# SIMULATED RADIANCES



## ERROR COVARIANCE MATRIX

### HORIZONTAL CORRELATION

$$\rho_{i,j} = 1.0 / (1 + 0.5 (rdist/L)^2)$$

### VERTICAL CORRELATION

$$v_{i,j} = \exp(-[\log(p_i/p_j)/D]^2)$$

### DIAGONAL OF THE SQUARE MATRIX

$$P^f(i, j) = \sigma_{i,j}^2 \qquad P^f(i, j) = \sigma_i \cdot \sigma_j \cdot v_{i,j} \cdot \rho^{i,j}(r)$$

### FORECAST

### OBSERVATION

	CONVENTIONAL		SATELLITE	
	GEPOTENTIAL	HUMIDITY	RADIANCES	RETRIEVALS
$v^{(mn)} \neq 0$				
$\rho^{(mn)}(r) \neq 0$	$\rho^{(mn)}(r) = 0$	$\rho^{(mn)}(r) = 0$	$\rho^{(mn)}(r) = 0$	$\rho^{(mn)}(r) = 0$
	$v^{(mn)} \neq 0$	$v^{(mn)} = 0$	$v^{(mn)} = 0$	$v^{(mn)} \neq 0$

# RESUME OF THE EQUATIONS

## FORECAST ERROR COVARIANCE MATRIX

$$P^f$$

## OBSERVATION ERROR COVARIANCE MATRIX

$$R$$

## GAIN MATRIX FOR RADIANCES

$$K = P^f I^T F^T (FIP^f I^T F^T + R^y)^{-1}$$

## GAIN MATRIX FOR RETRIEVALS

$$D_y = IP_{1D}^f I^T F^T (FIP_{1D}^f + R^y)^{-1}$$

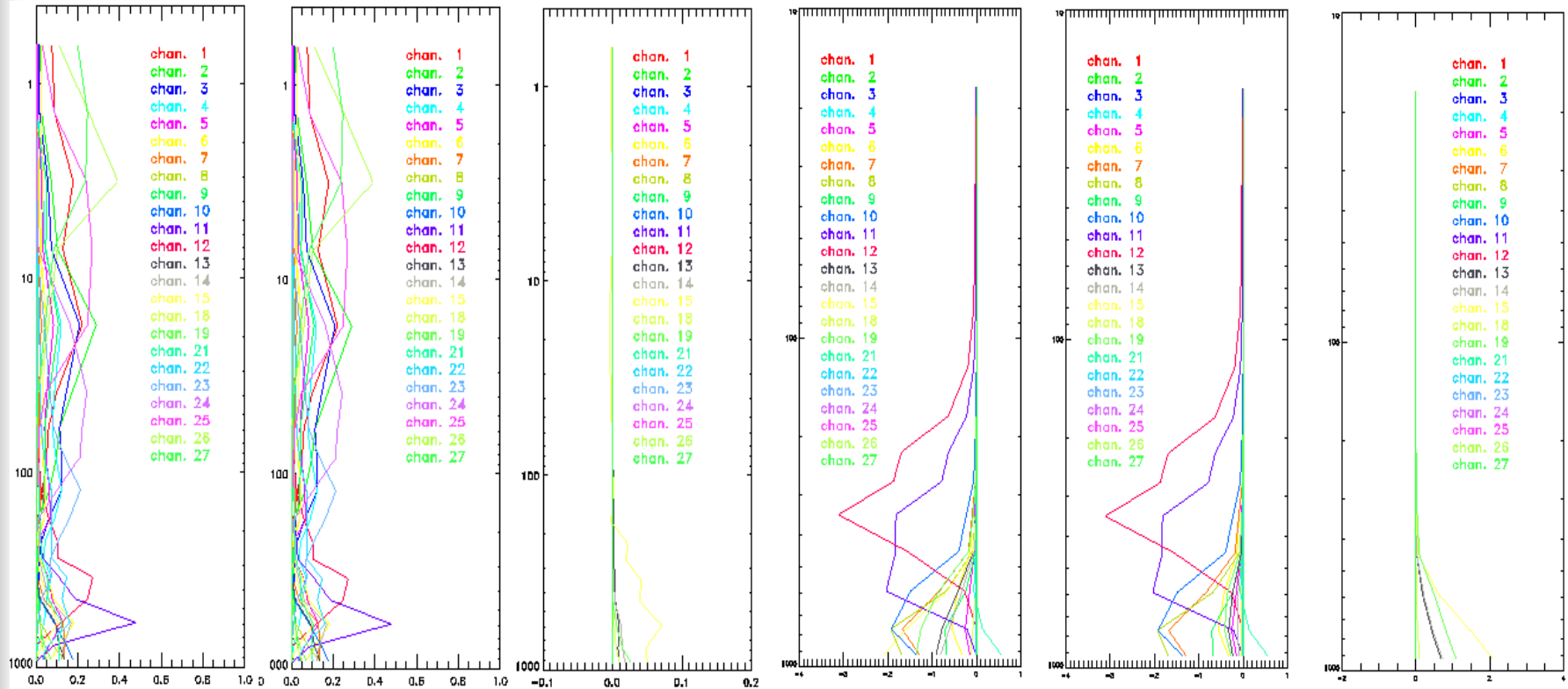
$$R^z = (I - D_y F) IP_{1D}^f I^T + (I - D_y F) I (P^f - P_{1D}^f) I^T (I - D_y F)^T$$

$$K^z = P^f I^T (IP^f I^T + R^z)^{-1}$$

## ANALYSIS ERROR FOR RADIANCES AND RETRIEVALS

$$P^a = (I - K^z D_y F I) P^f (I - K D_y F I)^T + K^z D_y R^y (K^z D_y)^T$$

# JACOBIANS



TEMPERATURE

HUMIDTY

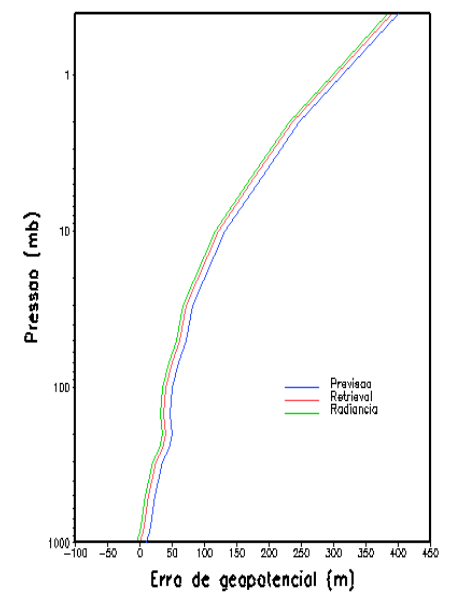
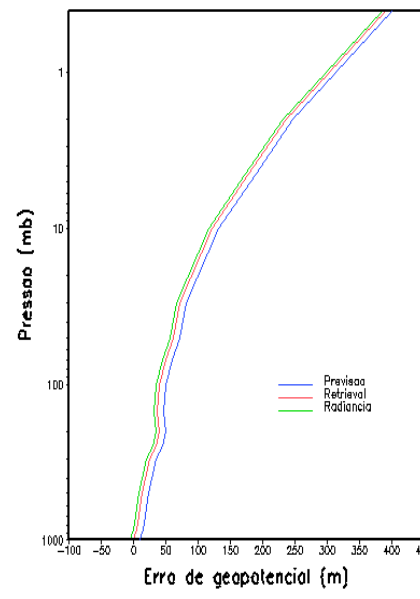
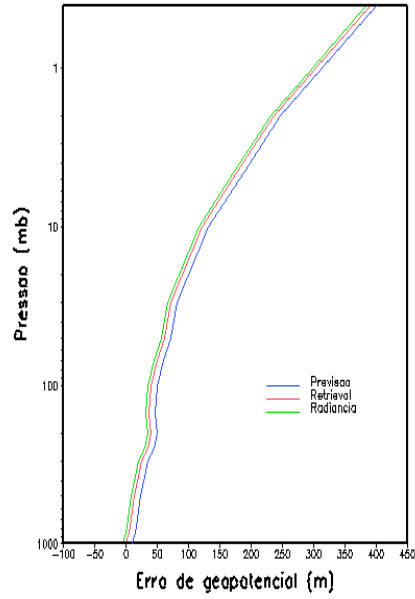
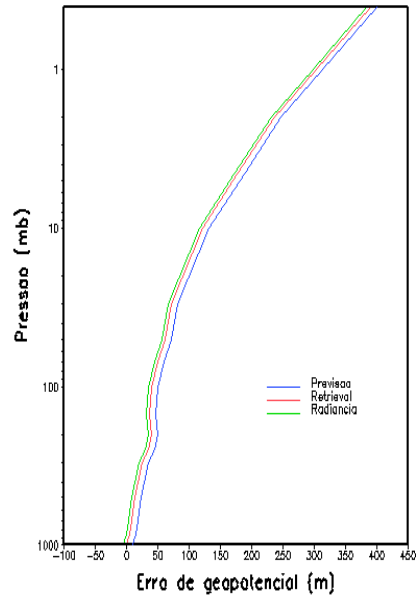
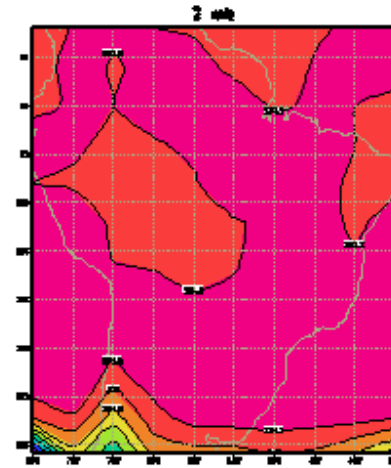
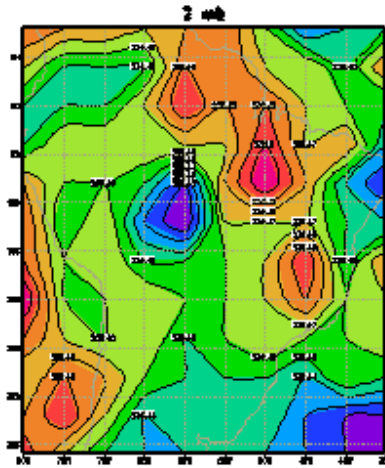
<b>LEVELS</b>	<b>TEMPERATURE</b>	<b>HUMIDITY</b>	<b>OZONE</b>
<b>0.4</b>	1, 24,		
<b>1</b>	1, 23, 24		
<b>2</b>	1, 2, 22, 23, 24		
<b>5</b>	1, 2, 3, 22, 23, 24		
<b>10</b>	2, 3, 22, 23		
<b>30</b>	2, 3, 22		9
<b>50</b>	2, 3, 4		9
<b>70</b>	20		9
<b>100</b>	20		9
<b>150</b>	12, 19		9
<b>200</b>	11, 12, 19		9
<b>250</b>	12		9
<b>300</b>	12, 19	12	
<b>400</b>	11, 12	1, 2, 3, 4, 11, 12	
<b>500</b>	5, 6, 7, 8, 10, 11, 12, 14, 15, 16, 18, 19	11, 12	
<b>700</b>	5, 6, 7, 8, 10, 11, 12, 14, 15, 16, 18, 19	5, 6, 7, 8, 9, 10, 11, 12, 1 8, 19	
<b>850</b>	7, 8, 10, 11, 13, 14, 15, 16, 17, 18, 19	5, 6, 7, 8, 9, 10, 11, 12, 1 8, 19	
<b>1000</b>	7, 8, 10, 11, 13, 14, 16, 17, 18, 19	5, 6, 7, 8, 9, 10, 11, 12, 1 8, 19	



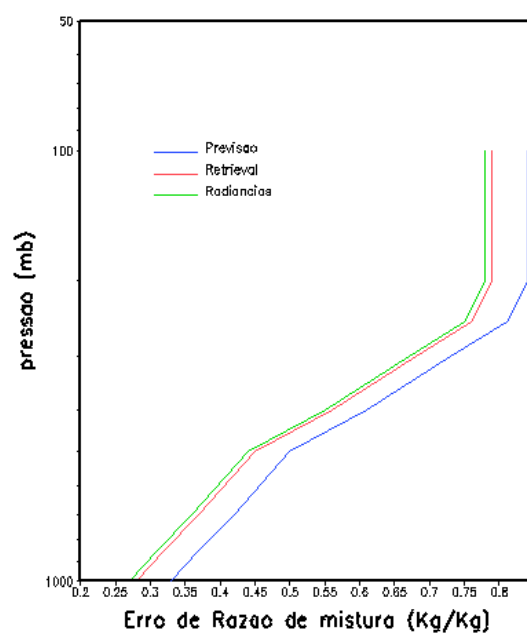
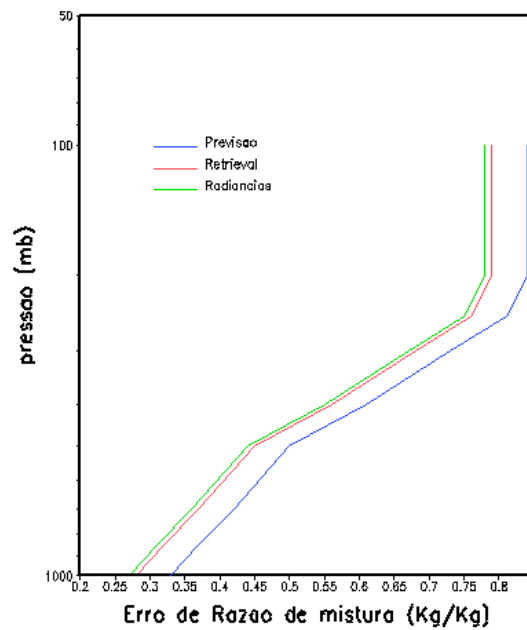
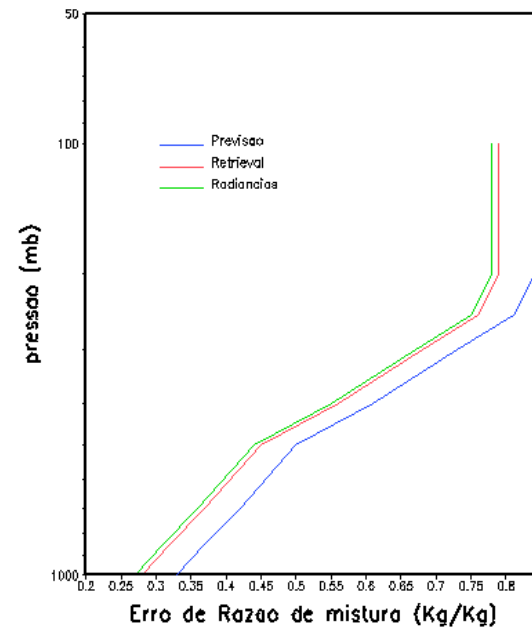
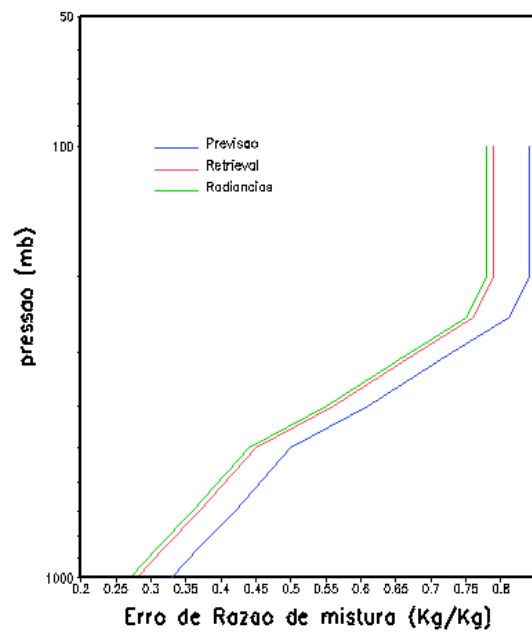
# GEOPOTENTIAL

RETRIEVALS

RADIANCIAS



# MIXING RATIO



# CONCLUSIONS

- **Analysis error:** The error analysis for directly assimilation is low that retrieval assimilation
- **Computational cost :** For a matrix the same size the CPU time for directly assimilation is low that retrievals assimilation.
- **Differences:** The difference between forecast error and analysis error for geopotential is high that for humidity.
- **Assimilação of data satellite:** we assumed the best way for South hemisphere, like radiances or retrievals
- **TR, Jacobians.**