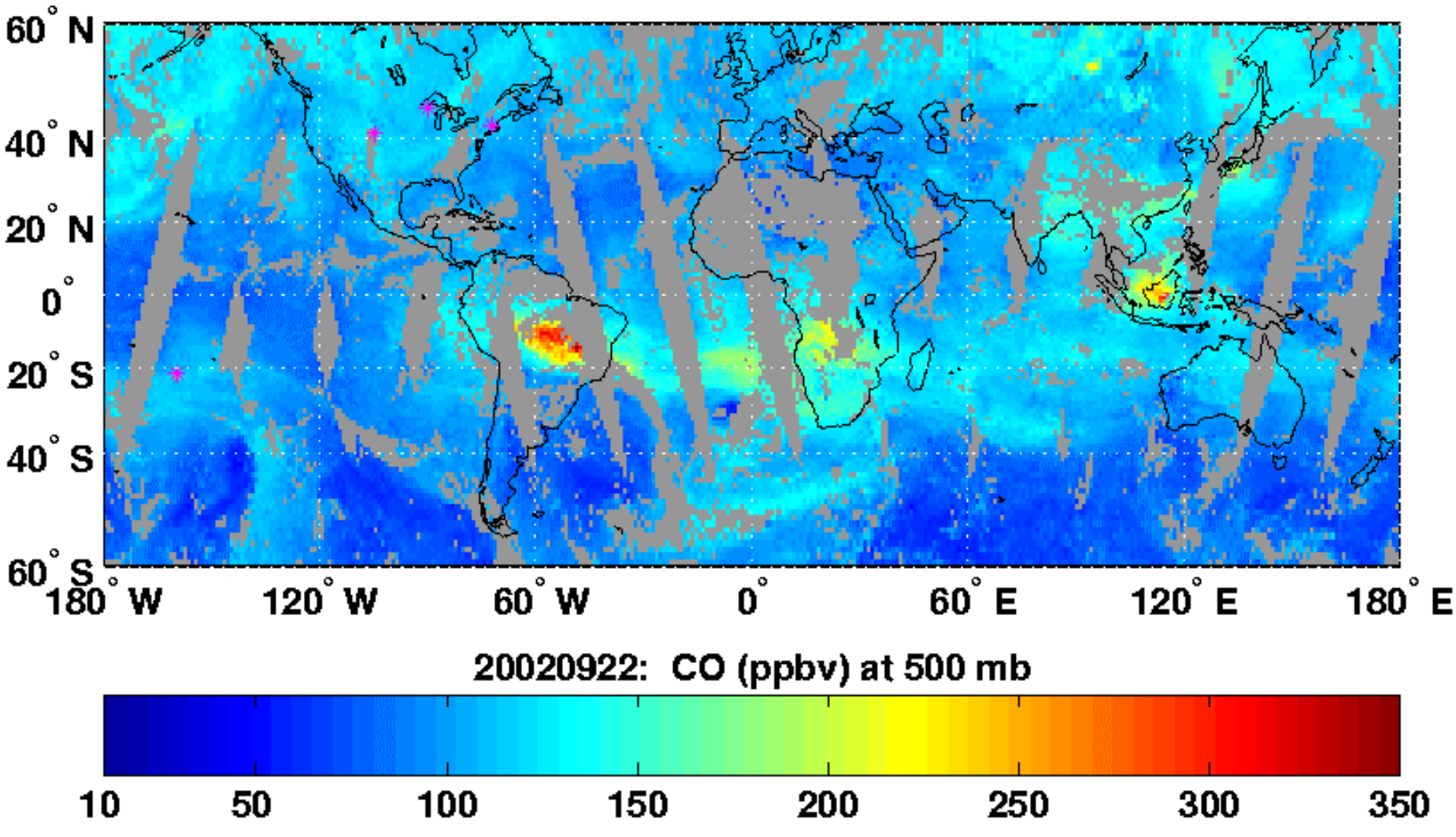
Daily Global Carbon Monoxide Maps from AIRS

W. Wallace McMillan
Assistant Professor of Physics
University of Maryland, Baltimore County

C. Barnet (NOAA/NESDIS), M. Chahine (JPL)
L. L. Strow, L. C. Sparling, M. L. McCourt, E. Maddy, S. Datta (UMBC),
P. Novelli (NOAA/CMDL), S. Korontzi (UMCP)

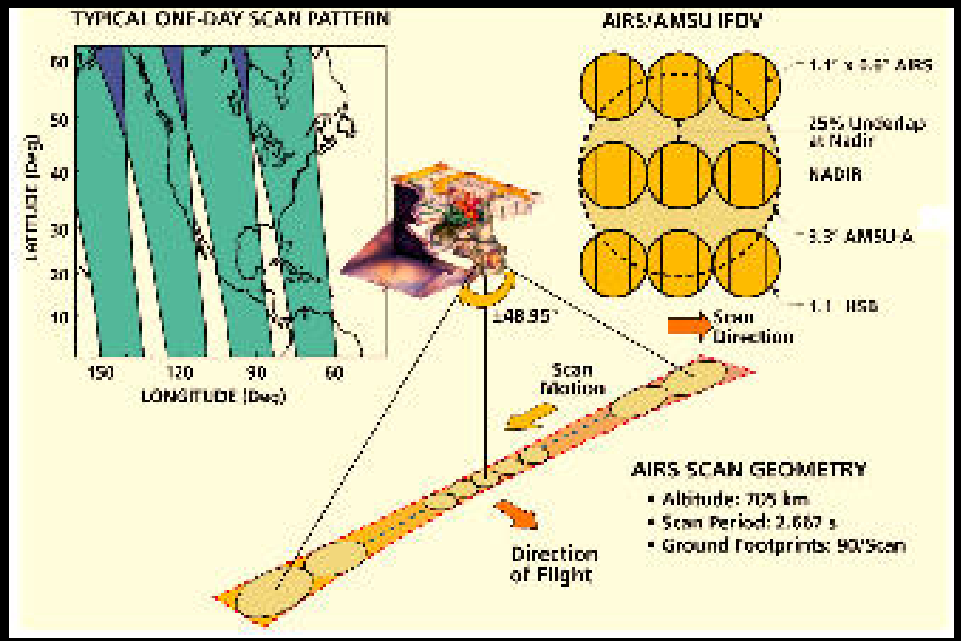
Thanks to: Mark Schoeberl (NASA/GSFC) and Chris Justice (UMCP)
And the entire AIRS Team!!!

AIRS Global CO



~200,000 daily CO retrievals binned to a 1º x 1º grid

- **13.5 km nadir IR FOV 1650 km swath**
- **40 km nadir μwave FOV (AMSU)**
- **2,916,000 AIRS FOV/day (40 Gb/day)**
- **AIRS 16-3.6 μm with 2378 channels**



Atmospheric InfraRed Sounder onboard NASA Aqua

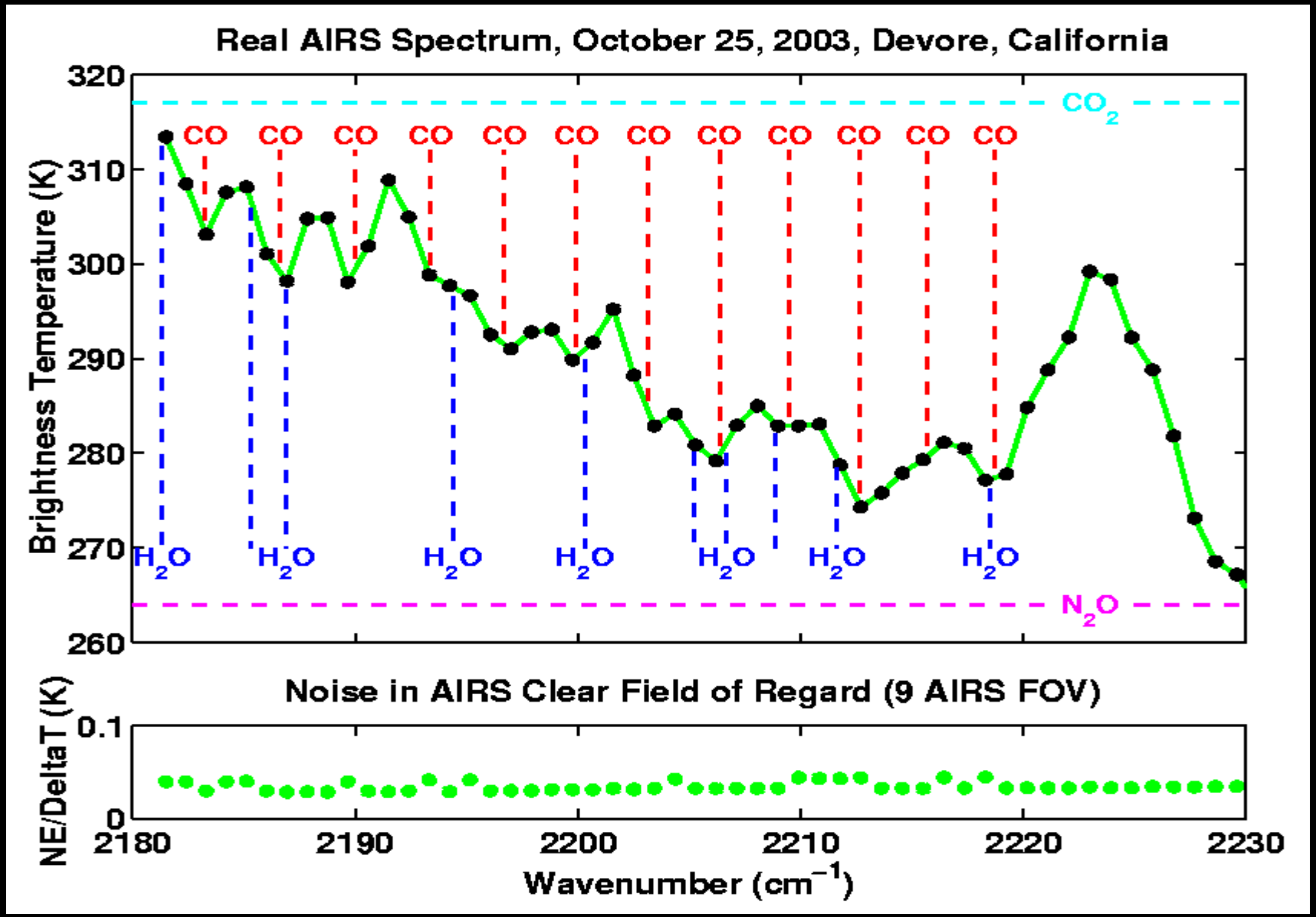
Mainly a temperature and water vapor profiler

AIRS CO Retrieval

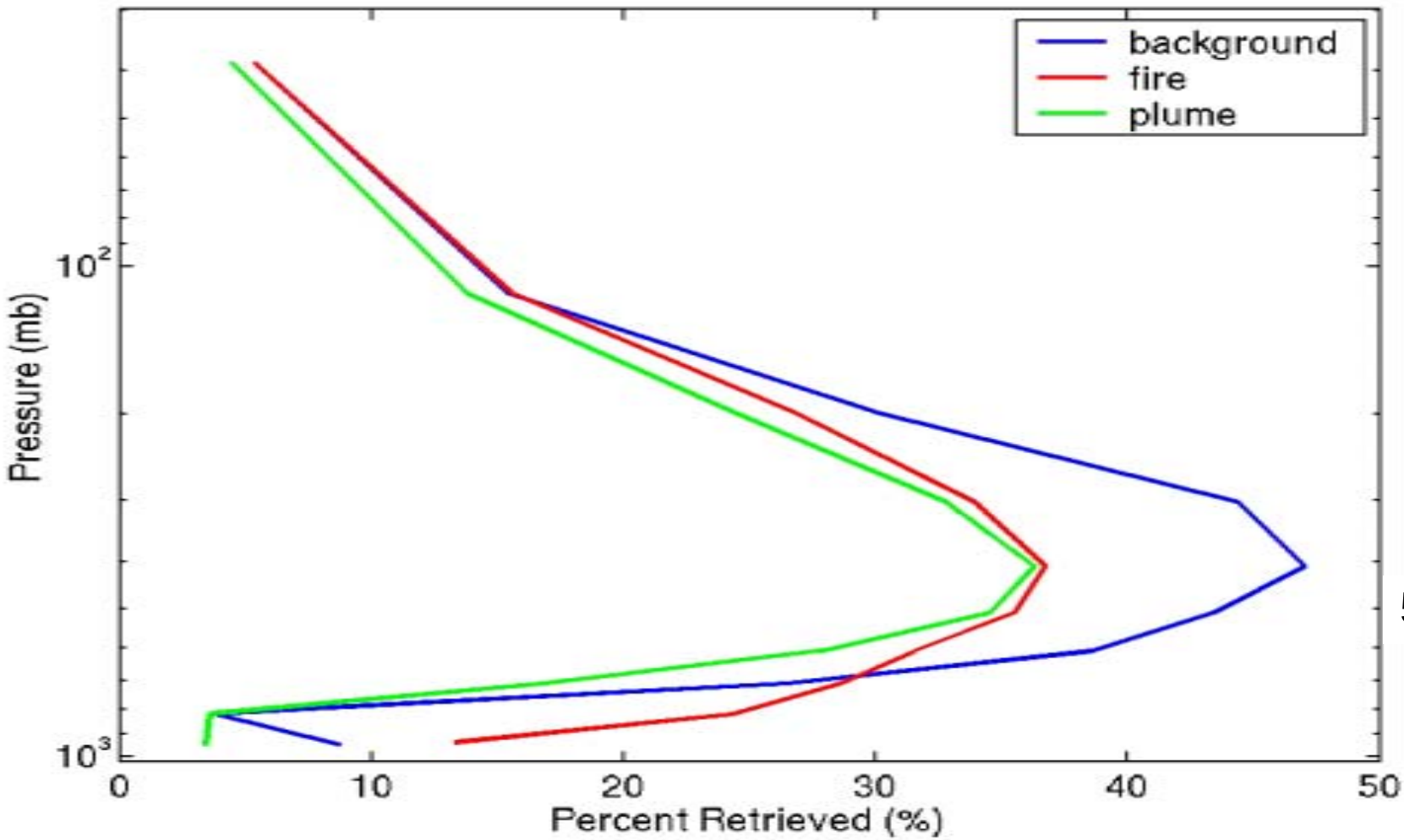
Becoming a Standard Product!

- CO, T(p), H_2O(p) retrieved simultaneously
- Physical retrieval with ongoing information content analysis for optimal damping
- Multiple "CO retrieval functions" but only 1-1.5 pieces of vertical information
  (similar to O_3 [IEEE TGRS, Susskind *et al*. 2003])
- Cloud-clearing on AIRS field-of-regard (FOR) increases retrieval yield (~60%)
- Accuracy < 15% in mid-trop., worse in PBL.
- Validation underway

AIRS Spectrum



AIRS CO Averaging Kernels



500

Baltimore
Bomem
Atmospheric
Emitted
Radiance
Interferometer

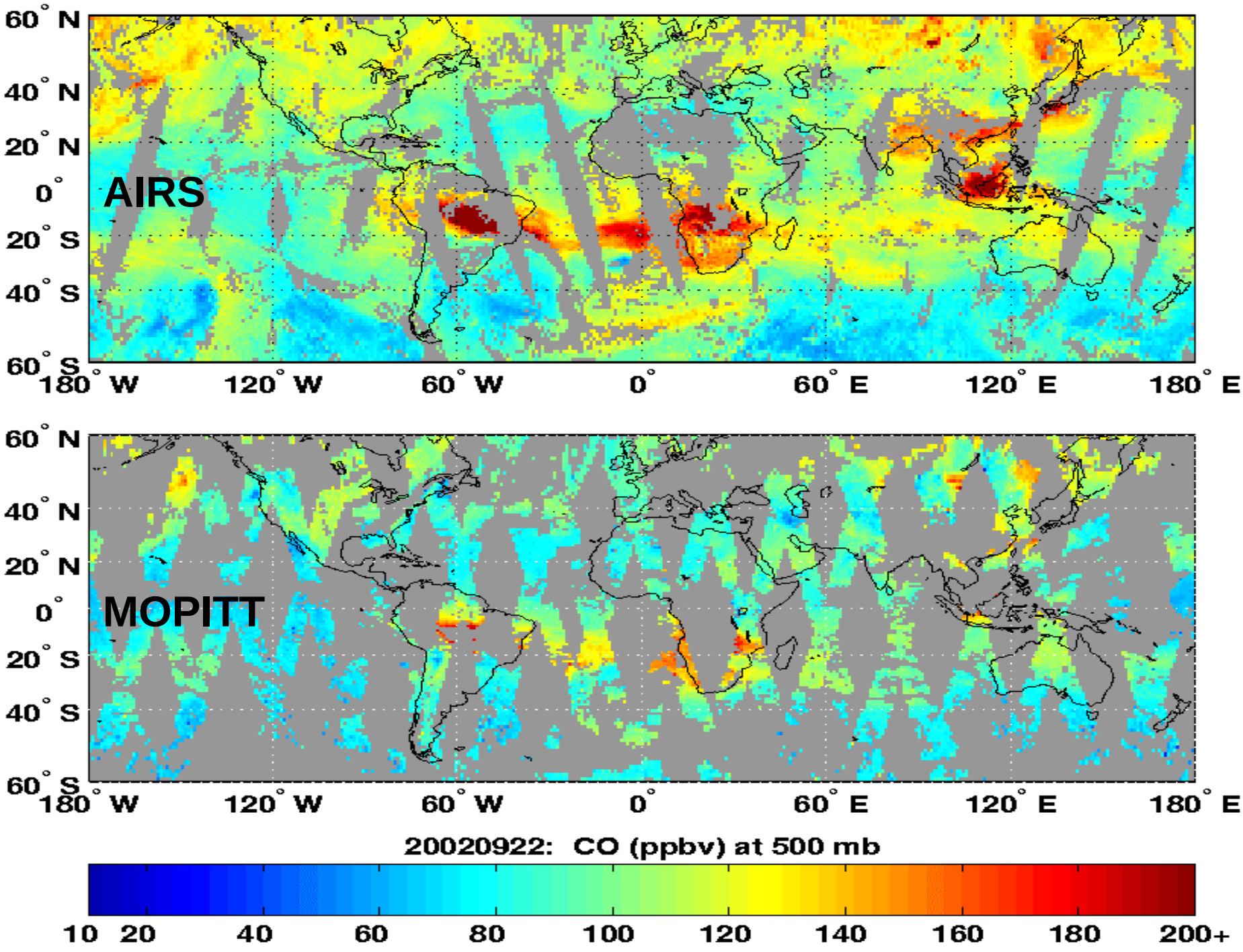
UMBC

AIRS BBAERI OCEAN VALIDATION

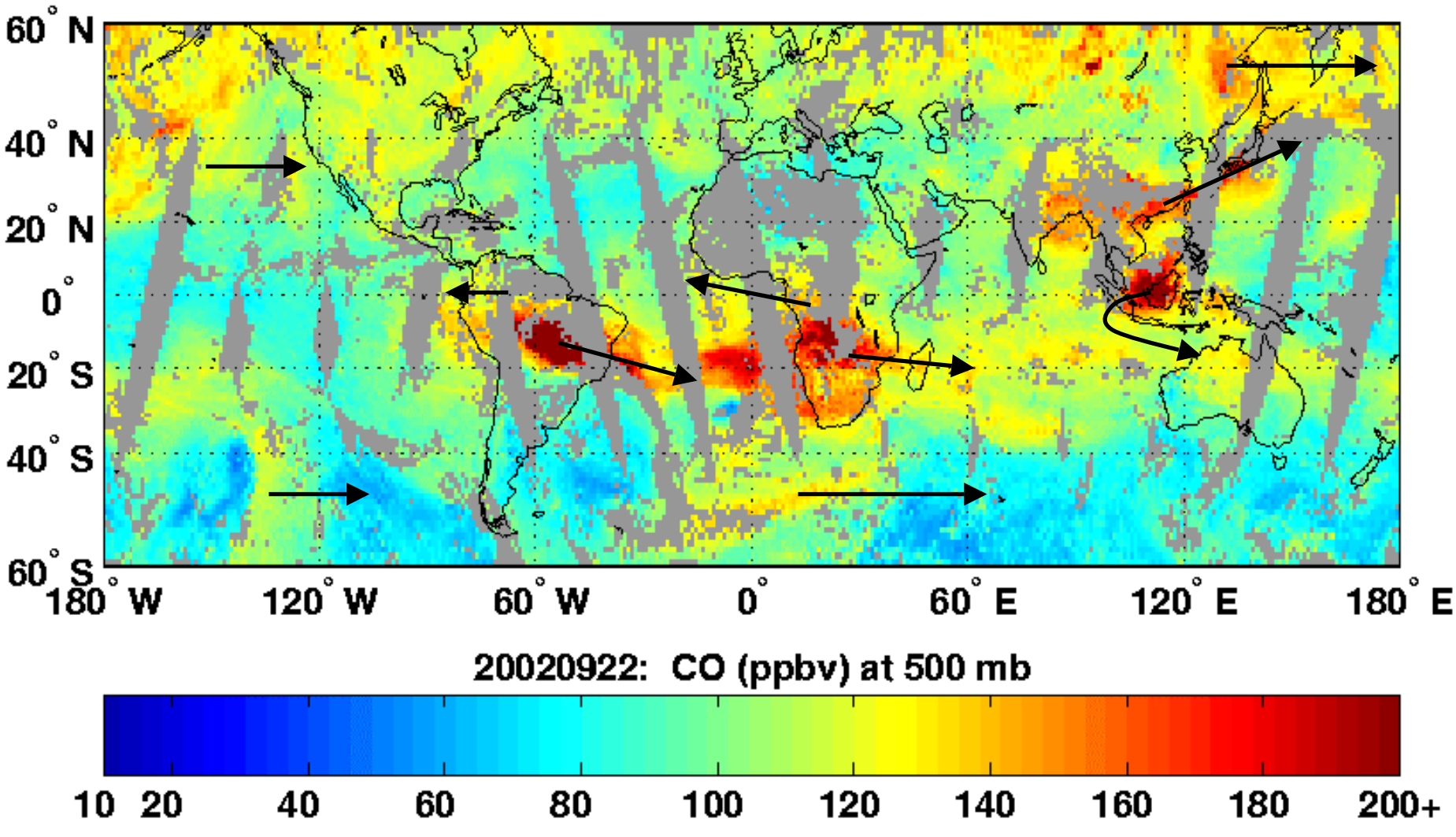
ABOVE

EXPERIMENT

Langley Research Center

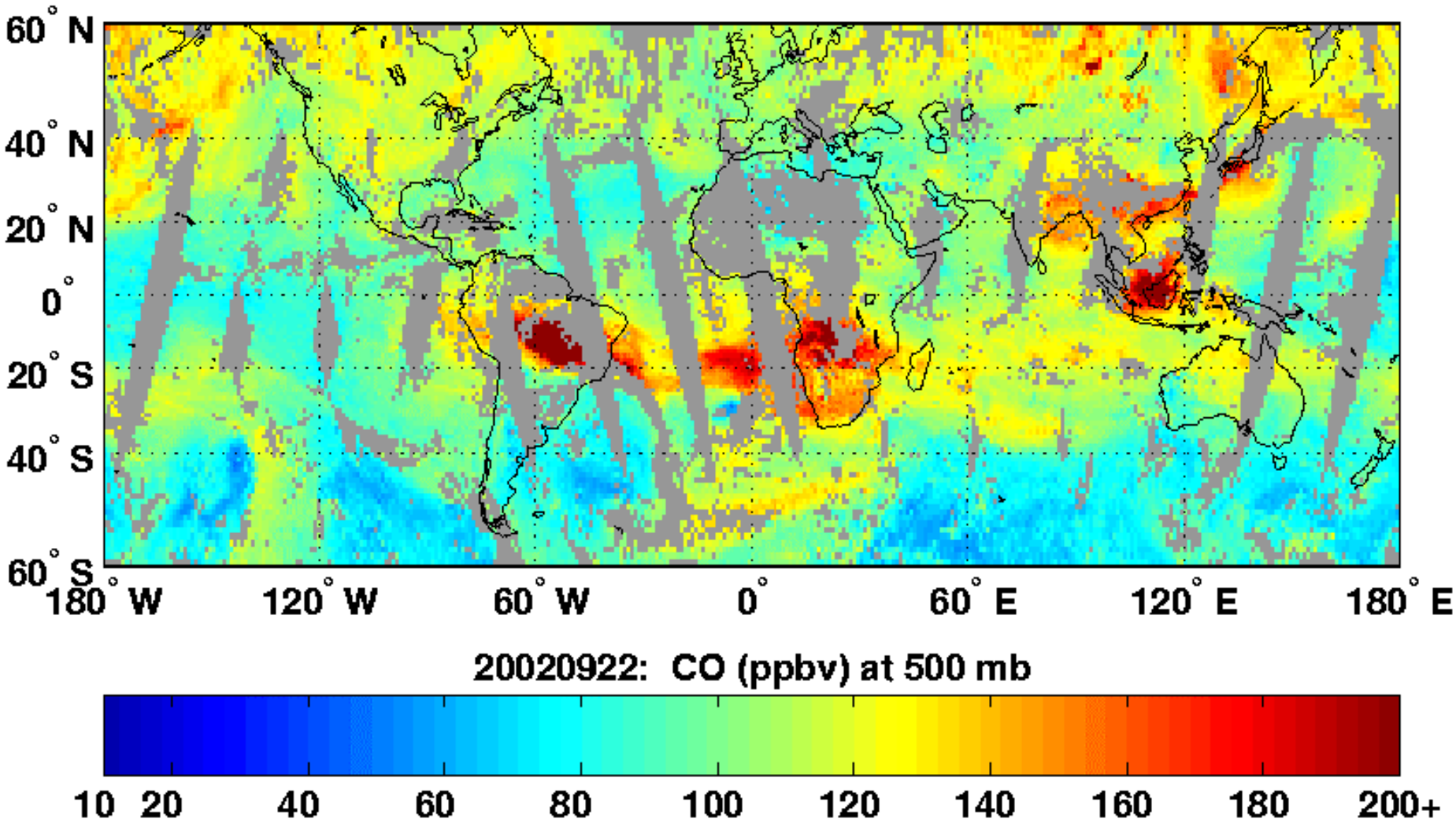

AIRS
MOPITT
60° N
40° N
20° N
0°
20° S
40° S
60° S
180° W
120° W
60° W
0°
60° E
120° E
180° E
20020922: CO (ppbv) at 500 mb
10
20
40
60
80
100
120
140
160
180
200+

AIRS Global CO



Typically AIRS sees 85% of the globe each day!

AIRS Global CO



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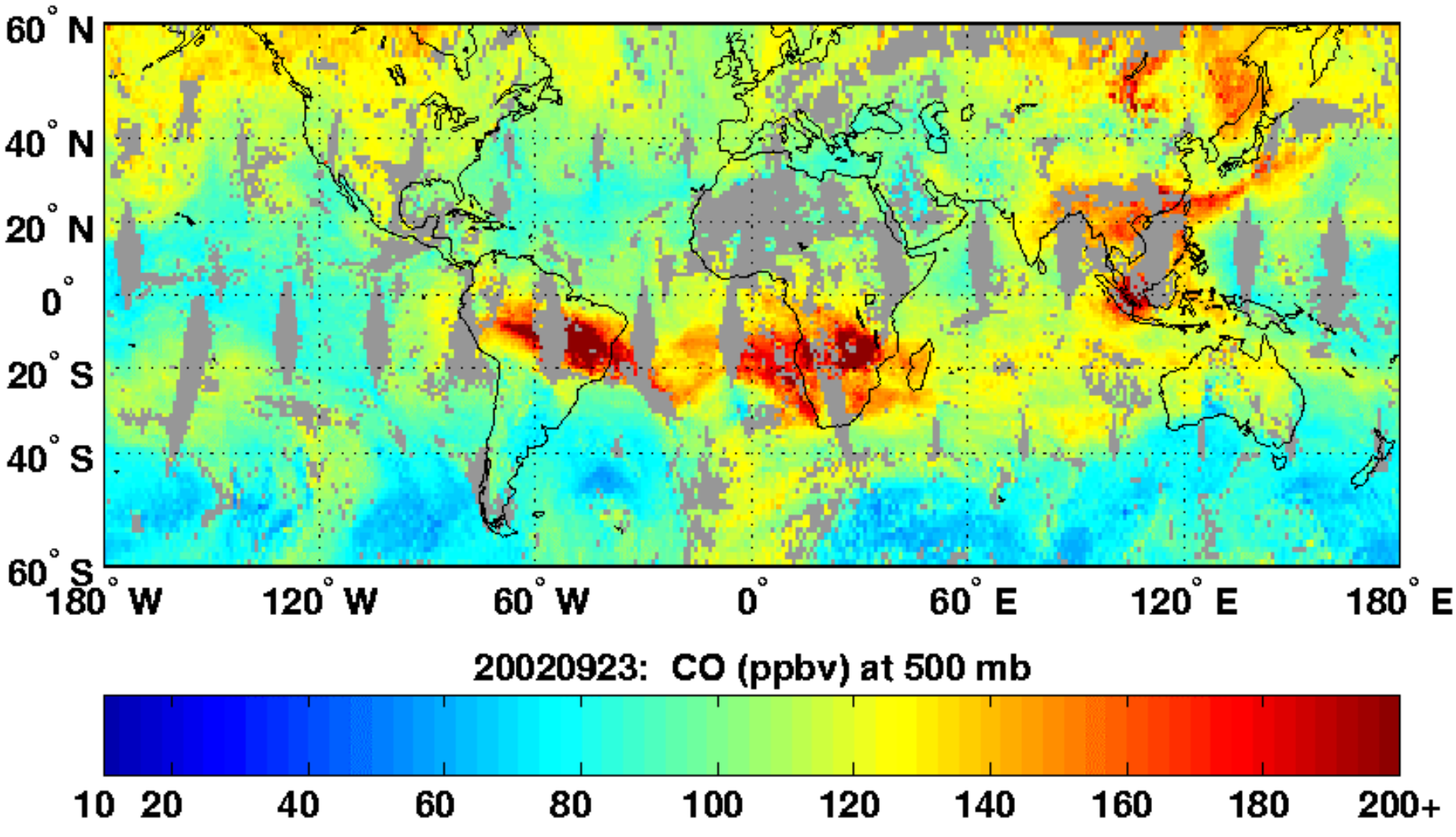

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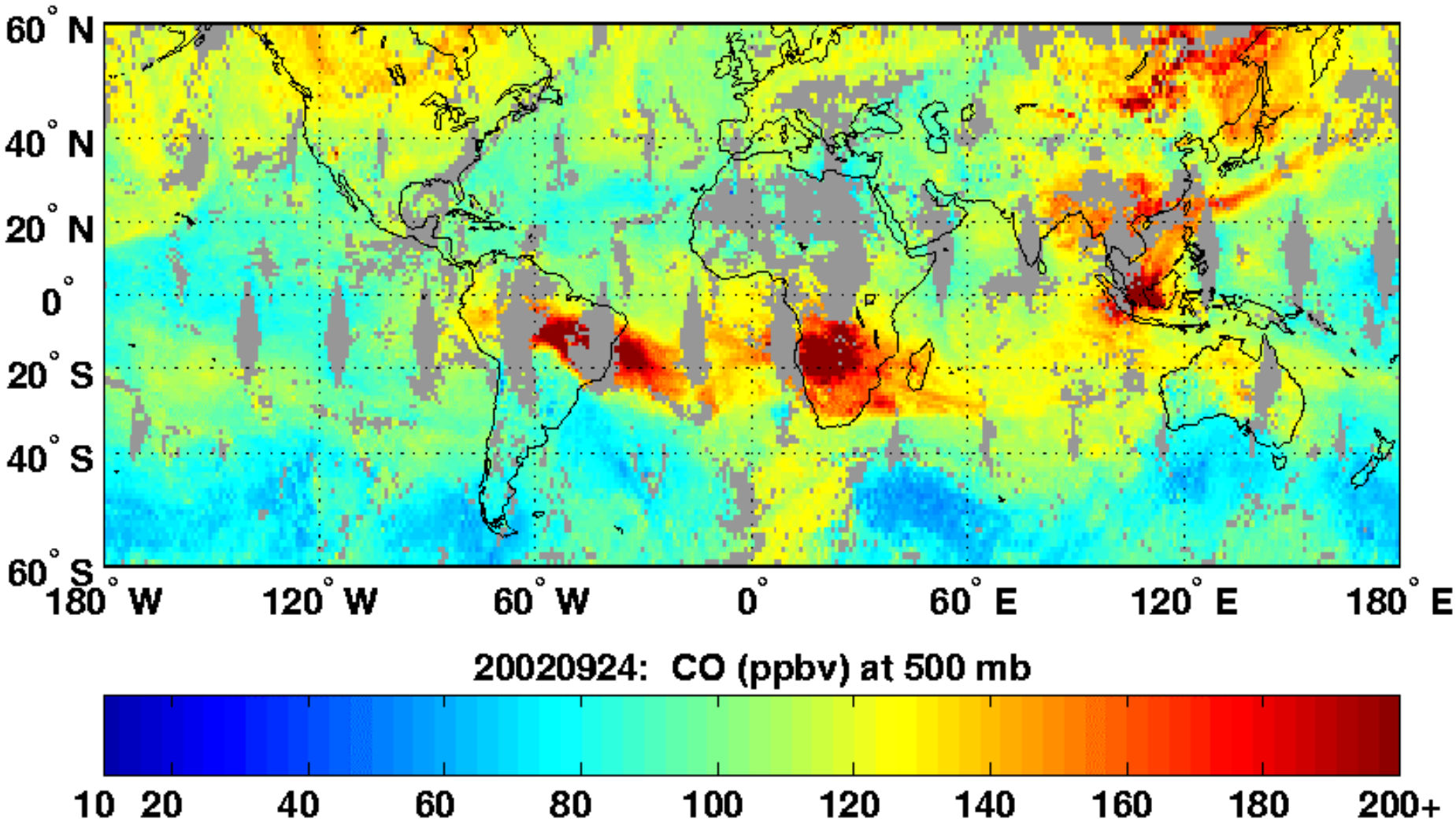

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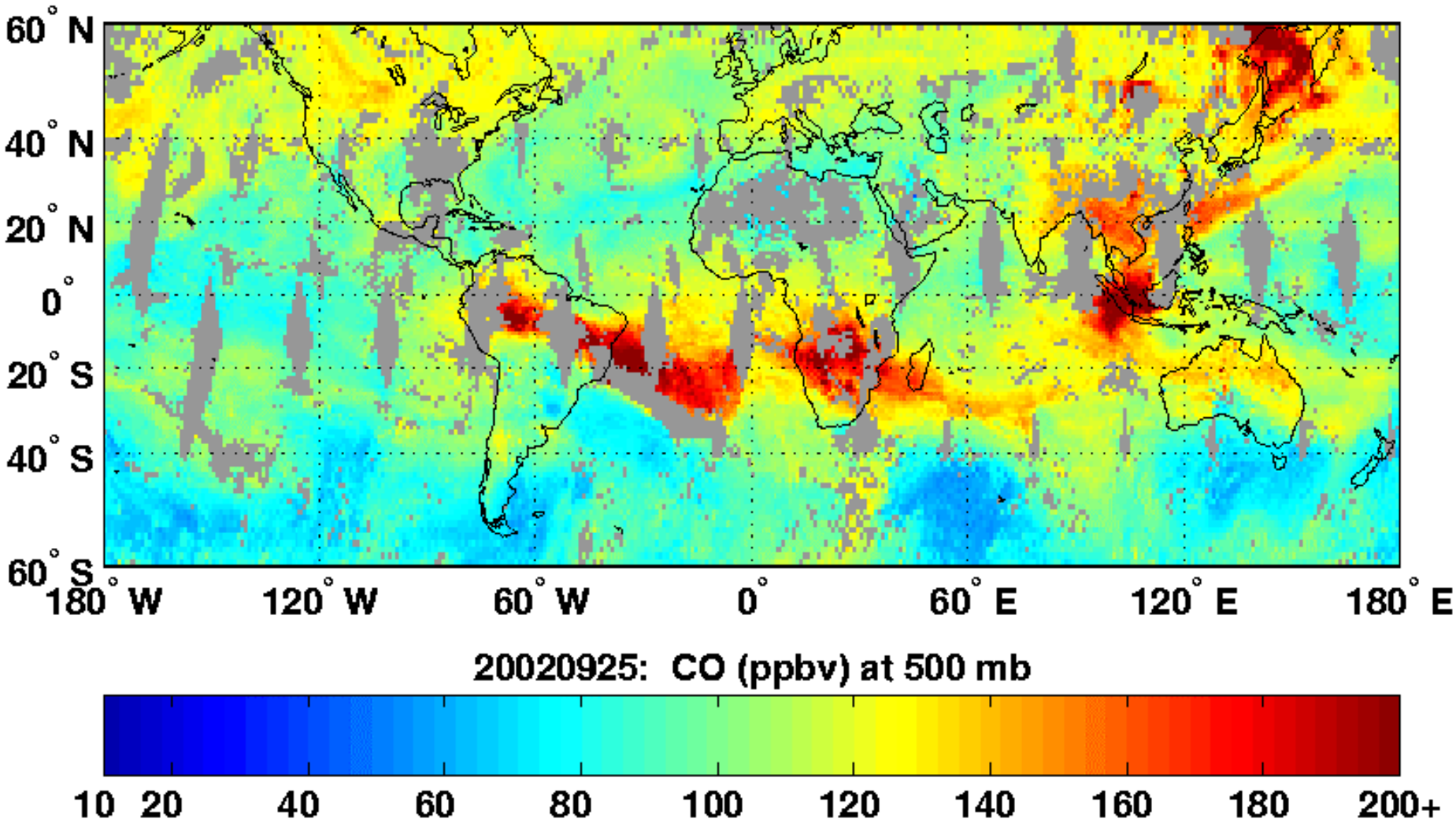

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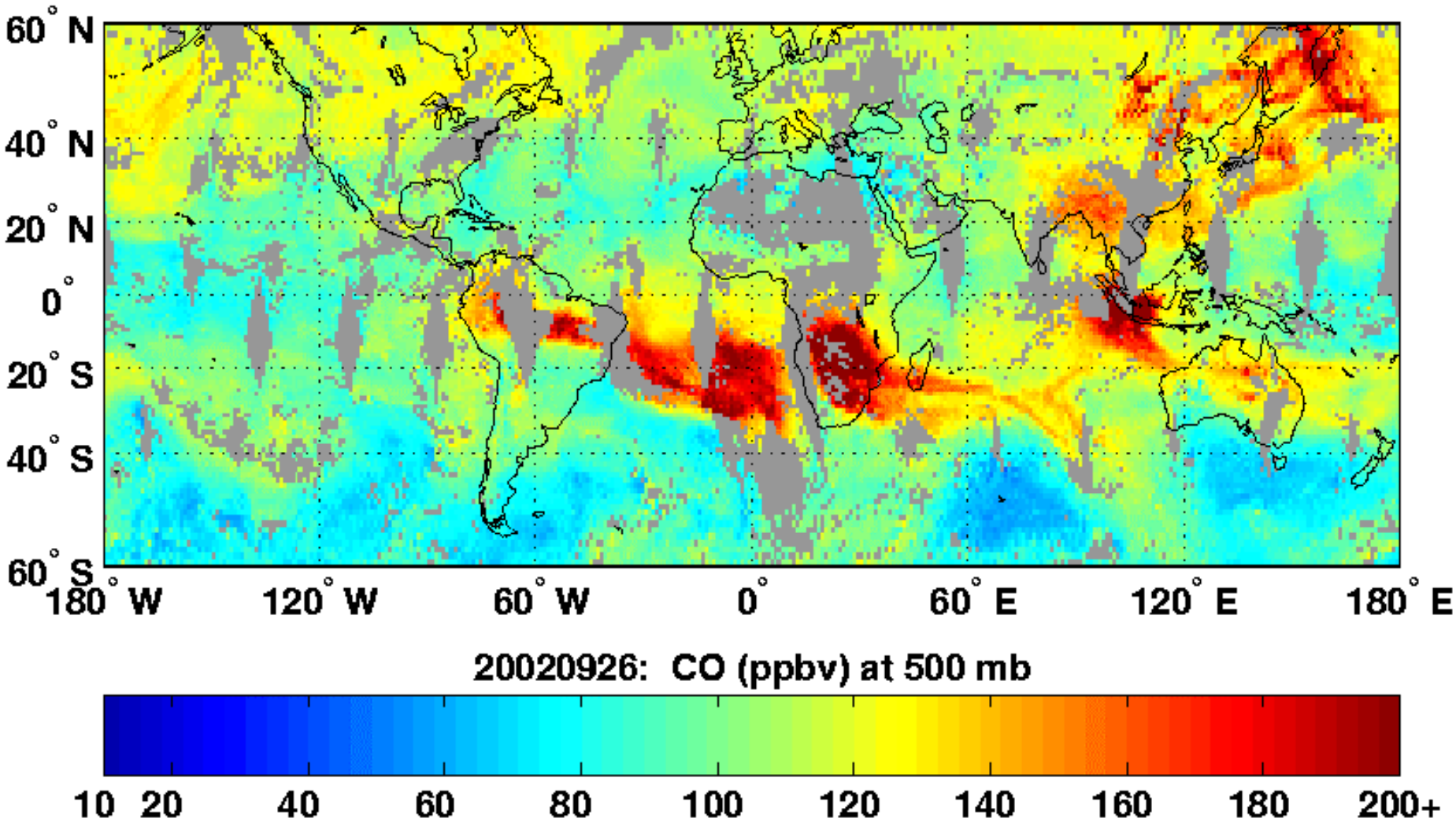

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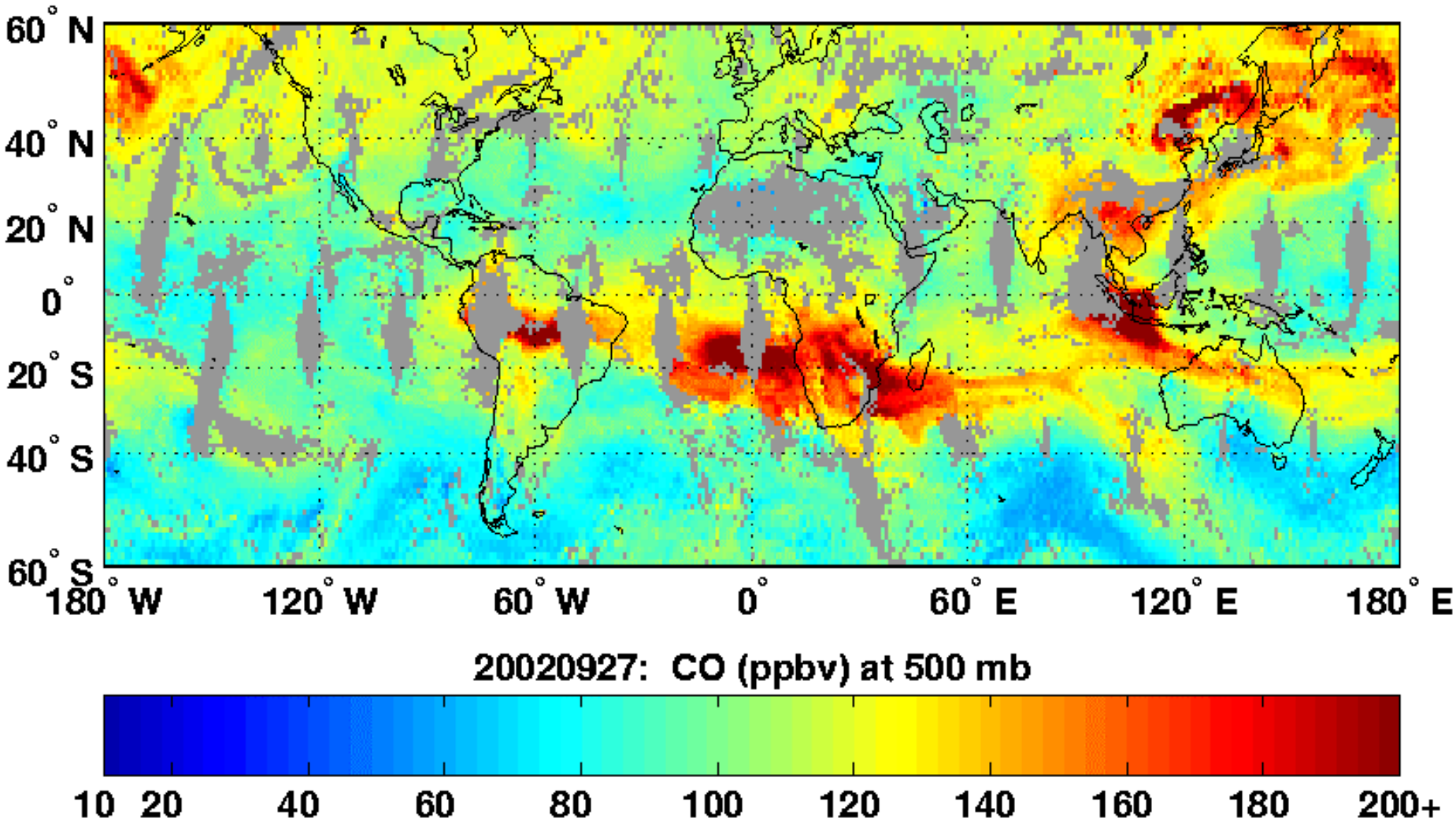

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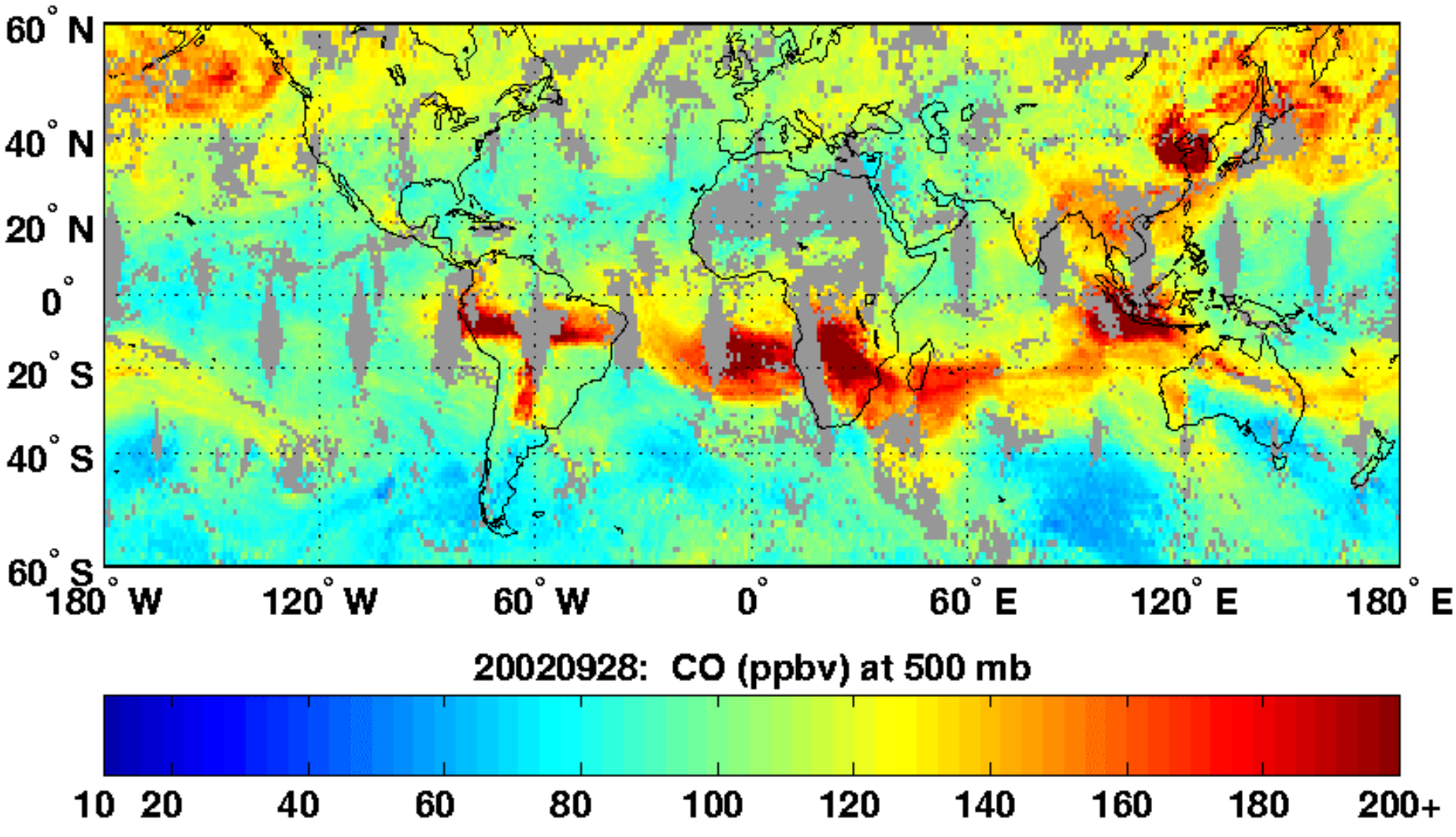

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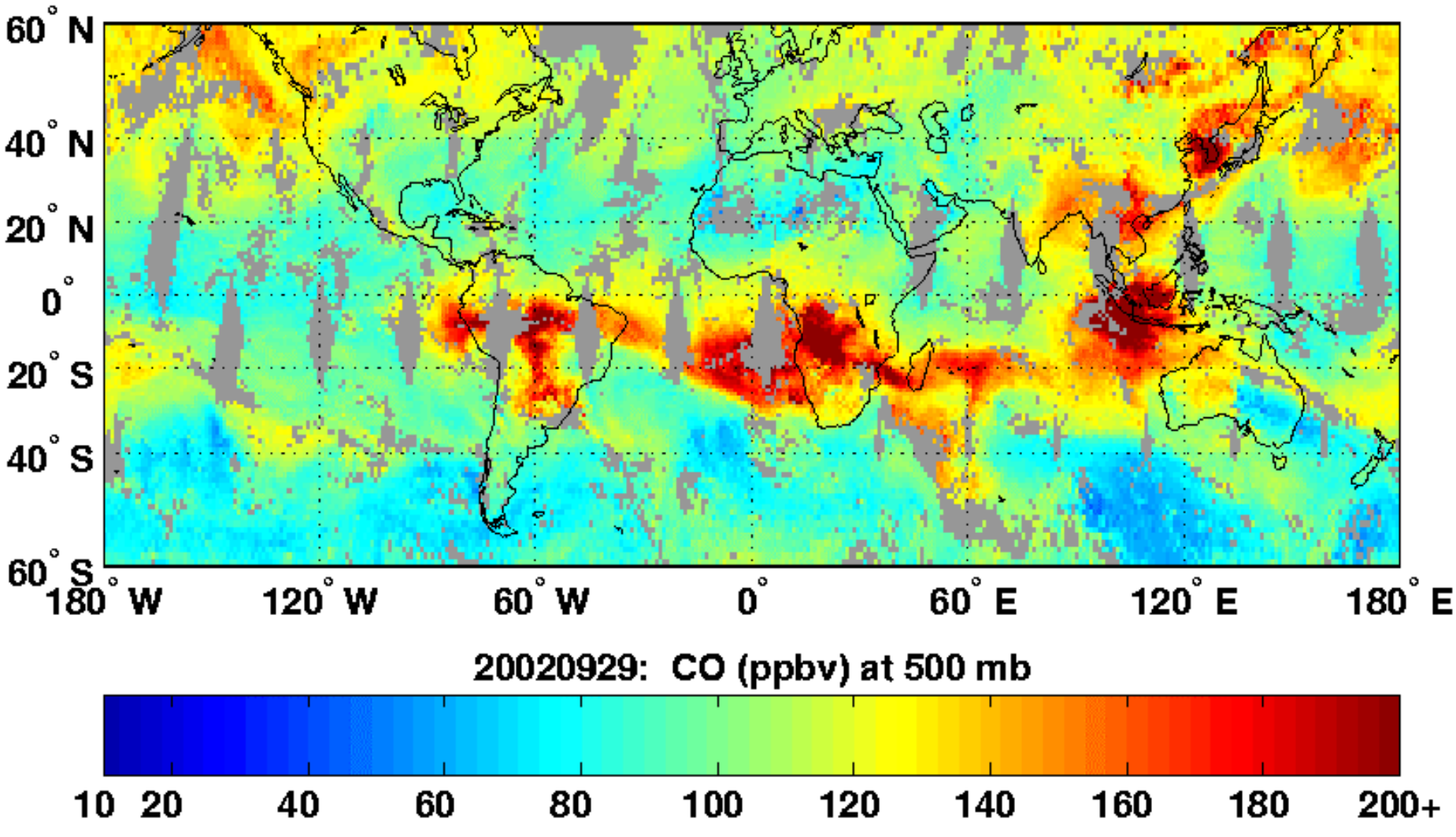
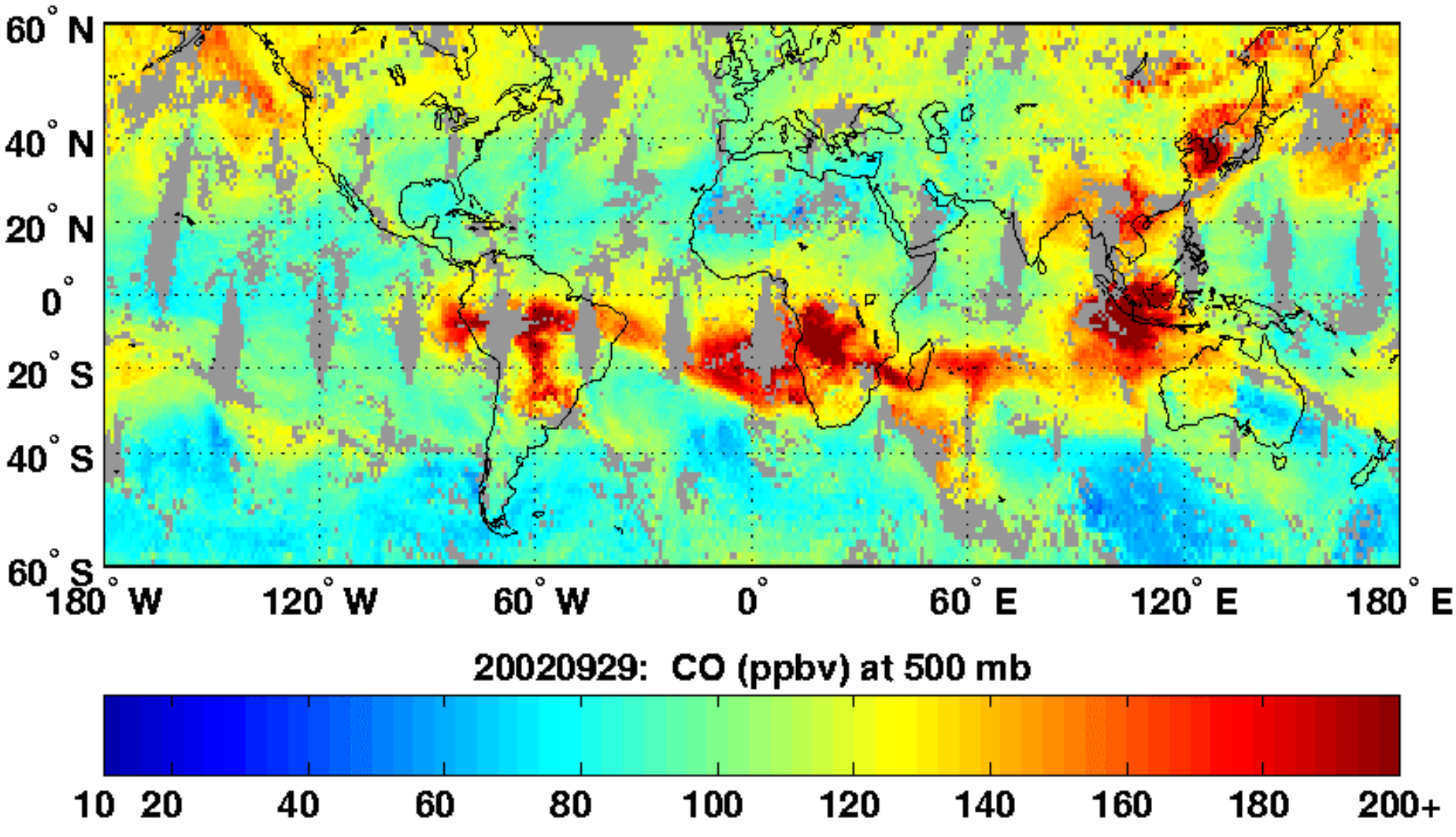
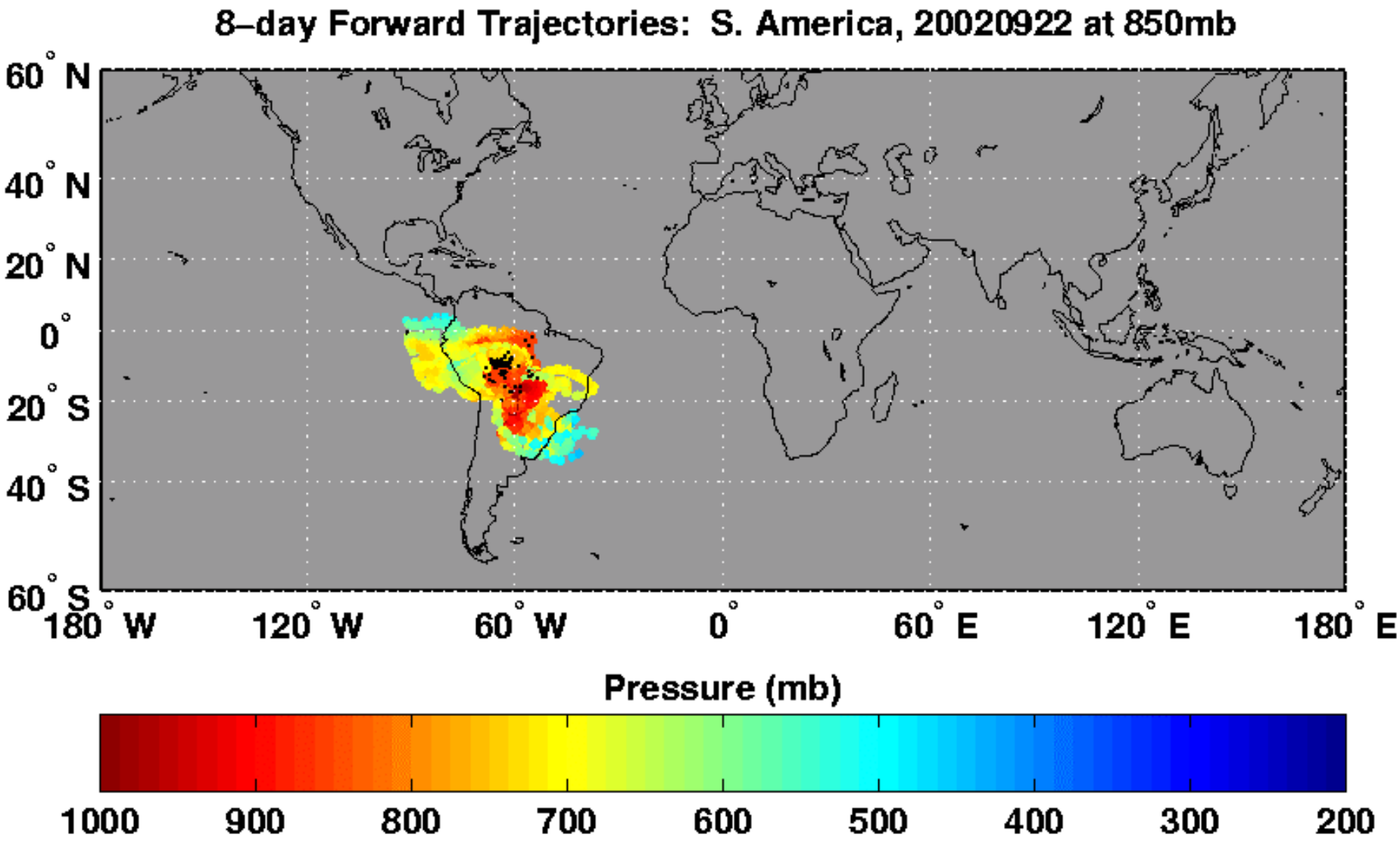


AIRS Global CO Movie



S. America Forward Trajectories



Thanks to: Mark Schoeberl for Goddard Trajectory Model and Chris Justice for MODIS fire locations.

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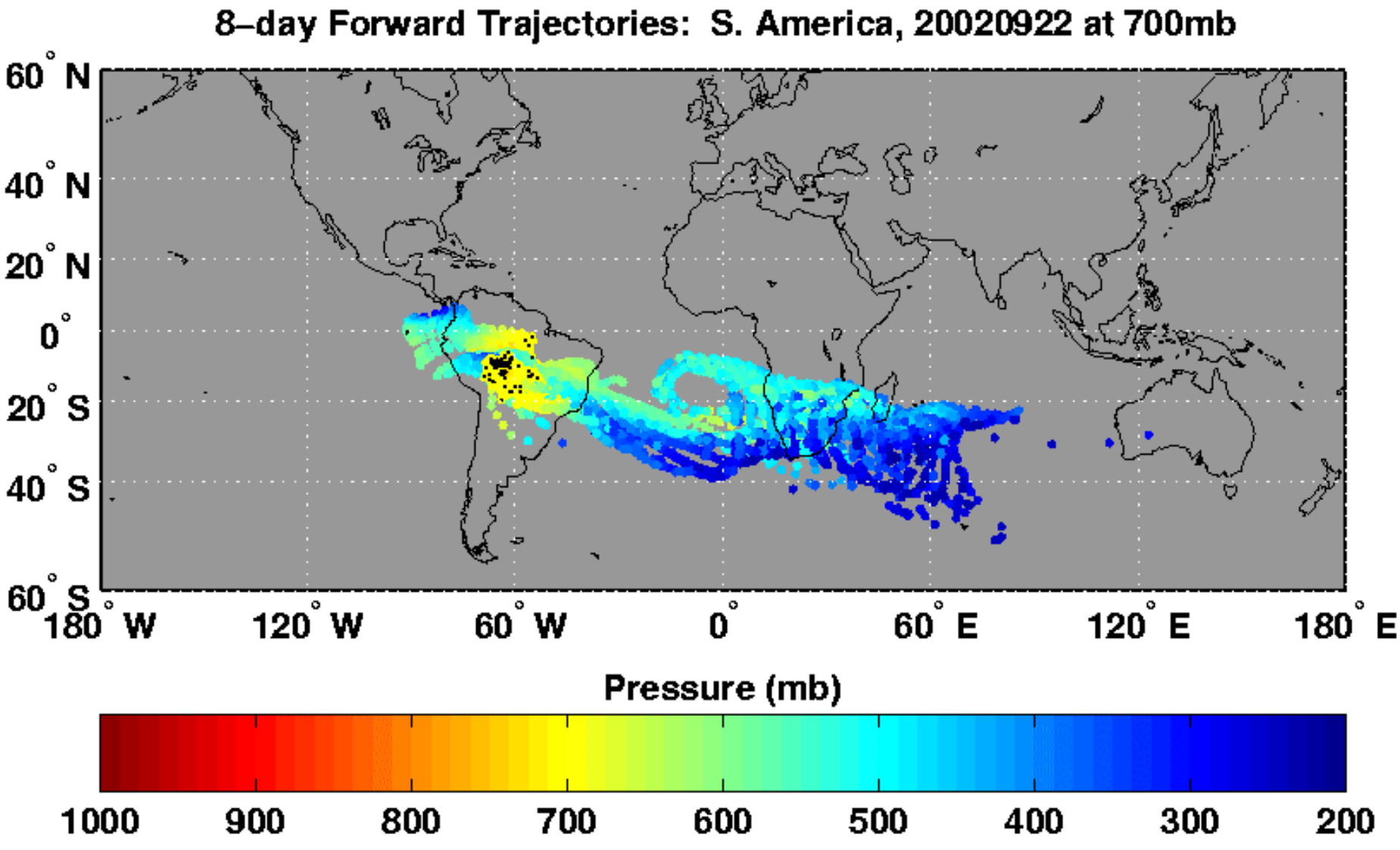

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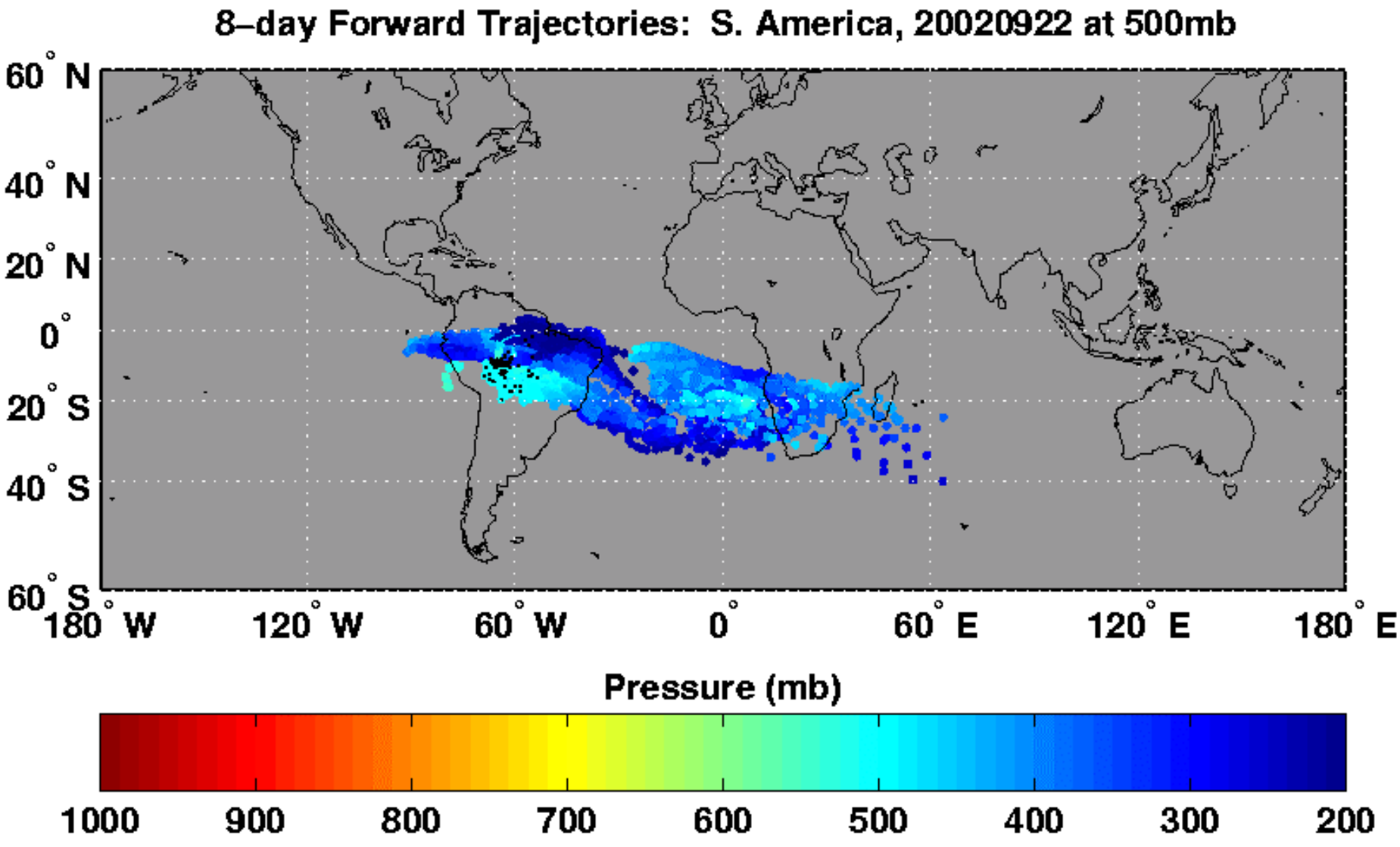

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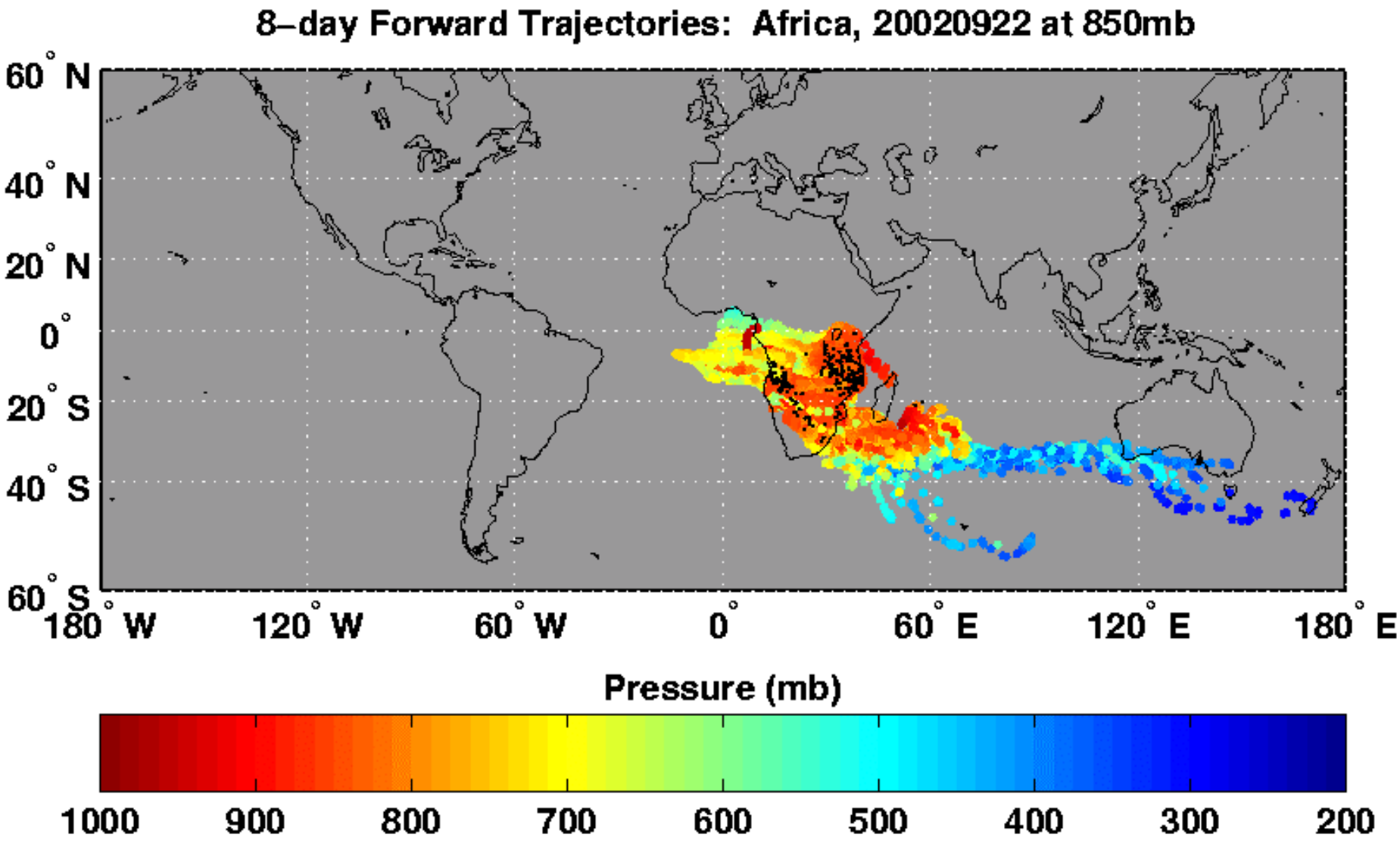
Africa Forward Trajectories



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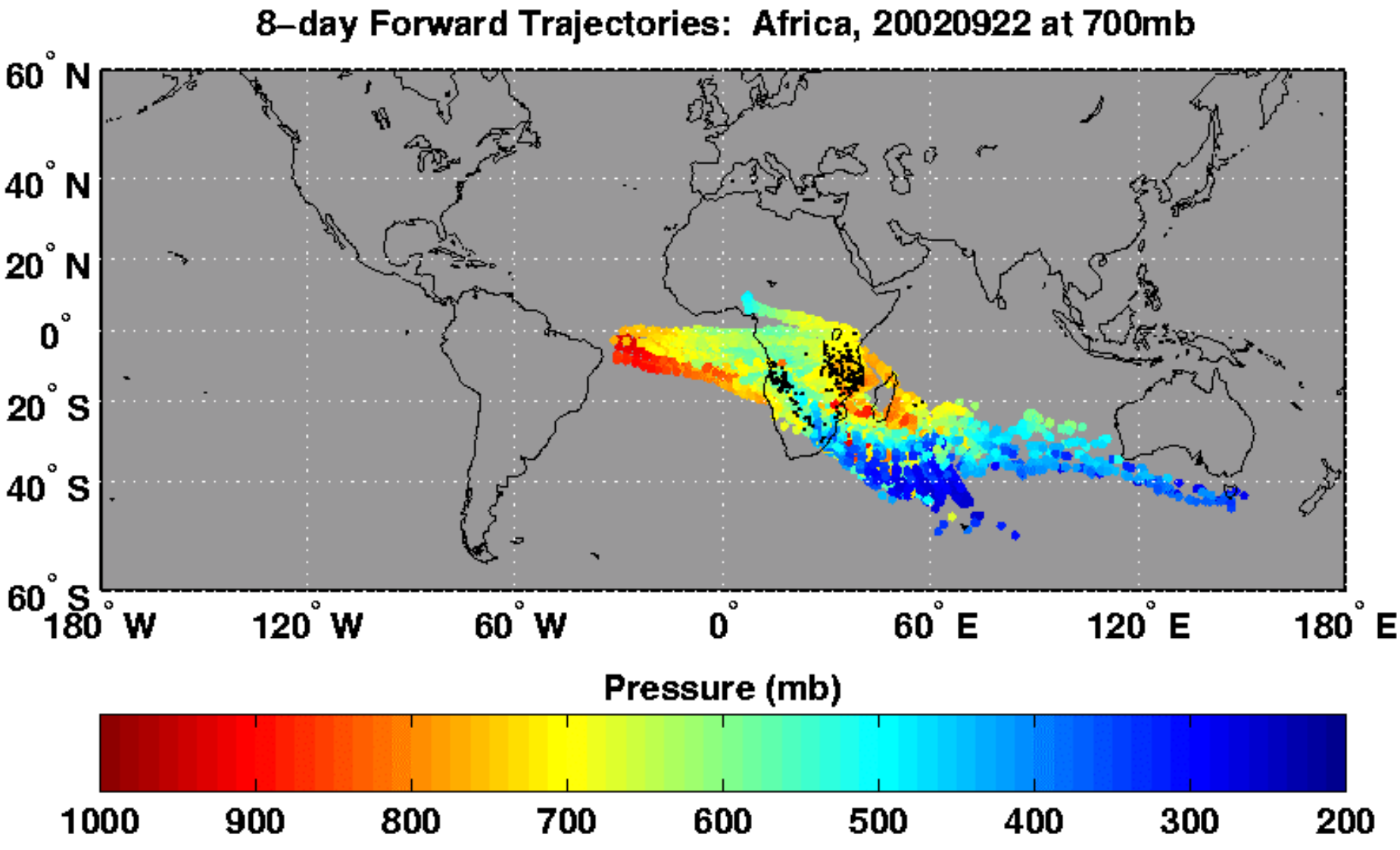

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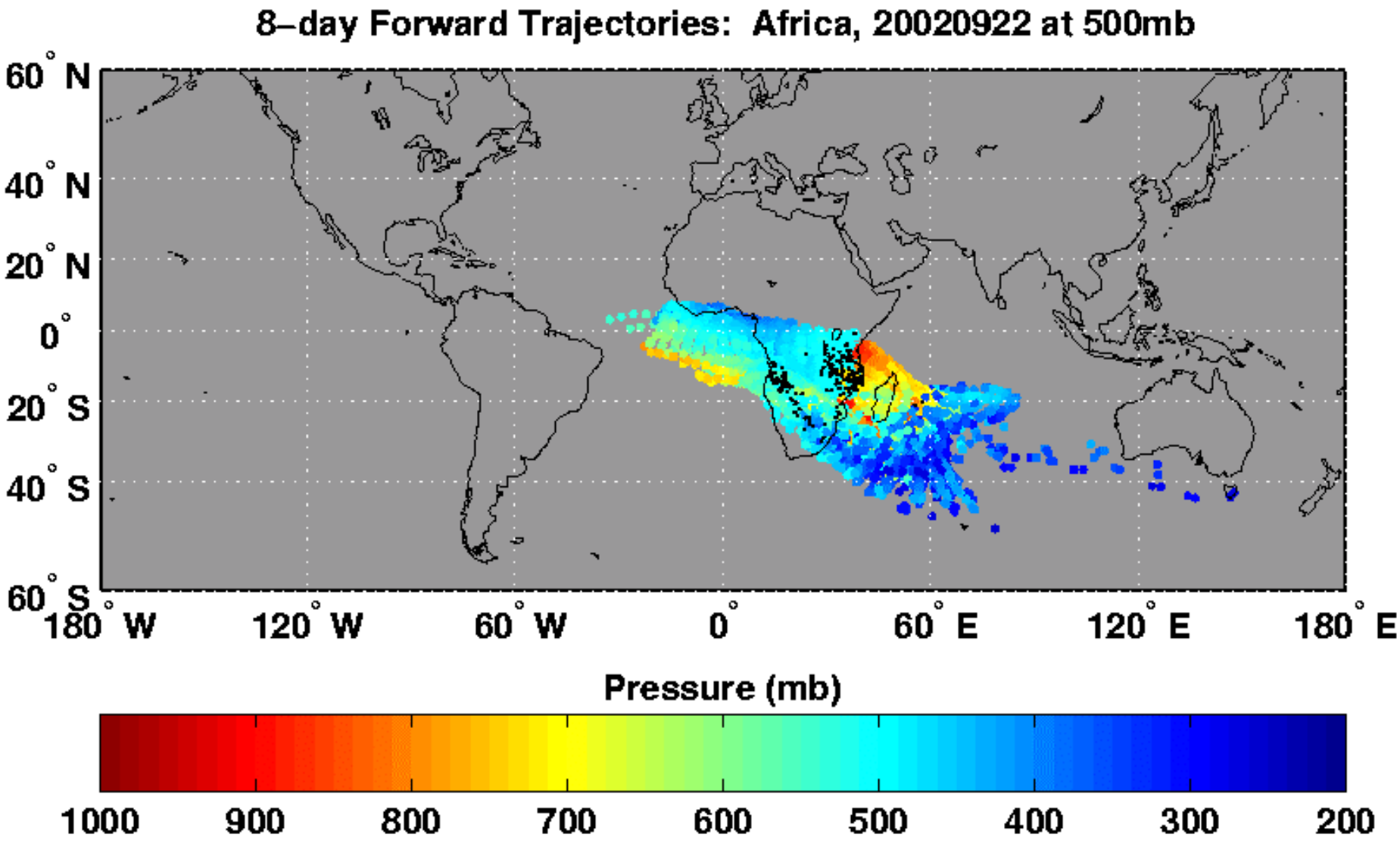

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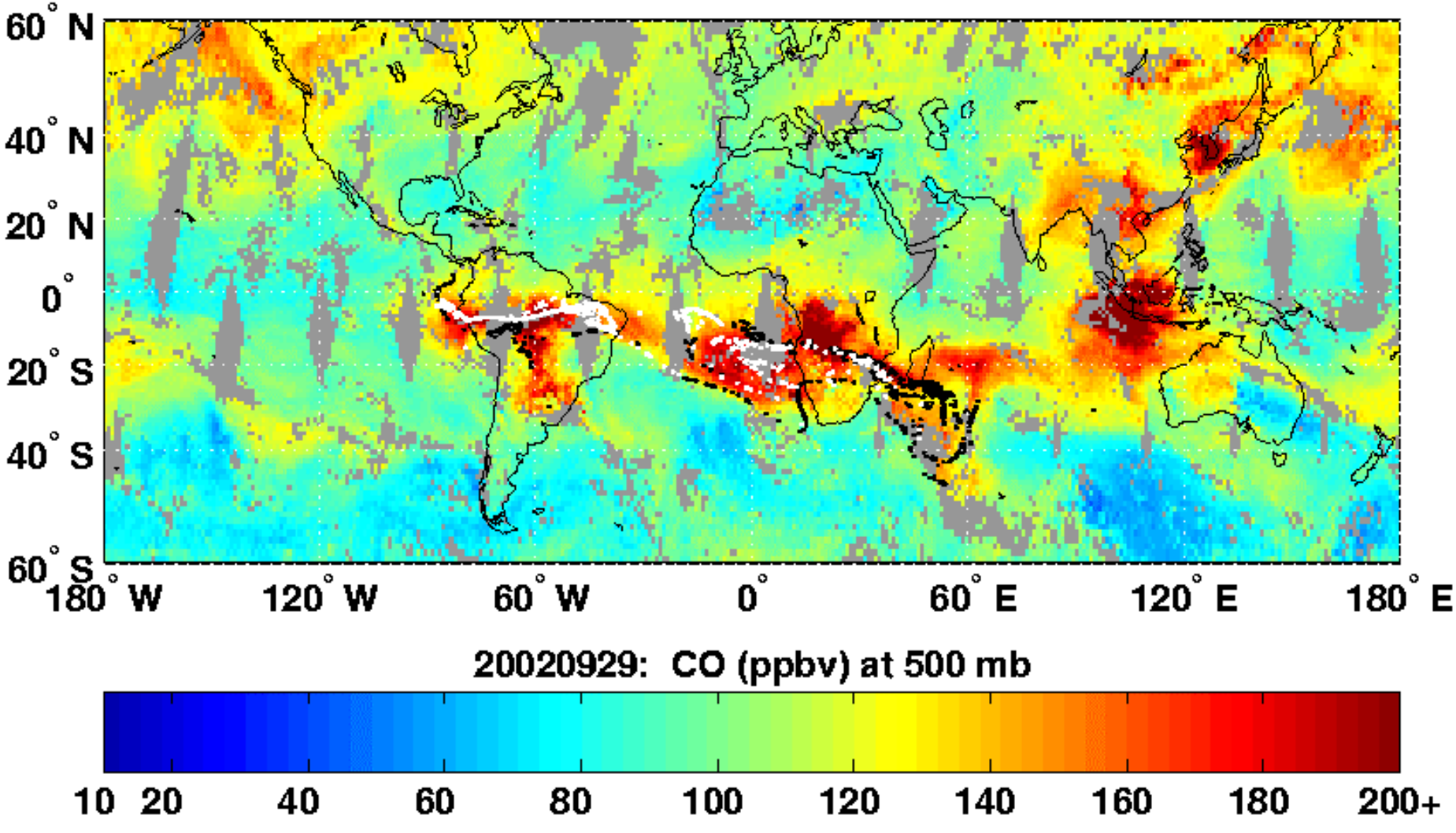
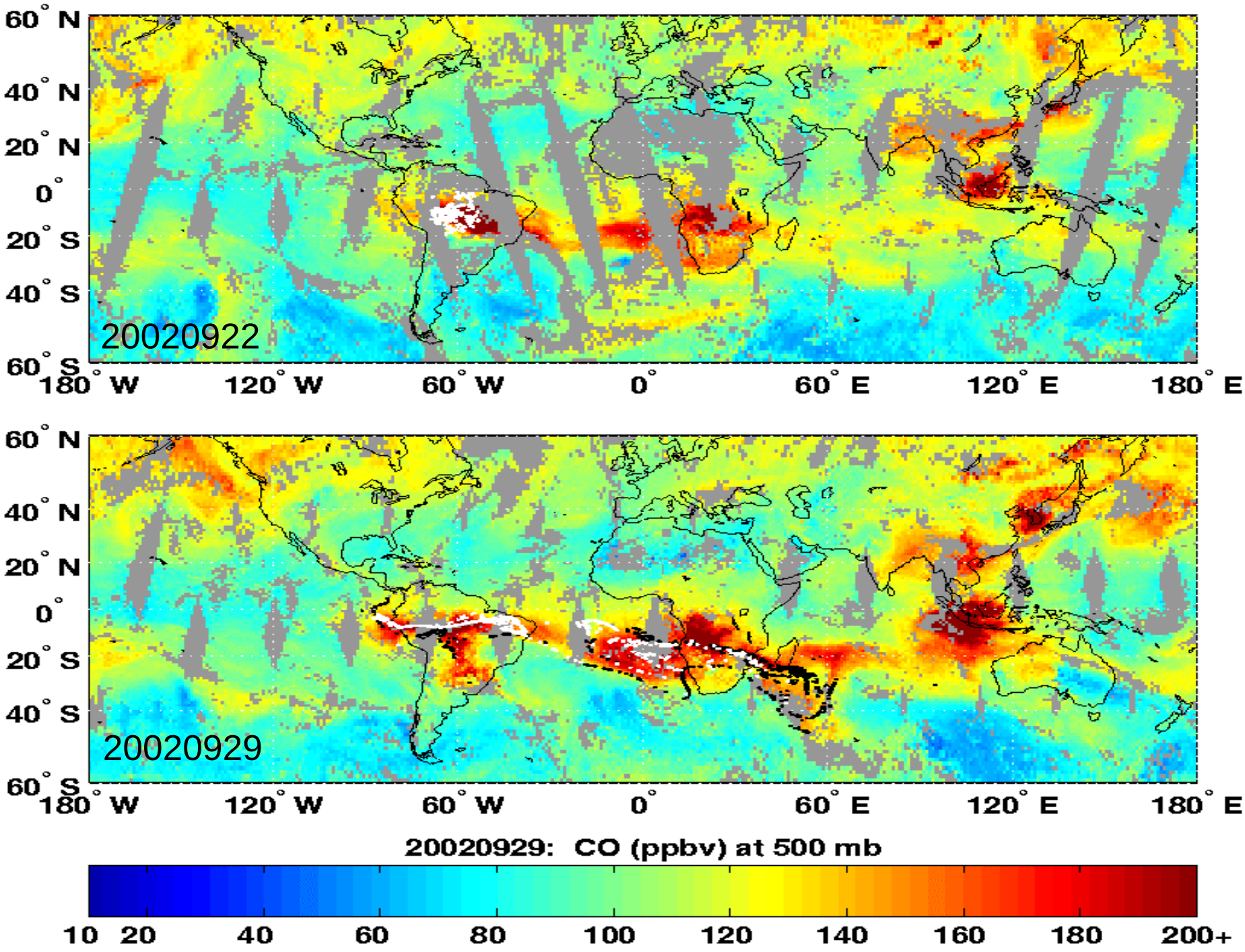
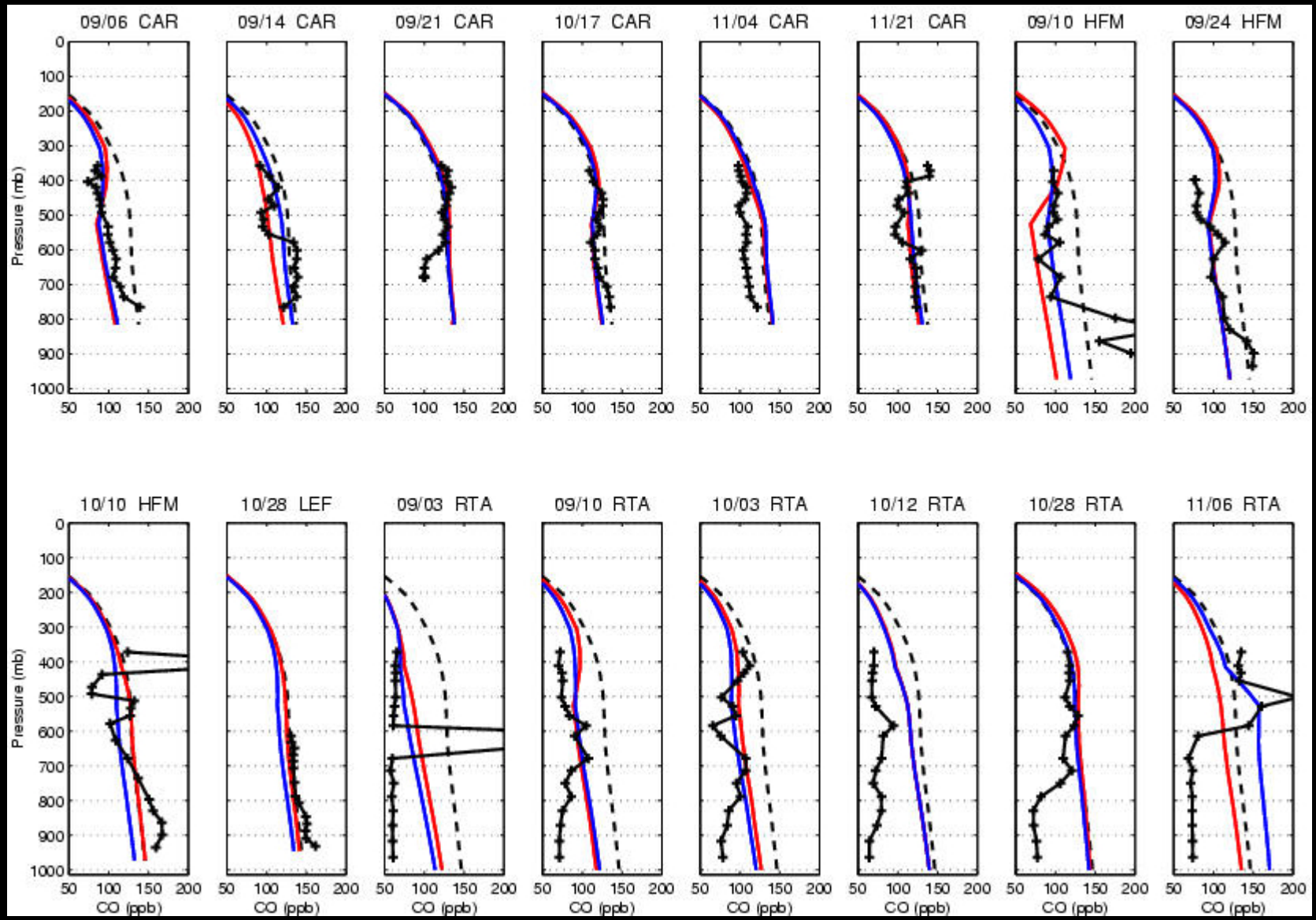
AIRS Global CO Movie w/SA traj.




60° N
40° N
20° N
0°
20° S
40° S
60° S
20020922
180° W
120° W
60° W
0°
60° E
120° E
180° E
20020929
20020929: CO (ppbv) at 500 mb
10
20
40
60
80
100
120
140
160
180
200+

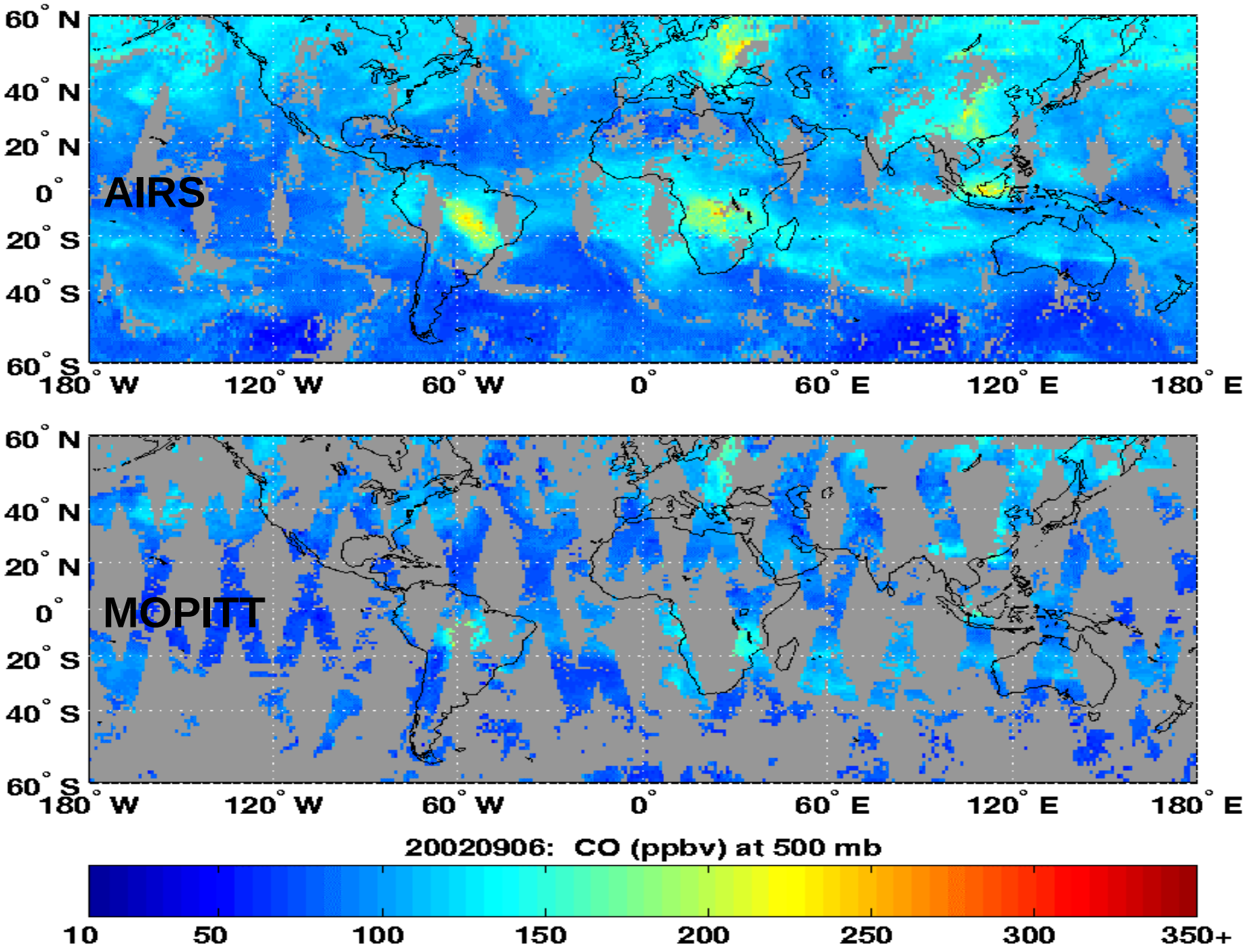
AIRS CO Validation: in progress



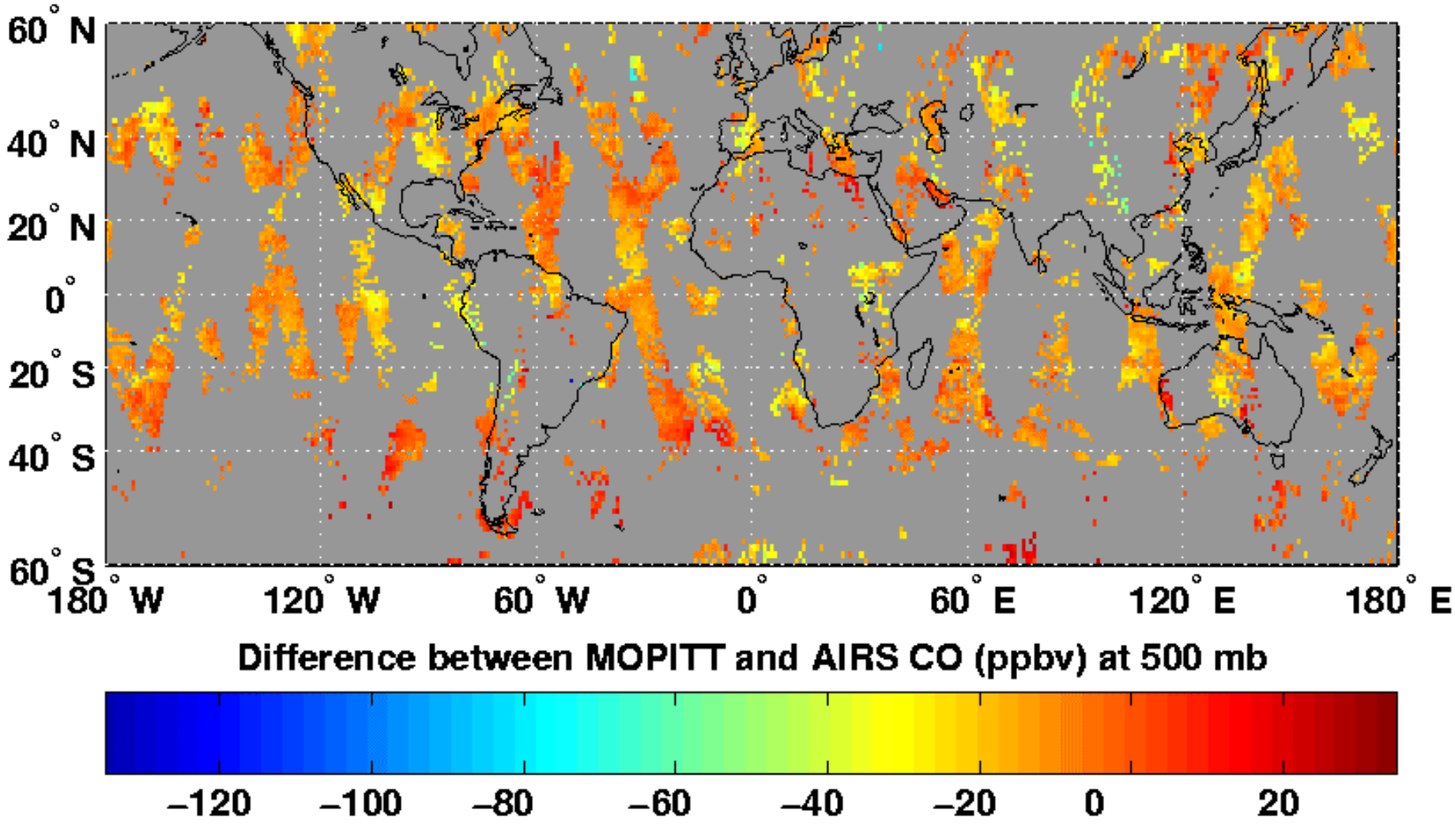
CO Profiles from Paul Novelli (NOAA, CMDL)

AIRS CO Validation: preliminary

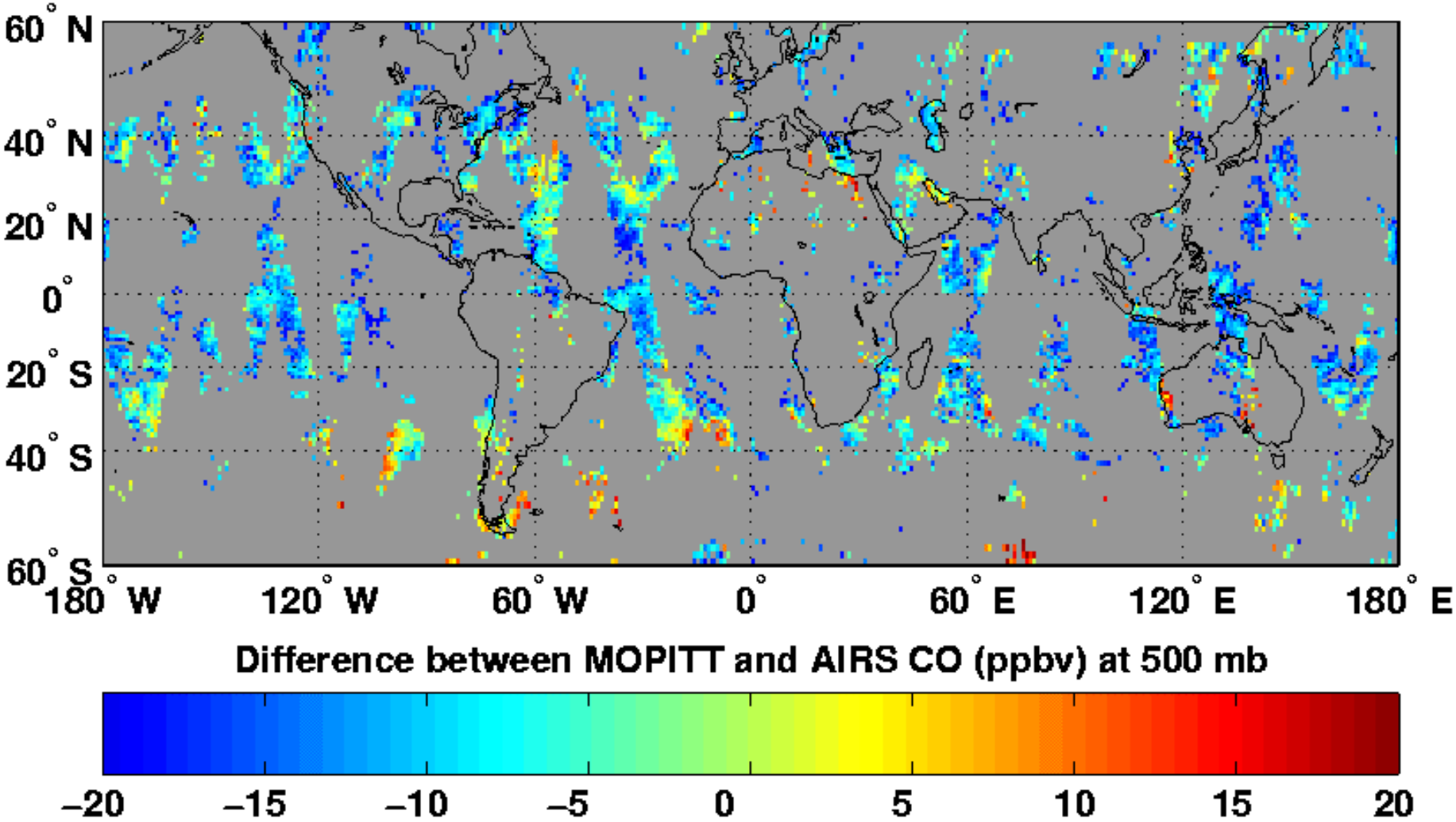
Location	Day 9/02	AIRS CO (ppbv)	AIRS ΔCO (ppbv)	CMDL CO (ppbv)	CMDL ΔCO (ppbv)	A-C (ppbv)	A-C %
CAR	6	93	+12 -11	90	± 9	3	3.3
CAR	14	113	± 6	106	± 14	7	6.6
HFM	10	94	+12 -10	98	± 6	-4	-4.1
HFM	24	108	+14 -11	91	± 14	17	18.7
RTA	3	88	+20 -13	63	± 1	25	39.7
RTA	10	99	+13 -10	80	± 12	19	23.8
						OVERALL	16


AIRS
MOPITT
60° N
40° N
20° N
0°
20° S
40° S
60° S
180° W
120° W
60° W
0°
60° E
120° E
180° E
20020906: CO (ppbv) at 500 mb
10
50
100
150
200
250
300
350+

MOPITT - AIRS

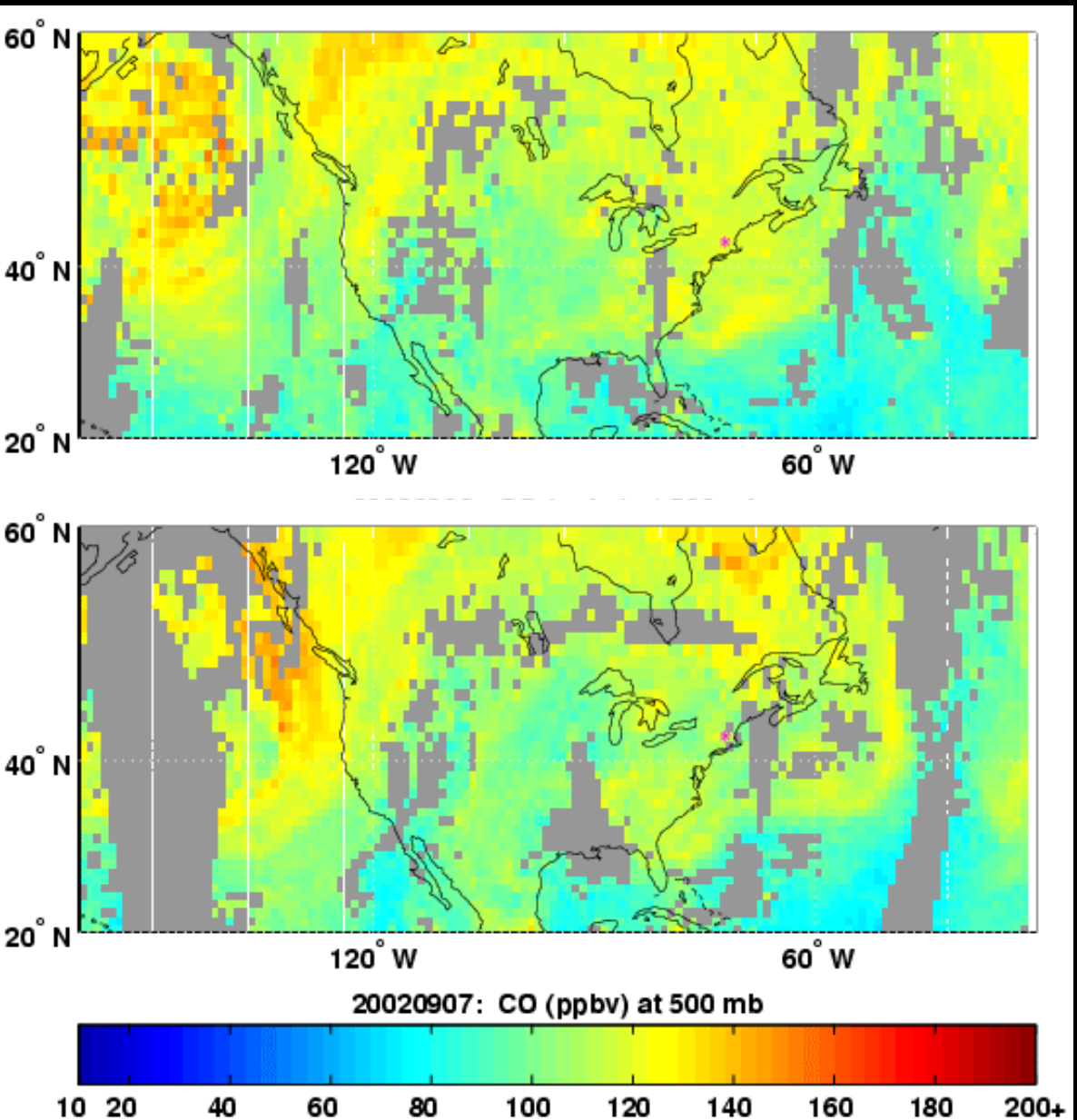

60° N
40° N
20° N
0°
20° S
40° S
60° S
180° W
120° W
60° W
0°
60° E
120° E
180° E
Difference between MOPITT and AIRS CO (ppbv) at 500 mb
−120
−100
−80
−60
−40
−20
0
20

MOPITT - AIRS



Of 7603 spatially coincident 1° x 1 ° retrievals,
79% (6037) fall within this range!

AIRS for INTEX-A



- **INTEX flight-planning**
- **AIRS CO validation**
- **Next day *or faster* CO retrieval maps: North America to Western Europe.**
- **AIRS *cloud-clearing* enhances yield**
- **24-48 hour CO fcsts. w/Brad Pierce**
- **CO maps and values archived, maps online during INTEX**

AIRS CO
Becoming a Standard Product!

- **Large scale CO transport (low and high)**
- **AIRS sees ~85% of globe every day**
- **79% of AIRS CO retrievals within ~20% of MOPITT values (~ 6000 comparisons/day)**
- **AIRS CO vertical information: in progress**
- **AIRS CO Validation underway:**

  preliminarily better than 16%!