Best ARIMA order from CV: (1, 1, 0) CV MAPE: 15.86367441077431

Best GRU cfg: {'units': 96, 'dropout': 0.15, 'window': 21} val_loss: 0.037046317011117935
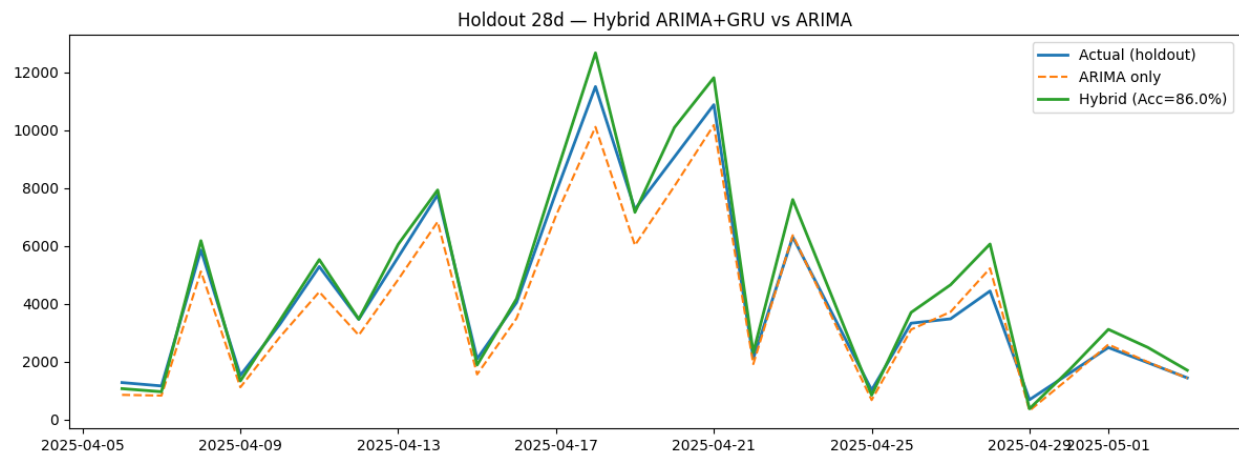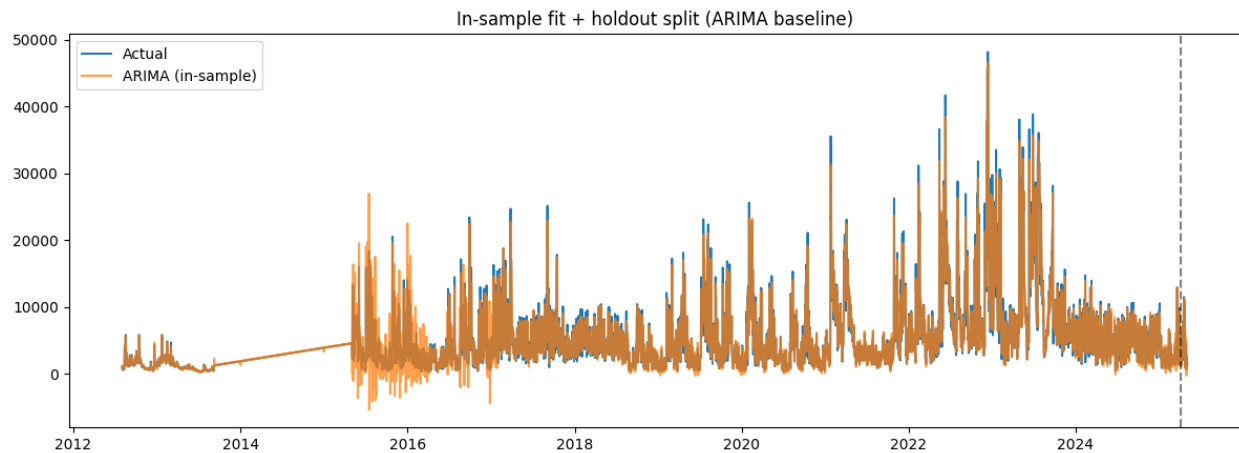
=== HOLDOUT (28d) METRICS ===
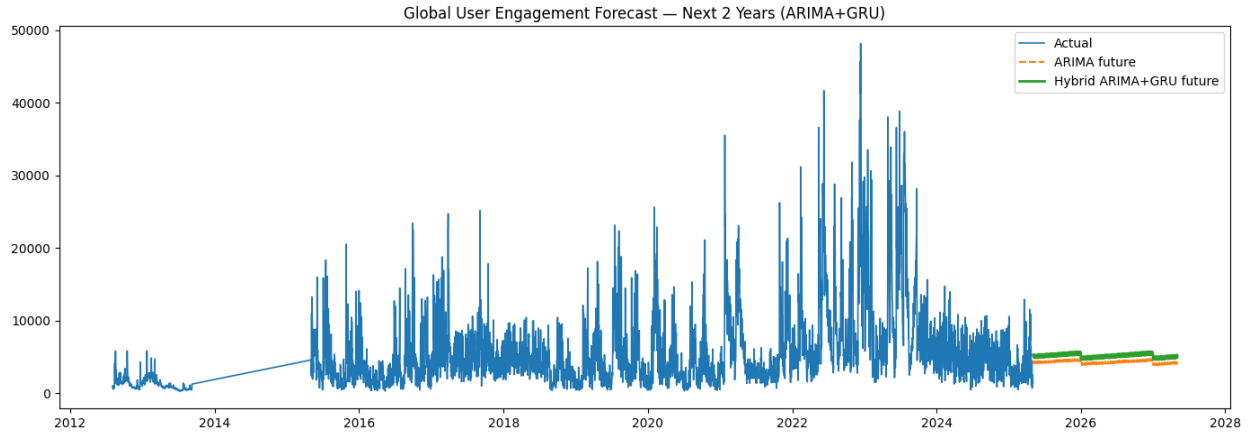
MAE: 477.12

RMSE: 635.80

MAPE: 13.97%

Accuracy (1-MAPE): 86.03%

ARIMA-only MAPE: 14.98% → ΔMAPE vs Hybrid: +1.02 pts

alpha=0.000, beta=0.091

In-sample fit + holdout split (ARIMA baseline)

Holdout 28d — Hybrid ARIMA+GRU vs ARIMA

Global User Engagement Forecast — Next 2 Years (ARIMA+GRU)

WARNING:absl:You are saving your model as an HDF5 file via `model.save()` or `keras.saving.save_model(model)`. This file format is considered legacy. We recommend using instead the native Keras format, e.g. `model.save('my_model.keras')` or `keras.saving.save_model(model, 'my_model.keras')`.

Artifacts: /content/hybrid_arima_gru_artifacts

 - 2year_forecast_arima_gru.csv

 - arima_model.pkl

 - arima_order.json

 - gru_residual.h5

 - metrics_arima_gru.json

 - x_scaler.npy

 - y_scaler.npy

Checkpoints: /content/arima_gru_ckpts

 - gru_best_win21.keras

 - gru_best_win28.keras