February 2010
Climate Prediction Division / Japan Meteorological Agency

Error in prescribing sea surface temperatures over inland seas

In the JMA Climate Data Assimilation System (JCDAS), COBE-SST is used as the boundary condition for 6-hour forecasts and analyses. It was recently found that climatological SST had erroneously been used over some of the inland seas since JCDAS became operational in January 2005.

CAUSE

The COBE-SST data is interpolated from the original COBE-SST pixel map to the grid points of JCDAS prior to being used in data assimilation. This interpolation is performed with a land-sea mask that defines three types of surface conditions, i.e. land, sea and inland sea (Fig. 1). Due to a bug in the interpolation program that has been used since JCDAS became operational, SST over some of the inland seas has not been handled properly and consequently SST over those areas has erroneously been set to the 1951-2000 climatology that is used in the COBE-SST data assimilation system.

IMPACT

We performed data assimilation experiments to evaluate the impact of this problem on the JCDAS product. The periods of the experiments are January 2006 and September 2007 when significantly large error occurred over Sea of Japan due to the bug (Fig. 2). From the result of the experiments, it has been found that this bug has the following impacts;

- For surface upward long wave radiation flux, no inter-annual variation is represented due to lack of inter-annual variation in the prescribed SST. **(Fig. 3(e), (f))**
- For sensible and latent heat fluxes, representation of inter-annual variation is degraded. **(Fig. 3(a)-(d))**
- For temperature and humidity analyses near the surface, there is a detectable impact when error in SST becomes large, but it is relatively small compared to inter-annual variation of those variables. **(Fig. 3(i)-(l), Figs. 4, 6(k)-(l), Figs. 5, 7(a)-(d))**
- For surface pressure, relative vorticity and divergence, impact is negligible. **(Fig. 3(m), (n), Fig. 5(e)-(h), Fig. 7(e)-(h))**

All of these impacts are confined within the inland seas (shaded in red in Fig. 1) and the neighboring areas.

The interpolation program has been replaced to the correct one and this change took effect on 14 January 2010. When using the dataset of the period between 1 January 2005 and 13 January 2010, please keep in mind this problem. For the period of JRA-25 (1979 to 2004), SST over the inland seas was handled properly and therefore this problem does not exist.

We apologize for any inconvenience caused by this problem.

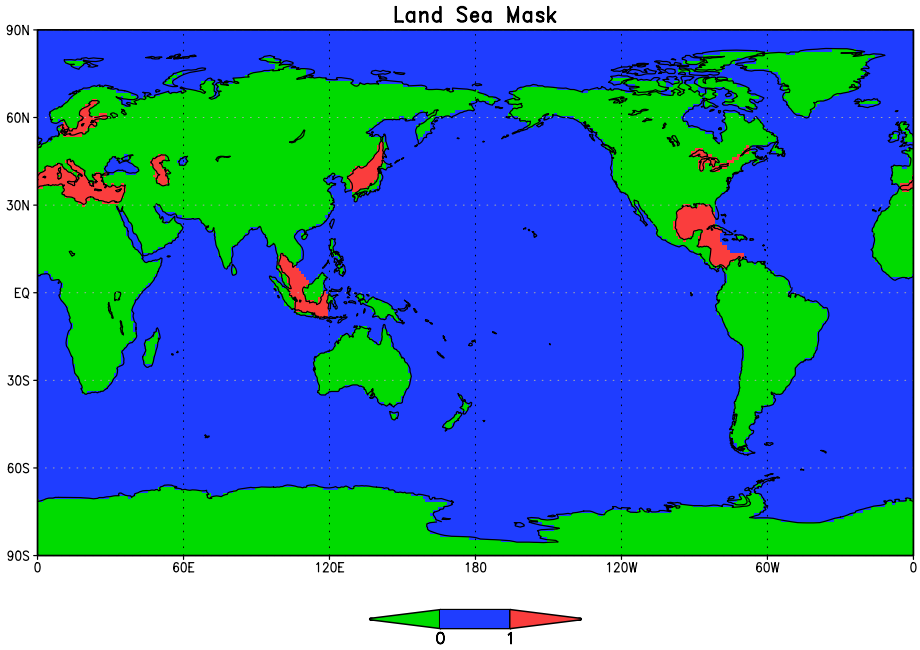


Fig. 1 The land-sea mask used in interpolation from the original COBE-SST pixel map to the grid points of JCDAS. Land areas are shown in green, sea in blue and inland sea in red. Over the inland seas, the 1951-2000 climatology, which is used in the COBE-SST data assimilation system, has erroneously been used since JCDAS became operational in January 2005.

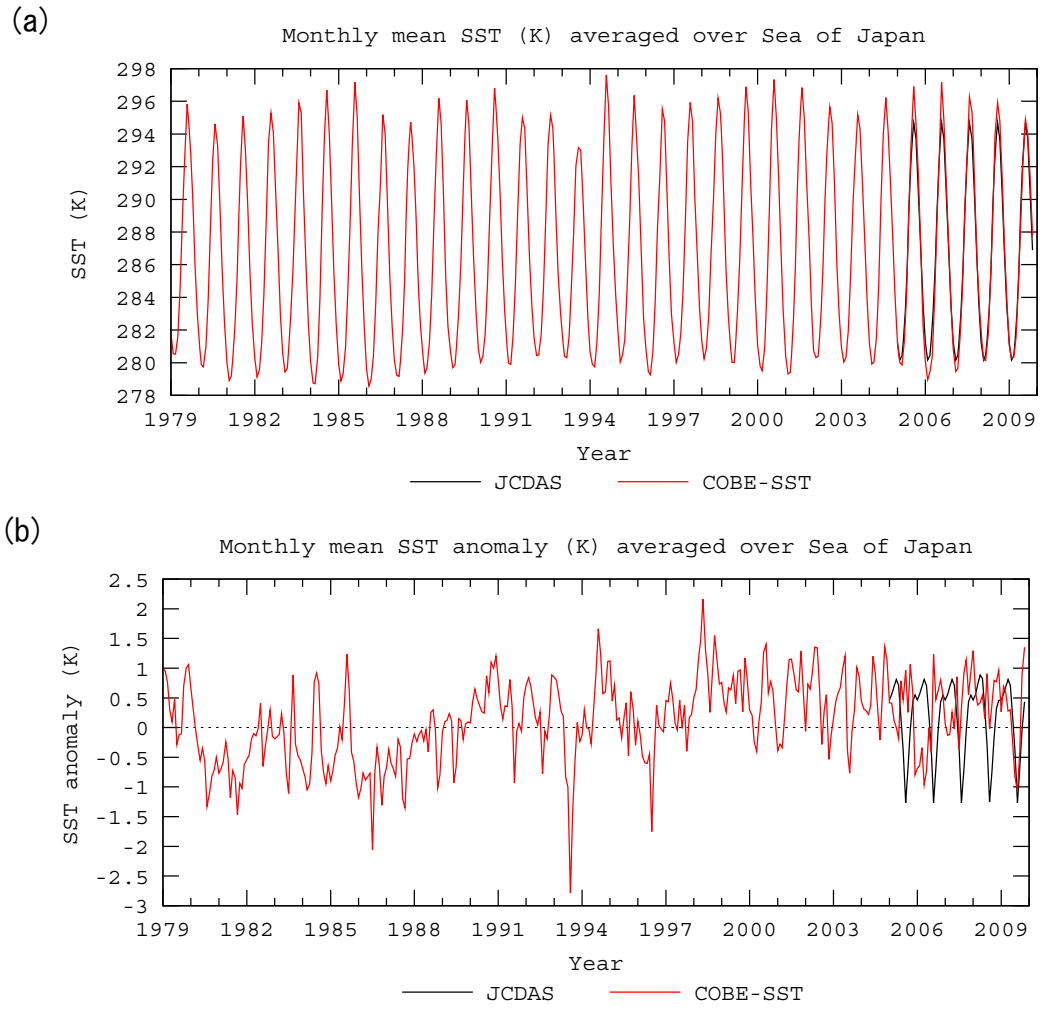


Fig. 2 Monthly values of (a) SST averaged over Sea of Japan (the sea area in 36~49N, 128~140E) and (b) respective anomalies from the 1971-2000 climatology (K) (black: JCDAS, red: COBE-SST).

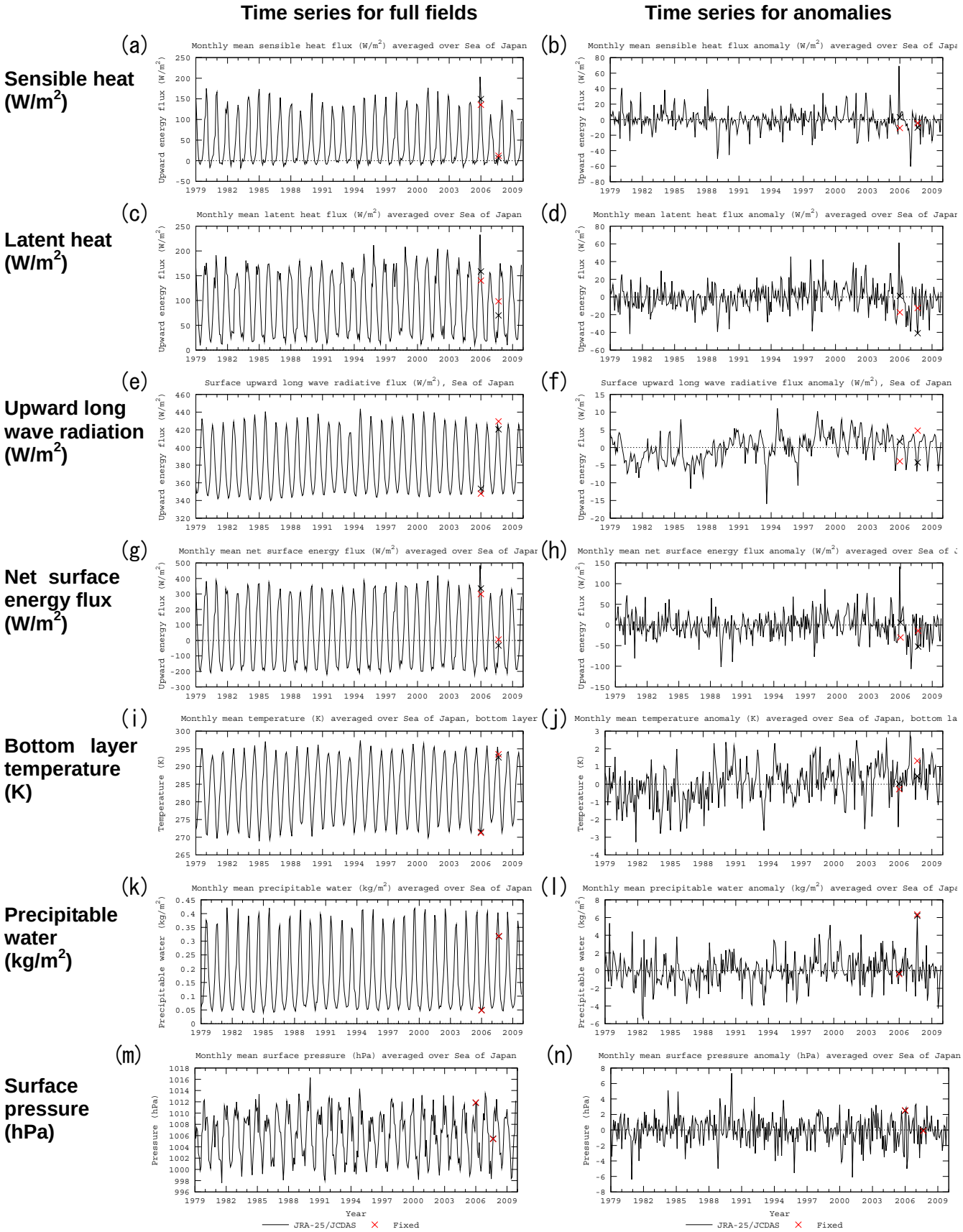


Fig. 3 Monthly values of (a) sensible heat flux (W/m^2), (c) latent heat flux (W/m^2), (e) surface upward long wave radiation flux (W/m^2), (g) surface net energy flux (W/m^2), (i) atmospheric temperature in the bottom layer (σ=0.995) (K), (k) precipitable water (kg/m^2), (m) surface pressure (hPa) and respective anomalies from the 1979-2004 climatology (b, d, f, h, j, l, n). (black: JRA-25/JCDAS, red: experiment with the fixed system)

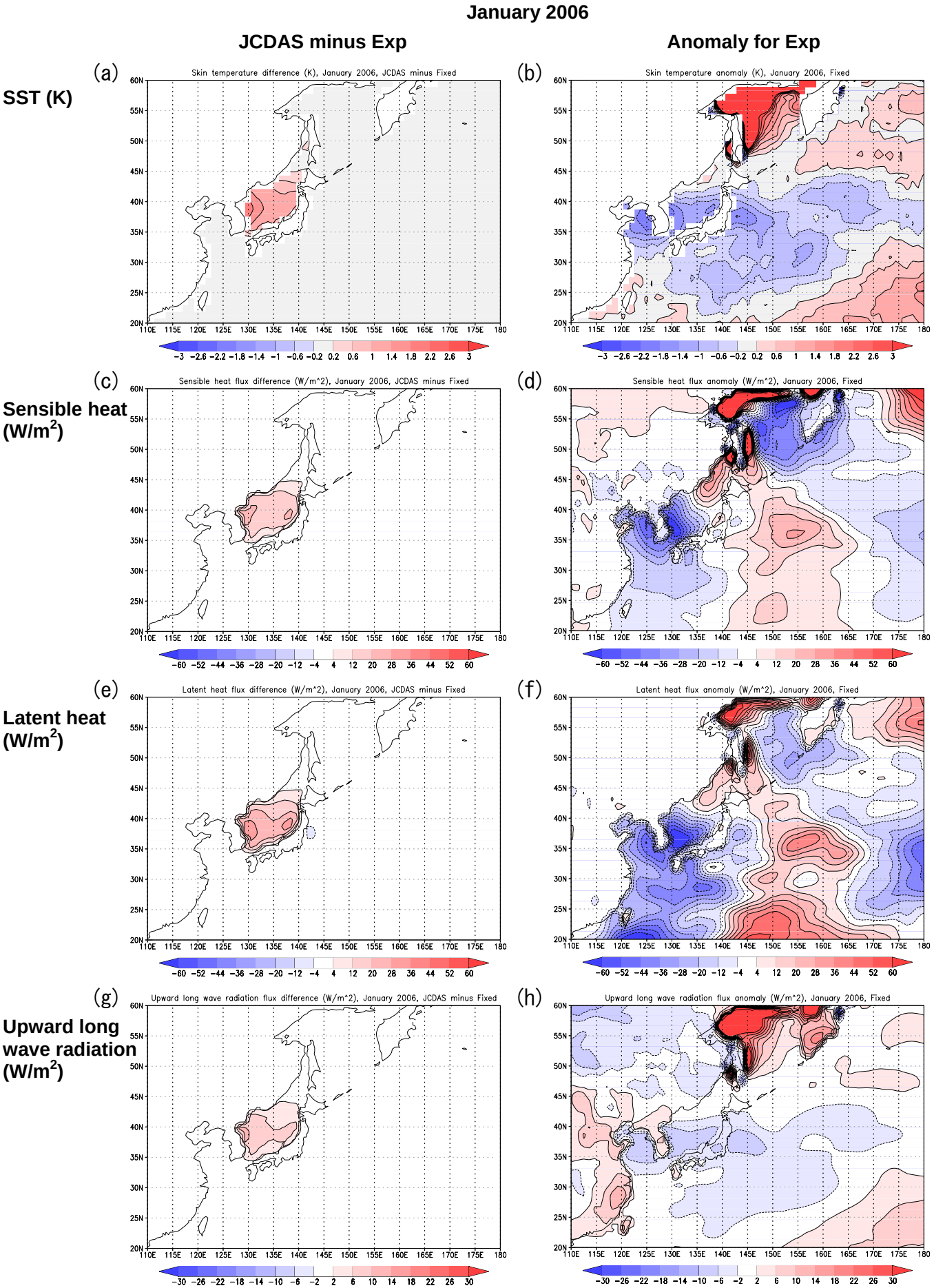
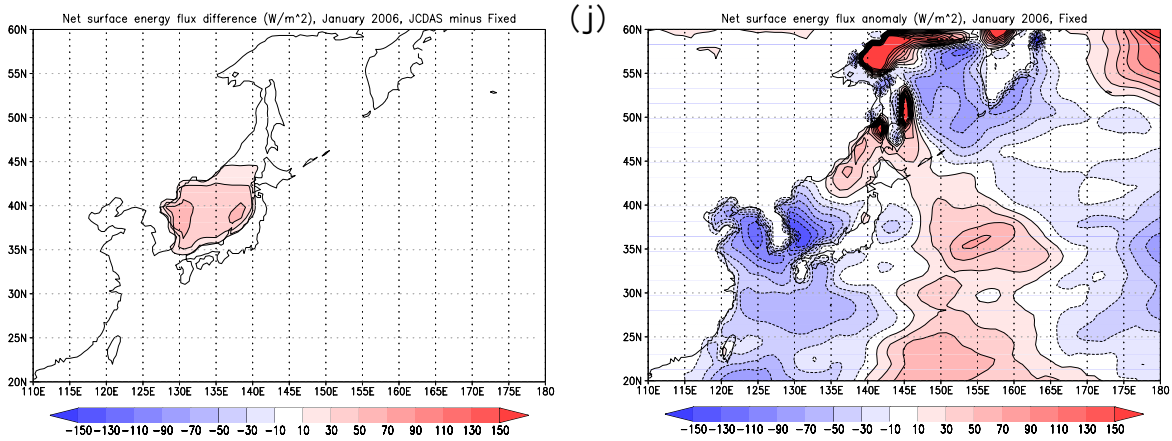


Fig. 4 Difference of (a) SST (K), (c) sensible heat flux (W/m^2), (e) latent heat flux (W/m^2) and (g) surface upward long wave radiation flux (W/m^2) between JCDAS and the experiment with the fixed system, and respective anomalies from the 1979-2004 climatology for the experiment (b, d, f, h) for January 2006.

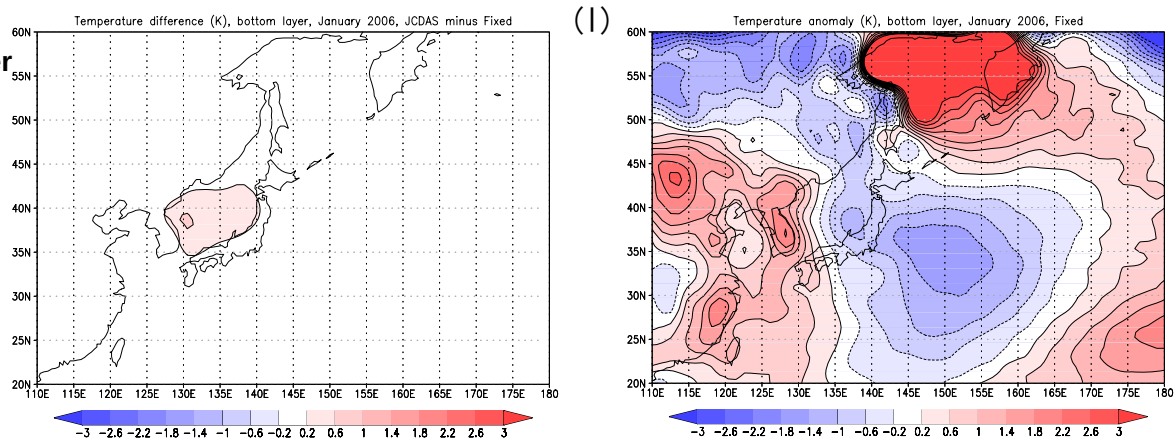
January 2006

JCDAS minus Exp | **Anomaly for Exp**

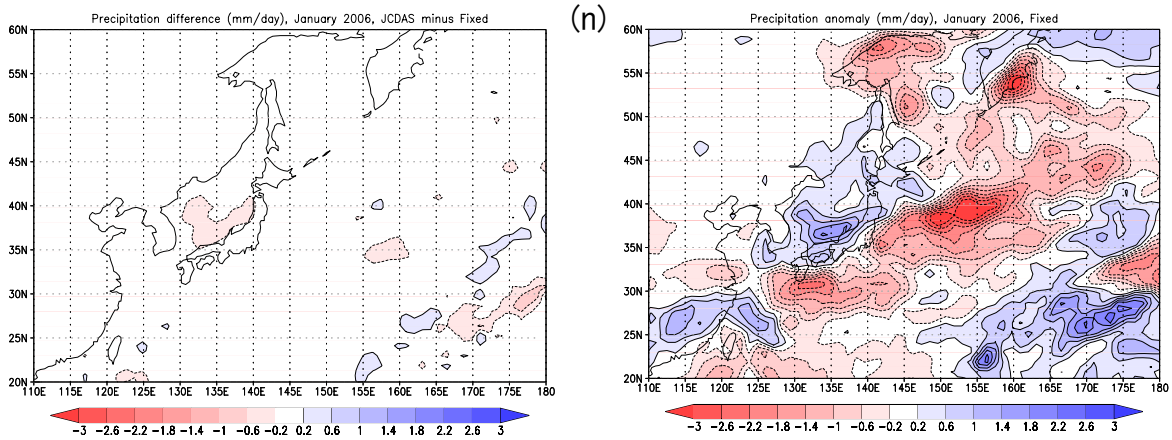
Net surface energy flux (W/m^2)



Bottom layer temperature (K)



Precipitation (mm/day)



Snow fall (mm/day)

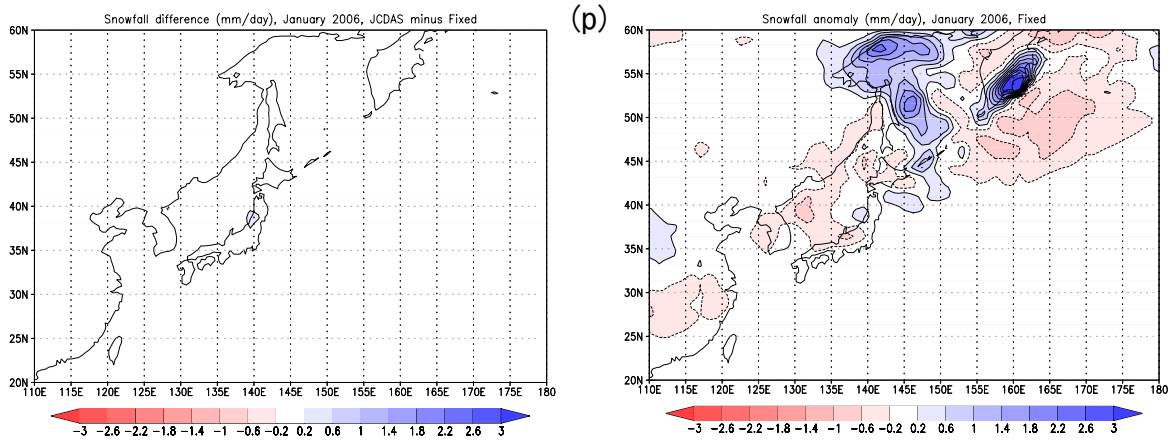


Fig. 4 Difference of (i) surface net energy flux (W/m^2), (k) atmospheric temperature in the bottom layer (σ=0.995) (K), (m) precipitation (mm/day) and (o) snow fall (mm/day) between JCDAS and the experiment with the fixed system, and respective anomalies from the 1979-2004 climatology for the experiment (j, l, n, p) for January 2006.

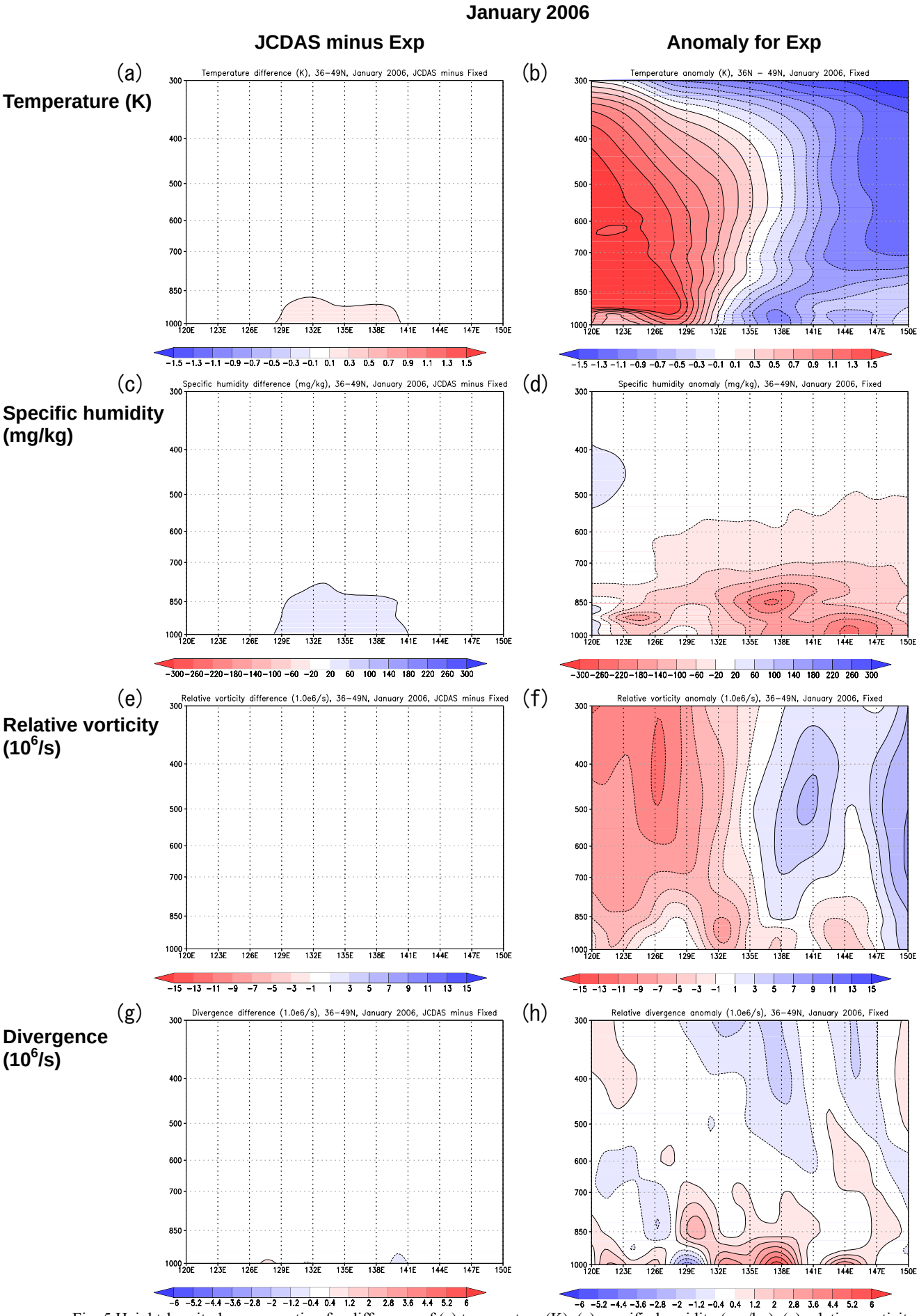


Fig. 5 Height-longitude cross-section for difference of (a) temperature (K), (c) specific humidity (mg/kg), (e) relative vorticity (10^6/s) and (g) divergence (10^6/s) between JCDAS and the experiment with the fixed system, and respective anomalies from the 1979-2004 climatology for the experiment (b, d, f, h) for January 2006.

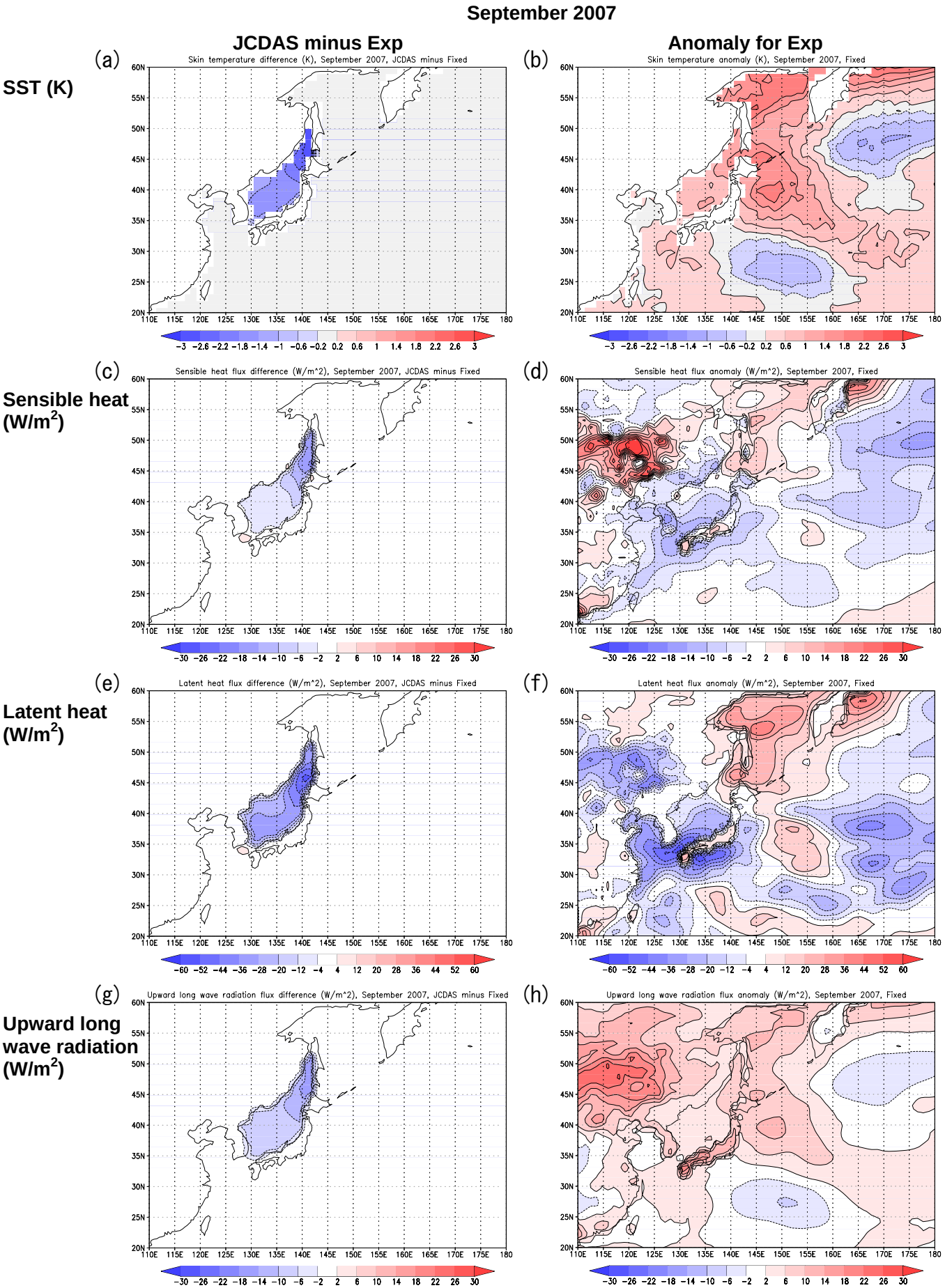
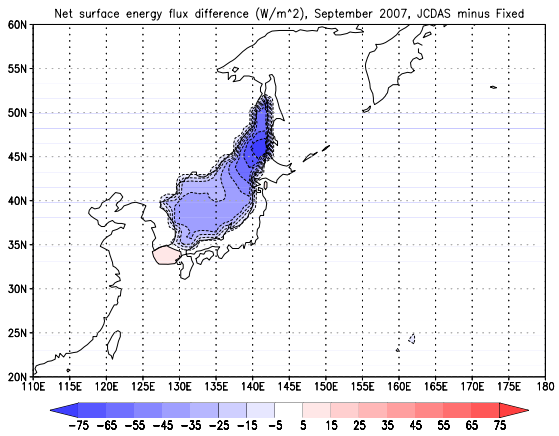


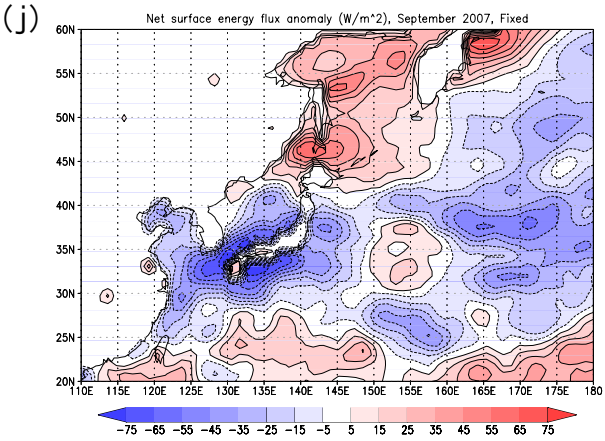
Fig. 6 Difference of (a) SST (K), (c) sensible heat flux (W/m^2), (e) latent heat flux (W/m^2) and (g) surface upward long wave radiation flux (W/m^2) between JCDAS and the experiment with the fixed system, and respective anomalies from the 1979-2004 climatology for the experiment (b, d, f, h) for September 2007.

September 2007

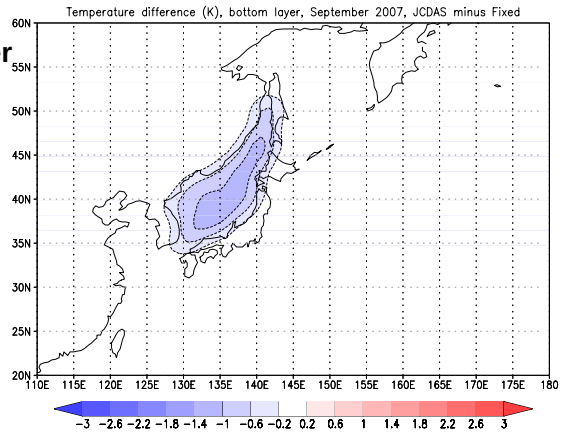
JCDAS minus Exp | **Anomaly for Exp**

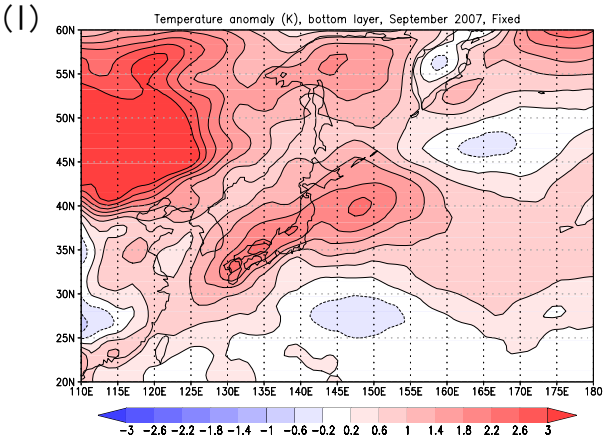
Net surface energy flux (W/m^2)



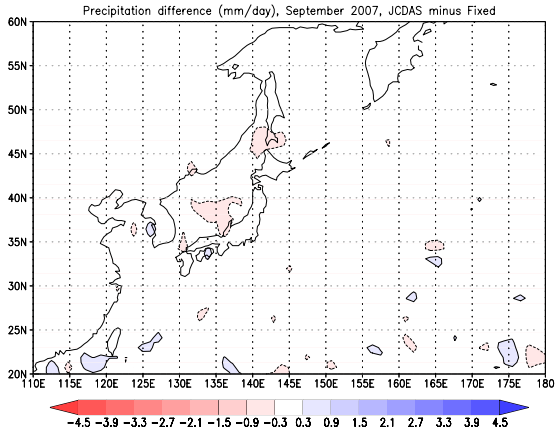


Bottom layer temperature (K)





Precipitation (mm/day)



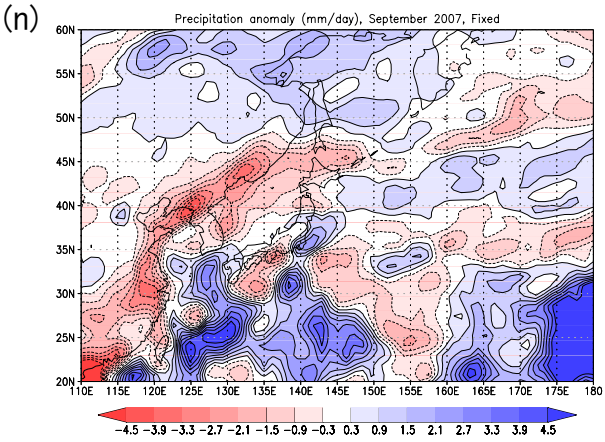


Fig. 6 Difference of (i) surface net energy flux (W/m^2), (k) atmospheric temperature in the bottom layer (σ=0.995) (K) and (m) precipitation (mm/day) between JCDAS and the experiment with the fixed system, and respective anomalies from the 1979-2004 climatology for the experiment (j, l, n) for September 2007.

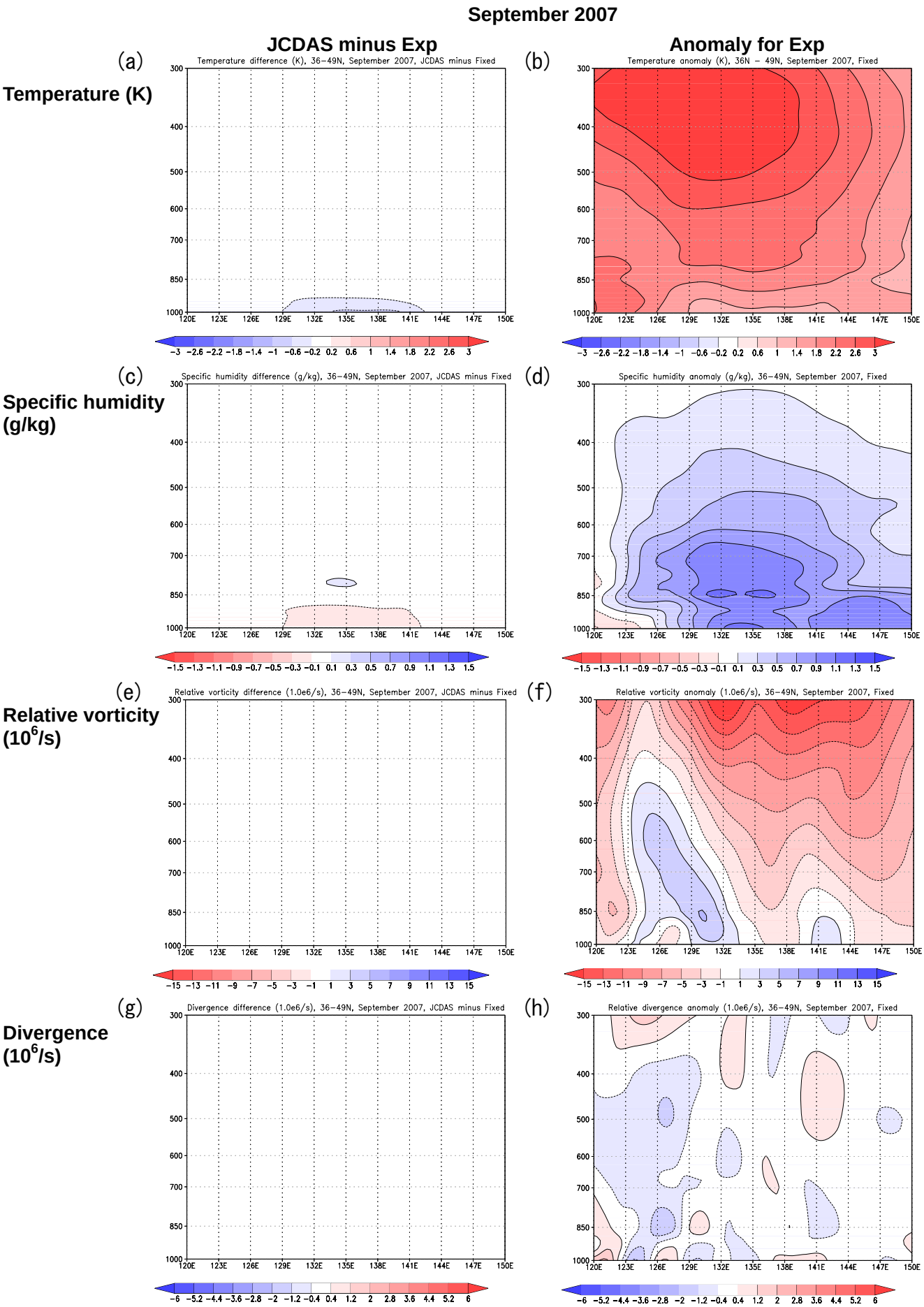


Fig. 7 Height-longitude cross-section for difference of (a) temperature (K), (c) specific humidity (g/kg), (e) relative vorticity (10^6/s) and (g) divergence (10^6/s) between JCDAS and the experiment with the fixed system, and respective anomalies from the 1979-2004 climatology for the experiment (b, d, f, h) for September 2007.